

# The Project Manager as an ambassador of the contract. The case of NEC4 ECC contracts.

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**Abstract** - NEC has always been known for its innovative approach to contract management. No other contract suite has had such a transformative effect on the built environment industry as NEC. It has put the collaborative sharing of risk and reward at the heart of modern procurement. It is also unique in providing a complete, back-to-back procurement solution for all works, services and supplies in any sector and any country.

The research is based on a literature review with the main objective of understanding of the specific contracts. A new contribution is made regarding the benefit of improving the traditional contracting models and, thus seeking to contribute to the closing of the knowledge gap of the NEC4 ECC. The purpose of this article is, therefore, to provide a review of some of the main characteristics of the NEC4 ECC contracts during their appliance in the construction Industry and the way they lead the overall management of the project.

**Key Words:** Project management, NEC4 ECC, Contract management.

## 1. INTRODUCTION

Many have argued about the existence of a necessity to migrate to collaborative environments, which can provide more innovative solutions and better overall constructability, particularly through the better development of a construction contract [1]. Rahmani [2] addresses such existence of a tendency for a change in adversarial traditional culture in the construction industry.

Mutual trust is also a determining factor in the contractual management of successful infrastructure projects; this is the basic quality of the collaborative philosophy under which the standardised contracting models were designed, which seek to propose collaborative environments between all levels of the project [3]. Although mutual trust and collaboration may appear easily achievable in theory, they both rely on a major overall change in the philosophy of the conservative and bureaucratic mindsets [4].

Such a philosophy opens up the possibility of balanced risk management between the parties involved in a construction contract, a quality identified as the most effective technique for avoiding conflict [5]. Furthermore, Eriksson et al. [6] and Taylor [7] assert that this philosophy would allow access to modern management mechanisms such as Early Contractor

Involvement (ECI), since contract risks are commonly assumed by the contractor, who often does not have the capacity for the aforementioned responsibility.

Table 1 and 2 summarizes the recent bibliography consulted in prominent journals and book, from which the global use of the NEC is highlighted in order to develop the subsequent subsections, allowing for the identification of the most important tools and practices from the NEC, as well as determining the recurrent use of the methodologies for research on this topic.

**Table -1:** Recent references (Source: Ardiles et al., 2023)

Author	Year	Method
Nkunda et al. [8]	2023	Literature Review
Yeung et al [9]	2022	Case Study
Alhyari and Ani [10]	2022	Literature Review
Rahmani [2]	2020	Interviews
Cheung et al. [1]	2020	Online surveys
Eriksson et al. [21]	2019	case study
Farrel and Sunindijo [11]	2020	Interviews
McDermot et al. [12]	2020	Literature Review
Laryea [13]	2019	case study
Lau et al. [14]	2019	Interviews

**Table -2:** ICE & NEC books (Source: ICE Library)

Author: ICE	Year: 2017
NEC4 Engineering and Construction Contract [19]	
NEC4 establishing a procurement and contract strategy [20]	
NEC4 preparing an engineering and construction contract [21]	
NEC4 managing an engineering and construction contract [22]	
Mitchell & Trebes	Year: 2017
Managing the reality. Book One: Introduction to engineering and construction contracts. Third edition [23]	
Managing the reality. Book Two. Procuring an engineering and construction contracts. Third edition [24]	
Managing the reality. Book three. Managing the contract. Third edition [25]	

## 1.1 New Engineering Contracts

It was in 1993 that the ICE published the first version of the New Engineering Contracts, a new and innovative way of managing construction contracts. It was designed to facilitate and encourage good management of risks and uncertainties, using clear and simple language.

The NEC approach to managing contracts was endorsed in "Constructing the team – The Latham Report", which was a government/industry review of procurement and contractual arrangements in the UK construction industry. This led to a second edition in 1995 incorporating the further recommendations of that review. This contract was used increasingly in the UK and overseas, and a major revision was made with the third edition. By 2005, this version had already demonstrated its effectiveness on several infrastructure projects in the UK, which led to the creation of NEC3 in that year. In search of improved collaboration, NEC4 was born in 2017, which is the most recent and complete version of these standardised contracts [15]. Such a suite of contracts, popularly misnamed collaborative contracts, are rather stimuli and procurement tools for construction, which propose clauses that allow for collaborative environments between the parties involved.

NEC has played a part in helping the industry do things differently and better. It has done so by introducing effective project management procedures into the contract itself. These require pro-active management of risk and change, and the day-to-day use of an up-to-date programme. The range of pricing options has given Client's flexibility in the allocation of risk and the ability to share risk and manage it, collaboratively.

There were three key objectives [16], in drafting NEC4: provide greater stimulus to good management, support new approaches to procurement which improve contract management and inspire increased use of NEC in new markets and sectors. The features of NEC4 include a new design build and operate contract to allow flexibility between construction and operational requirements in timing and extent and a new multi-party alliance contract based upon an integrated risk and reward model. They offer new forms of subcontract to improve integration of the supply chain. Further enhancements include finalizing cost elements during the contract incorporating a party-led dispute avoidance process into the adjudication process, increasing standardization between contracts and also providing enhanced guidance to give greater practical advice to users.

The NEC is fundamentally the same as other contracts [17], in that it provides a legal framework. But it is also radically different in that it establishes a detailed set of project management procedures. All NEC forms of contract are designed and drafted with three the following three key principles in mind.

**Clarity.** NEC contracts are easier to read and understand than many other standard forms because they are written in plain and readable English, use minimal legal terminology, are highly organised, orderly, modular in structure and are

free from references to specific laws. The principle of clarity in the NEC provides clear roles for all involved, and clear processes defining exactly what people must do and within what time periods.

**Flexibility.** The NEC family provides a contract for any project, service, applied anywhere in the world (globally applicable), in any legal jurisdiction, in any sector, with any level of complexity, with any level of design responsibility by the supplier, under almost any procurement strategy, with different payment options, with different levels of risk allocation between contract parties.

Once the appropriate contract is chosen, NEC's application flexibility is further illustrated by the modular structure of the NEC Engineering and Construction Contract (ECC). An NEC ECC contract is built up from:

- the nine core clauses (common to all main payment options)
- one of six main payment options - including lump sum, re-measurement, target cost and cost reimbursable.
- one dispute resolution option
- a choice of secondary options to suit the specific requirements of the contract.
- a choice of jurisdiction-specific secondary options designed for particular local legal issues.
- any additional conditions of contract ('Z' clauses). The flexible nature of the options means that, ideally, there should be little need for additional conditions of contract.

## 1.2 Innovative Elements

Uniquely, one of the foundation clauses of every NEC4 contract states [16] the parties are to act, '*in a spirit of mutual trust and co-operation.*' This differentiates them from traditional contracts, which tend to follow a more adversarial, 'us and them' approach.

A very important, innovative, and unique characteristic of NEC4 contracts is the 'early warning' process. If either party becomes aware of any matter which could affect time, cost, or quality, they are required to notify the other party immediately. This is promptly discussed at an early warning meeting to decide how best to mitigate the risk and aiming to decrease the time taken to resolve the issue.

If there are changes to the amount of work the supplier has to do, there are clearly defined processes to handle changes in costs and time called 'compensation events'. The contracts also provide a clear and precise process for evaluating the cost and time implications of compensation events, which include events arising from client scope changes, and the contract sets out the process to determine the time and cost effects, within a set timescale.

The result is that the programme and budget are continually updated and agreed as changes and events happen. There should be no surprises at the end of an NEC4 Contract. All works and supply contracts also allow for early contractor/supplier involvement [16]

### 1.3 Allocation and Management Risk

Allocation and management of risk [16] is the core of the legal and commercial relationship established by a project's contract. This allocation must be fair and sustainable through the life of the project. The party holding a risk should also be able to count on the co-operation of the other party to identify and resolve issues as they arise. NEC therefore built around procedures for sensible risk allocation and ensuring that when risks do emerge the parties collaborate to deal with them quickly and decisively. Unfortunately, many contracts do not support this approach to risk management. They start from the assumption of failure and attempt to offload risk and costs on to suppliers.

Any security or protection this appears to give the client is illusory. This type of contract creates a defensive, adversarial environment, in which information is withheld and the best minds of the project devote their energies to defending their commercial position. The result is often multiple legal claims and counter claims which can continue for many years after the project has been completed.

It's needed a fair and sustainable Risk Allocation for each project. Risks should be allocated to the party best placed to manage them. This judgement normally flows from an assessment of a project's complexity and size.

Complexity creates more risks, while size increases the financial impact of a risk being realised. In both cases suppliers normally demand a higher price for taking on higher levels of risk. However, in highly complex scenarios, pricing risks might not be feasible. Furthermore, at larger projects, contractors and sub-contractors may lack the financial strength to accept their share of project risk. In these circumstances it might be more beneficial for both sides to either share the risk or for the client to take on risk.

In a tight market or where a client has a dominant position in the sector, there may be a temptation for client to use their power to unfairly (and unsustainably) offload risk on to their suppliers. While this could lead to a short-term cost advantage for the client, it often results in long-term difficulties. Suppliers may adopt an aggressive stance to improve their position, leading to conflicts, strained relationships, and project setbacks.

Establishing a fair and sustainable risk allocation aligns the interests of clients and suppliers, fostering a co-operative environment across multiple contracts that cover the relationships with different suppliers servicing various project aspects from design to operations.

### 1.5 Diversity Payment and Delivery Models

NEC [15] provides diverse payment and delivery models tailored to match the complexity and scale of projects:

- For straightforward work where a supplier can handle project risk: Clients can opt for a fixed price contract, ensuring cost certainty.

- In complex or larger projects where both client and supplier agree to pool risk: Clients can use a Target Cost contract, sharing savings or overspends through a pain/gain mechanism.
- Within the contracts the client is best suited to manage risks: Clients use a Cost-Reimbursable Contract, in which suppliers receive their costs plus an agreed fee or a Management Contract, in which suppliers are paid a fee for managing the sub-contractors delivering the works.

These choices [16] are further complemented by optional contract clauses allowing parties to address issues upfront, while also allowing contracts to reflect public policy priorities such as fair payment or local content provisions. NEC contract also supports framework contracts and design, build, and operate options.

Risk allocation is not the same as risk management. It is essential that the parties to the project co-operate to ensure that problems are identified and dealt with as soon as they arise. A project should have a single view of live risks and how they will be dealt with. This shared view must extend to the implications of any action taken for the project budget, its delivery programme, and the quality of what will be delivered.

### 1.6 Methodology

By its nature, this paper is an integrative literature review. This is a form of research that reviews, critiques, and synthesizes representative literature on a topic in an integrated way such that new frameworks and perspectives on the topic are generated (Torraco, 2005). Integrative literature reviews can be structured using a set of competing models and information. No data were generated or analysed during the study. At the first part of this paper the concept of NEC contracts and their principles is presented while follows the implementation of them and the new innovative way of thinking is demonstrated. The paper is complete with discussion, conclusions and recommendations [18].

The methodology of this study comprises consisting of (i) a literature review on the main topic of the study and (ii) the analysis and deeper understanding of the NEC contracts. Simultaneous systematic scientific research focused on the NEC was undertaken. Google Scholar was the starting search engine, where the research was directly limited to review articles. Keyword combinations such as NEC, Collaborative Procurement, Early Contractor Involvement, Compensation Events, Early Warnings and Dispute Avoidance Boards were used.

Then, papers in Scopus and Web of Science were analysed, considering that such databases contain the largest number of peer-reviewed journals and have a broader coverage of information. The Institution of Civil Engineers' own literature on the NEC4 was also studied as a fundamental topic source in the literature review. This included the NEC4: Engineering and Construction Contract Bundle and the Managing Reality, third edition: Complete Set, both acquired via NEC Contracts' official website. Finally,

the analysis of the collected data was developed, with the main focus on the roles, documentation, and strategies proposed by NEC4 ECC.

## 2. GAINING AN UNDERSTANDING

To gain an understanding of how NEC ECC is carried out<sup>[16]</sup>, it is necessary to make a complete review of some relevant aspects, such as roles, documentation, and tools of the standard model, which generate incentives for good project management. Firstly, it is appropriate to point out that the roles of the ECC have no point of comparison with any traditional model contract. Therefore, it is necessary to know the roles and responsibilities of those involved in an NEC4 ECC contract. Table 3 gives details on these aspects with focusing on the roles that will be part of the of the study. Table 4 describes the documentation related and required by the NEC4 ECC contracts.

**Table -3:** Roles in NEC ECC (Source: Ardiles et al., 2023)

Role	Liabilities
Client	One of the parties of the project. Submit the tender proposal in part 1 of the contract. Appoint PM and supervisor. Monitor and record project's KPI.
Project manger	It' the client representative on the site. Establish structure, procedures and systems for project development. Approve charges scope, defects and delegate responsibilities.
Supervisor	Ensure compliance with the scope and performance standard. Supervise carried out tests and inspections. Notify and file defects on site.
Contractor	It's the other party of the contract. submit its proposal in Part 2 of the contract specifying how the work and subtracting will be carried out.

Similarly, it is necessary to recognise the documentation involved in the procurement and tendering process of a project, as these are approved by various levels of management or representatives prior to the signing of the contract, indicating that a professional standard required for quality control must be met.

It is of utmost importance to mention that a properly prepared Contract Data minimises any ambiguity and uncertainty regarding important data such as the response periods between the parties, the names of the parties involved, start and end dates of the works, methods of payment and all types of Secondary Option Clauses chosen for a given project. Similarly, an appropriate scope provides the contractor with information that specifies and describes the works required by the client.

**Table -4:** Documentation in NEC ECC (Source: Ardiles et al., 2023)

Client	Description
Form of Contract	Contract itself
Contract Data Part 1	Specific complementary information required to operate the contract. Conditions to be fulfilled by the Contactor
Site Information	Construction site, its surroundings, existing buildings, and services.
Scope	Technical information. Obstacles to contactor. Safety requirements. Drawings and technical specifications
Contractor	Description
Contract Data Part 2	Conditions presented by the Contactor to validate the contract data according to the clauses requiring it
Programme	Execution programme, including resources labour and equipment
Pricing Documents	Activity schedule (options A& B) and bill of quantities (options C & D)
Contractor's Scope	response to client's scope indicating how the work will be carried out.
Design and Risk Management	Risk and Action plan

On the other hand, the parties involved in the tendering, procurement, and execution of a work under NEC4 apply the same responsibilities as indicated in Table 3, regardless of the degree of customisation of the contract.

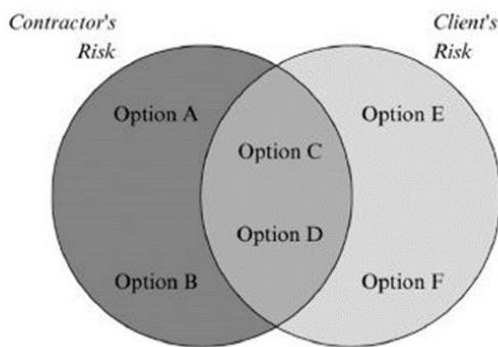
This is because the standardised NEC4 ECC model is based on nine Core Clauses, which are not modifiable and, on their own, provide greater sophistication and detail than any other the pro-forma.

Within the contract, there are six Main Option Clauses<sup>[22]</sup> to define the type of payment to the contractor for the work performed, of which one must be chosen depending on the balance in the desired risk allocation.

The Main Option Clauses eligible in an NEC4 ECC contract are the following:

- Option A, priced contract with activity schedule.
- Option B, priced contract with bill of quantities.
- Option C, target contract with activity schedule.
- Option D, target contract with bill of quantities.
- Option E, cost reimbursable contract.
- Option F, management contract.

Figure 1 shows the distribution of risks according to the type of Main Option chosen, which it shared between the client and the contractor.



**Fig -1:** Distribution of risks in NEC ECC  
Source: Ardiles et al., 2023

maintain a proper identification<sup>[17]</sup> and level of response to communications, it is established that each party has its own record and schedule of communications, which will allow immediate access to the record of events that may facilitate the prevention or resolution of potential problems.

## 2.2 Early Warning (Clause 15)<sup>[22]</sup>

An early warning, on the other hand, is a notification that can be made by either the project manager or the contractor, to alert the other party of any event that may increase the price total, delay completion dates and key deliverables or impair the performance of the works. The generation of an early warning should be performed as soon as the event becomes known, so that meetings are held to establish and manage the appropriate resolution changes more efficiently. If the contractor does not generate an early warning that could have foreseen a damaging event for the project, the contractor will be penalized; however, if the project manager does not generate an early warning, the project manager will not be penalized. In this way, the contractor and the client are encouraged to fulfil their responsibilities diligently.

## 2.3 Compensation Events (Clause 6)<sup>[22]</sup>

Compensation events refer to a situation that may occur during the execution of the project and that, if not attributable to the contractor, the latter is entitled to be compensated for the effects that may have been generated.

Failure to be notified by the contractor within eight weeks from the first instance when such an event could have been alerted shall result in the contractor being penalised by recognising the value of the work performed as if such a compensation event had been alerted and foreseen in time by a competent contractor. A project manager<sup>[17]</sup> has no time limit for notifying compensation events. Considering that, under a philosophy of mutual and cooperative work, such as the one proposed by the NEC, it is expected that a contractor is neither benefited nor harmed by a compensation event, he must present the solution and quotation of the compensation event to the project manager, who will evaluate it and, if necessary, instruct him to reformulate better alternatives that are more practical at the moment of facing the situation.

## 2.4 Incentives (Clause 6)<sup>[22]</sup>

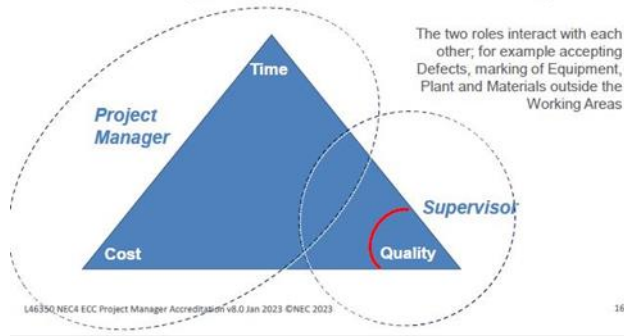
While collaborative actions and tools have been mentioned positively, they could not be carried out in a context where incentives for good working practices are not encouraged. Thus, NEC4 provides some specific clauses to reward the parties for their good performance in achieving objectives. One example is clause X12,<sup>[17]</sup> which apart from encouraging a particularized multiparty collaboration, provides incentives to those parties that meet or improve the established KPIs. Similarly, and being mutually excluded with clause X12, clause X20 encourages incentives to the contractor through the obligation to report on KPIs set and programmed by the counterpart, which will be evaluated, approved, and remunerated by the project manager.

works | services | supply



## Overall role of the Project Manager

The role of the Project Manager is delineated from the Supervisor



**Fig -2:** Overall role of Project Manager  
Source: NEC ECC material

The basis of the standardized model is sufficient to be able to contract with NEC4; however, the complexity of the infrastructure works, the involvement of the multiple actors in the contract and the variable circumstances that occur in a medium to large project make it necessary to apply incentives for good project management. NEC4 proposes stimuli and tools for good project management in its Core and Secondary Option Clauses, starting with the procurement and tendering processes, where these stimuli and tools are specified in documents such as it's the Contract Data the scope, the programme, etc. Within a wide range of clauses, they stand out as the main drivers of the philosophy of collaborative work.<sup>[17]</sup>

## 2.1 Communications (Clause 13)<sup>[22]</sup>

Communications within the framework of an NEC4 ECC contract are the most important basis and tool for establishing collaborative environments. All parties to the contract are obliged to notify each other by means of a written communication system that is properly established in the contract. There are, therefore, established response times for all types of notifications, be they early warning, compensation events, ambiguities, inconsistencies, etc. To

There are also incentives for the early completion of the works (clause X6) or incentives from the Main Options C and D that work with the target contract, where the final price for the works performed is compared with a target price set in the contract, so that, if there is a positive balance of this comparison, this is divided between the parties as contracted.

## 2.5 Dispute Avoidance Board (Clause W3) [22]

NEC4, within its new tools, provides three (03) dispute mitigation and resolution options. Of particular interest is option W3, where a Dispute Avoidance Board is used as the first method of resolution. Board members visit the project site, inspect the works, provide recommendations [17], and resolve potential disputes before they are formally referred to a court.

## DISCUSSION

Implementing an early warning system may enhance and innovate problem-solving techniques in projects, since it implies both parties to work together in preventing or mitigating cost, time, and quality risks, as concluded by Meng [27]. Such a system becomes essential when accompanied by compensation events, which can improve the risk allocation and help avoid possible future disputes between the parties. Remembering also that the contract is made up of supporting documentation, it is important to ensure that it contains all the information necessary for the contractor to be able to carry out the proposed works. To achieve this, a procurement structure such as NEC4 could be adapted, which contains particular documents such as the site information, which is provided by the entity and avoids the contractor being confronted with unforeseen existing buildings or services; in the same way, the scope specifies the extent of the works required by the entity, thus having two documents strictly referring to project information, which would facilitate the delivery of the works to the contractor.

Finally, to complement the proposal in view of the inherent need to improve the documentation pertaining to procurement processes, implementing a document such as Contract Data would ensure knowledge of the contract in its entirety, as well as the responsibilities of each party and would demand a higher level of collaborative work during its elaboration; in addition, it would allow for raising the performance levels of both parties during the execution of the contract.

In any case, in agreement with Wilkinson and Farhi [26], as long as the search for a change in philosophy and mentality is not prioritised, in order to achieve higher standards of mutual work among public servants, none of these innovation tools will have a major positive impact on public procurement processes and the clauses and documentation implemented will remain as merely legal formalities.

Moreover, it is important to address the research limitations, which resulted in the analysis of a single infrastructure project in the case study. One of the primary constraints is

the outdated and limited availability of information in the public. Additionally, inherent difficulties arose when attempting to obtain information directly from the parties involved in the contract, largely due to issues related to confidentiality and internal bureaucratic processes.

## EPILOGUE

Its common at Construction Industry [27] projects have significant delays and budget overruns. A lack of trust [28] and collaborative work within the construction sector has created systems of checks, double-checks and over specification to cover legal ramifications both real and perceived issues. Due to the existing conditions, it is concluded that there is a need for change in the processes, as well as in the way the contract and its parts are used, which, as the NEC postulates, should be everyday working documents.

## REFERENCES

- [1] Cheung, S.O., Cao, N.; Ma, W.S.A. Using KPI for Incentivization. In Proceedings of International Structural Engineering and Construction; ISEC Press: Fargo, ND, USA, 2020; Volume 7.
- [2] Rahmani, F. Challenges and opportunities in adopting early contractor involvement (ECI): Client's perception. *Archit. Eng. Des. Manag.* 2020,17, 67-76.
- [3] Mitchell, B.; Trebes, B. *Managing Reality. Book One: Introduction to the Engineering and Construction Contract*, 3rd ed; Institution of Civil Engineers: London, UK, 2017.
- [4] Lau, C.H.; Mesthrige, J.W.; Lam, P.T.I.; Javed, A.A. The challenges of adopting new engineering contract A Hong Kong study. *Eng. Constr. Archit. Manag.* 2019, 26, 2389-2409.
- [5] ARCADIS. *Global Construction Disputes Report: Collaborating to Achieve Project Excellence*. ARCADIS: Amsterdam, The Netherlands, 2020.
- [6] Eriksson, P.E.; Volker, L.; Kadefors, A.; Lingegard, S.; Larsson, J.; Rosander, L. Collaborative procurement strategies for infrastructure projects: A multiple-case study. *Manag. Procure. Law* 2019,172,197-205.
- [7] Taylor, F. NEC 4 Contract: Early Contractor Involvement (ECI). 2022. Available online: <https://www.hka.com/nec4-contract-early-contractor-involvement-eci/> (accessed on 10 Jan 2024).
- [8] 8.Nkunda, R.M.; Kazungu, I.; Changalima, I.A. Collaborative Procurement Practices in Public Organizations: A Review of Forms, Benefits and Challenges. *Ghana J. Dev. Stud.* 2023,20, 40-57.

- [9] 9.Yeung, J.F.Y.; Chan, D.W.M.; Chan, J.H.L.; Lok, K.L. Development of a Composite Project Performance Index for the New Engineering Contract (NECPPI) of construction projects in Hong Kong: A Delphi study. *Int. J. Constr. Manag.* 2022, 23, 2804-2817.
- [10] 10.Alhyari and Ani [4 Alhyari, O.H.; Ani, A.R.A. Is the Engineering and Construction Contract Legally Less Competitive than the Red Book in Civil Law Countries? *J. Leg. Aff. Disput. Resolut. Eng. Constr.* 2022,14, 06522001.
- [11] Farrel, A.; Sunindijo, R.Y. Overcoming challenges of early contractor involvement in local government projects. *Int. J. Constr. Manag.* 2020, 22,1902-1909
- [12] 12. McDermot, E.; Agdas, D.; Diaz, C.R.R.; Rose, T.; Forcael, E. Improving performance of infrastructure projects in developing countries: An Ecuadorian case study. *Int. J. Constr. Manag.* 2020, 22, 2469-2483.
- [13] 13. Laryea, S. Compensation events in NEC3 contracts: Case studies from South Africa. *Proc. Inst. Civ. Eng.* 2016, 169, 49-64.
- [14] Lau, C.H.; Mesthrige, J.W.; Lam, P.T.I.; Javed, A.A. The challenges of adopting new engineering contract: A Hong Kong study. *Eng. Constr. Archit. Manag.* 2019, 26, 2389-2409.
- [15] Ardiles Y. O, Sanchez-Carigga C., Espinoza Vigil A., Malaga M., and Milon Zevallos A., 2023. Seeking the Optimisation of Public Infrastructure Procurement with NEC4 ECC: A Peruvian Case Study. *Buildings* 2023,13,2828.
- [16] The NEC 3 Engineering and construction contract. Complementary. Second Edition. Blackwell. Science
- [17] Mott Macdonald,2020. The MM Little book of NEC Contracts. Available at:  
<https://www.apm.org.uk/v2/media/wwnbcddl/mott-macdonalds-little-book-of-nec-20221121.pdf>
- [18] Torraco, R. J. (2005). Writing integrative literature reviews: Guidelines and examples. *Human Res. Dev. Rev.* 4 (3): 356– 367. Available at: <https://doi.org/10.1177/1534484305278283>
- [19] ICE. *NEC4 Engineering and Construction Contract*; Institution of Civil Engineers: London, UK, 2017.
- [20] ICE. *NEC4 Establishing a Procurement and Contract Strategy*; Institution of Civil Engineers: London, UK, 2017.
- [21] ICE. *NEC4 Preparing an Engineering and Construction Contract*; Institution of Civil Engineers: London, UK, 2017; Volume 2.
- [22] ICE. *NEC4 Managing an Engineering and Construction Contract*; Institution of Civil Engineers: London, UK, 2017; Volume 4.
- [23] Mitchell, B., Trebes, B. *Managing Reality. Book Three: Managing the Contract*. Institution of Civil Engineers: London, UK, 2017. 3rd ed
- [24] Mitchell, B., Trebes, B. *Managing Reality. Book Two: Procuring an Engineering and Construction Contract*, 3rd ed.; Institution of Civil Engineers: London, UK, 2017.
- [25] Mitchell, B.; Trebes, B. *Managing Reality. Book One: Introduction to the Engineering and Construction Contract*, 3rd ed.; Institution of Civil Engineers: London, UK, 2017
- [26] Wilkinson, S.; Farhi, C. Could the NEC be widely used in New Zealand? *Manag. Procure. Law* 2008,161,107-113.
- [27] Meng, X. Is Early Warning Effective for the Improvement of Problem Solving and Project Performance? *J. Manag. Eng.* 2014,30,146-152.
- [28] Hammadhu R, 2023. Guide to Lean Construction-Easy way to become Lean with case studies. Printed by Amazon.
- [29] Moujib, A.,2007. *Lean Project Management*. Paper presented at PMI® Global Congress 2007. EMEA, Budapest, Hungary. Newtown Square, Project Management Institute

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