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## RESEARCH ARTICLE

### CONSTRUCTION TIME EXTENSIONS IMPACTS: CAUSES, CLAIM PREPARATION GUIDE AND COST

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#### ABSTRACT

**Background:** The construction industry is one business sector where time is of affluence. For this reason, most construction projects have well-stipulated timelines in the schedules to control and manage all sections of the project. Conversely, there are possible expectations beyond reasonable control where the extension of time in construction is necessary. However, extensions do not come cheap. The cost implication which could be very devastating is dependent on the size of the project, the intended project purpose, as well as the new scheduled completion date. **Objective:** The aim is to determine the causes and cost impact of construction delays leading to time extensions. Furthermore, to suggest guidelines for claim preparation. **Methods:** This paper reviews severally outlined reasons for project completion delays and cost implications from the various literature on the causes of delays which otherwise triggers time extensions. **Results:** Time extension are as a result of delays causing time overrun during the execution phase of projects. The literature suggest several factors play a role in triggering time extension, thus the need to identify each of the contributing factors at every phase of execution. These are either excusable (compensable and non-compensable) and nonexcusable (non-compensable). **Conclusions:** The analysis of the factors and the resulting impacts proves to burden stakeholders sometimes with high financial constraints, triggering confusion and prolonging project completion times. The causes of time extension though vary from project to project; the underlying impacts are similar. Consequently, there is the need to document and use appropriate means to evaluate requested time extension for appropriate resolution of dispute during the project execution.

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## INTRODUCTION

The construction industry is a significant contributor to the gross domestic product (GDP) and the development of most economies worldwide. The reasons for time extensions have become inevitable setbacks in the construction sector in recent times and are attributable to the approved complexities or sophisticated process involved in any single construction project by the sector players (regulators, consultants, designers, clients, users, suppliers, contractor/subcontractors). Notwithstanding the sector player's mentioned in the complexities of processes, advanced technology, as well as the financial position of the owners or financiers, have, however, played extraroles in not meeting scheduled completion dates, consequently, creating time extension. As a result, most urban, semi-urban and rural developmental aspirations are associated. According to Muspratt (1984), the largest and most competitive yet the least profitable industry in America is the

construction sector. Per the Muspratt (1984), assertion, the industry in 1984 was grossing \$250 billion a year, with 10% of the workforce in America in the construction industry and generate 10% of the GDP. Also, the construction industry contributed 15% and 50% of the capital information and fixed capital formation respectively and paid the highest salaries. Nevertheless, Russell et al. (2007), claims the disjointed character of the industry lingers to hinder expected efficiency and throughput. The desire for the complexity of global development has necessitated the industry to fine-tune its products to meet the desired and set objectives for clients, owners, and users. The complexities, however, have compelled engineers to design and construct sophisticated structures for the pleasure and pleasing of the owners and the public. Consequently, much is required of all stakeholders to enable achievable targets. The sophistication in the new standards, advanced technology, and multi-party involvement calls for additional knowledge, training and financial commitments from all stakeholders (regulators, consultants, designers, clients, users, suppliers, contractor, and subcontractors). As a result, projected times for project completion are not met, thus

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requiring time extensions. Projects not completed on the schedule are delayed. Construction contracts usually make provision and stipulate types of delay which may or may not qualify for changes to the time of performance (Zack and Badala, 2017). Divya and Ramya (2015), defined delay as “the time overrun either beyond completion date specified in a contract or beyond the date that the parties agree upon delivery of a project”. There is a belief that delays in construction projects that require time extensions are universal occurrences and do not pertain to a specific region or project type or size. Nonetheless, time extensions in contracts or projects are evidence-based or ability to reveal that the construction schedule may perhaps remain impacted due to delays in the execution of the project to completion per targeted dates (Rodriguez, 2017).

## MATERIALS AND METHODS

The method adopted involve the review of various research database and online publications for various most relevant articles on construction time extensions and impact implications. The papers reviewed and used for this appraisal were mostly associated with real projects with consideration of time extension, causes, cost impact. Also, papers with issues relating claims were analyzed and incorporated to solve claim preparation. As a result, some guides for claim preparation is outlined to help constructors generate appropriate procedures for claims relating to the impact of the extension of time.

**Background:** Divya and Ramya (2015), assert that delays in construction projects are one issue that is believed to be the most repetitive setback. The delay consequences are mostly unpleasant as the project success remains based on cost, time, quality and safety. Clients, users, consultants, designers, owners, contractors and subcontractors, and suppliers may cause delays, thus requiring time extension in the completion of a project. Accordingly, bringing mistrust, litigation, arbitration and cash flow problems. Only projects that try to satisfy the cost, time and quality limitations applied are termed successful and would not need an extension of time. Delays result in time extensions which may cause cost overruns and disputes. According to Marzouk and El-Rasas (2012), delays in civil engineering projects are a common phenomenon, resulting in litigations and disputes. However, most present disputes are negotiated or mediated. Once there is a delay, a time extension is needed to complete the project if it needs to stay done or the contractor needs to increase the workforce. Therefore, it is necessary to study and analyze the causes of construction delays or extension requirements. Marzouk and El-Rasas (2012), for this reason, reviewed the literature and interviewed several construction experts on the causes of construction delays. A questionnaire generated from their findings was subsequently presented to 33 experts (owners, consultants, and contractors) in the construction industry for their views on the causes of delays which resulted in project time extension. In another development, Hamzah et al. (2011), reviewed the literature on causes of construction delay and related the outcome of happenings in the sector in Malaysia. From the review, they came up with two main delay types which were used to construct a theoretical delay framework. Hamzah et al. (2011), defined delays resulting in time extensions as “a situation when the actual progress of the construction project is slower than the planned schedule or late completion of projects.” Consequently, failure to meet target time for a construction results in an unexpected negative

impact such as budgeted cost and specified quality results, on the project. The types of delay outlined in their paper are excusable and non-excusable as shown in Figure 1. Hamzah et al. (2011), asserts that contractors remain held responsible for non-excusable delays whereas owners and third parties subsist typically associated with excusable delays (accidents beyond the control of the owner or contractor and “acts of God”). Non-excusable delays are not compensable, however excusable delays due to an owner are compensable, on the contrary not when due to third parties such as “acts of God.” In addition to the two types of delays, Hamzah et al. (2011), mentioned concurrently as another cause of the delay. However, this delay type is a more complicated one. It consists of more than a single delay factor. According to Zack and Badala (2017), contractors may recover time resulting from delays and damages caused by the owner and are considered excusable (compensable). Compensable delays remain categorized into direct and indirect damages. Damages relating to direct delays account for the cost for idled equipment, extension of labor or workforce output, extension storage time, an extension of bond with costs implication, material inflation and many more. The compensation is calculated on idled equipment, labor, material price escalation and extended use of field office as well as general condition costs.

The indirect delay damage relates to loss of efficiency, extension or unabsorbed home office overhead costs, and extension of field office overhead costs. For that reason, delays given the needed require time extensions remain delays contractors may not have caused, however, occurred primarily due to change orders (Rodriguez, 2017). Divya and Ramya (2015) stated that delays affect clients, contractors, and consultants negatively. The uncertainty, complexity, dynamics of the environment and multiparty stakeholders of construction makes it arduous to complete projects on a planned schedule (Kartam, 1999). As a result, the industry is bedeviled with open disputes always.

## RESULTS

Based on the literature search, results are presented as the causes of time extension, interventions, time extensions and claim preparation guide, assessment of time extension and impacts, and cost impact.

**Causes of Time Extension:** The time extension of projects is caused by several factors, some of which stands attributable to the owner or project management team, and all others are attributed to the contractor and “acts of God.” Divya and Ramya (2015), through the review of the literature and questionnaire surveys, identified the major causes of delays in construction, the effects on projects and contributed the possible ways to minimize such delays on construction projects. Most of the effects are antagonistic which ruins the relationship between stakeholders. Divya and Ramya (2015), outlined political situations, segmentation, the award of projects to the lowest bidder, delays in progress payment by owners and shortage in equipment as significant causes of delay from the perspective of contractors and consultants. Also, Divya and Ramya (2015) specified that in addition to the earlier mentioned causes, poor ground conditions, insufficient inspectors, inappropriate design, monopoly and natural disasters as some causes of delays. This, overall by all standards trigger time extensions and its associated impacts.

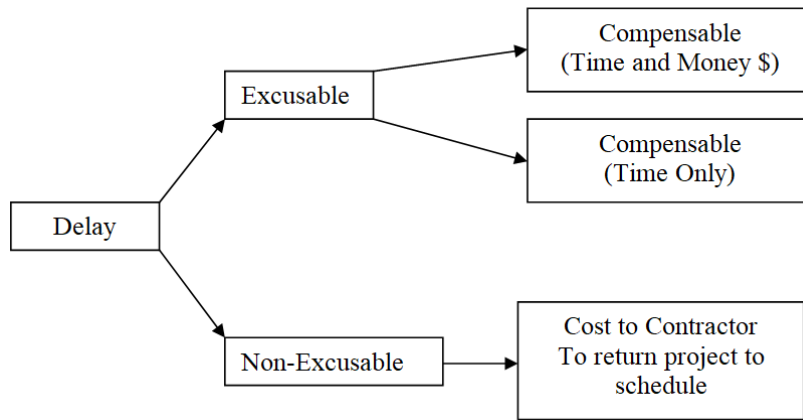


Figure 1. Types of Delays

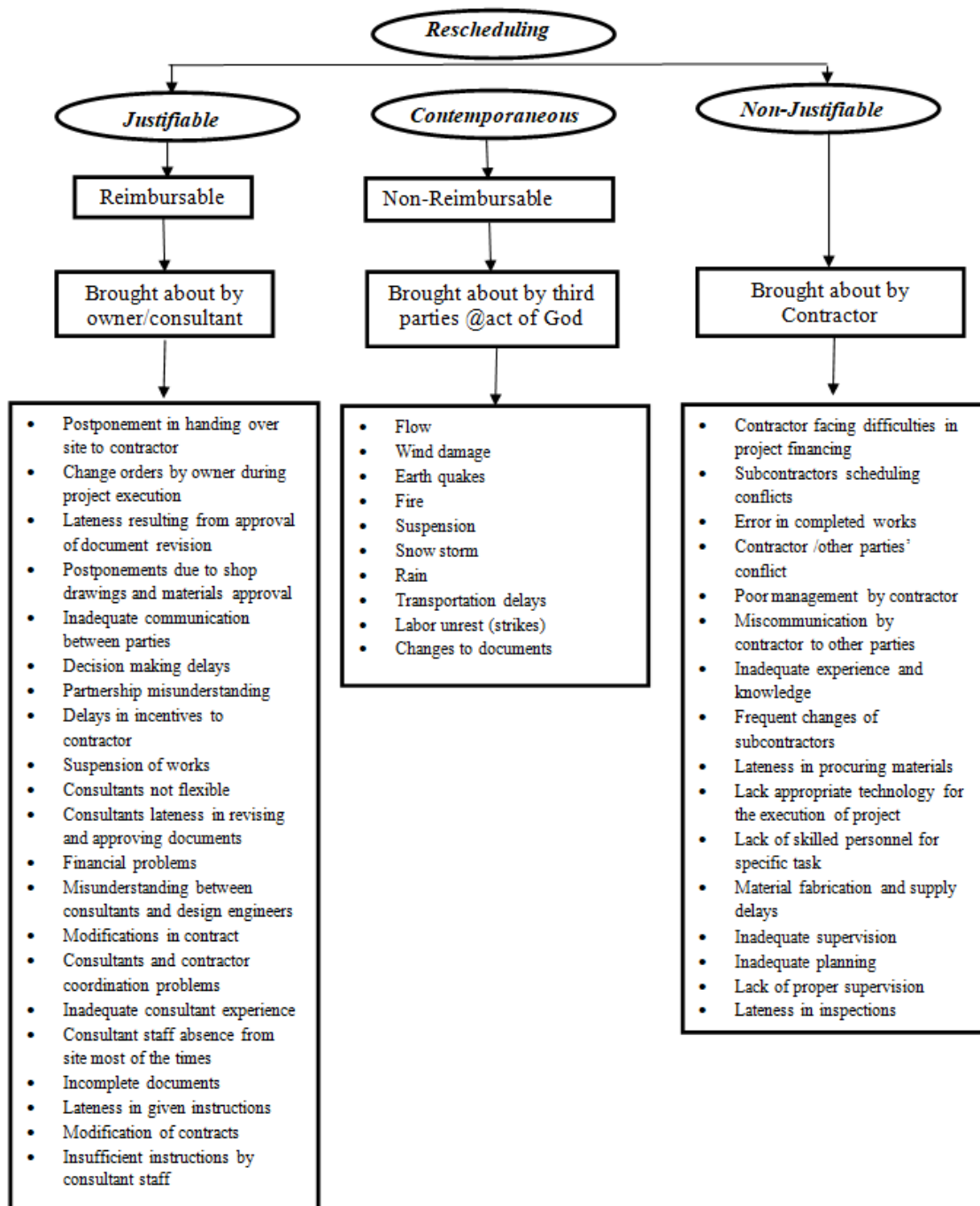


Figure 1. An outline of typical delay causes resulting in time extension for construction projects (Adapted from Hamzah et al. 2011)

**Table 1. Cost impact of project time extension, adapted from Chester and Hendrickson (2005)**

| Description             | Days Delayed | Cost Increase | Increase % |
|-------------------------|--------------|---------------|------------|
| Delay                   | 28           | \$561,000.00  | 5.7        |
| Cost Cutting            | 0            | \$211,000.00  | 2.1        |
| Resequencing            | 57           | \$376,000.00  | 3.8        |
| Acceleration            | -12          | \$ 4,000.00   | 0.1        |
| Change of scope(rework) | 39           | \$395,000.00  | 4.0        |
| Defective work          | 22           | \$153,000.00  | 1.5        |
| Strike                  | 31           | \$174,000.00  | 1.8        |

**Table 2. Cost impacts from delays from 22 federal funded construction projects (adapted from Diekmann and Nelson1985)**

| Change Order Type         | Changes |    | Money        |    | Time |    |
|---------------------------|---------|----|--------------|----|------|----|
|                           | Number  | %  | \$           | %  | Days | %  |
| Design Errors Changes     | 145     | 46 | ,452,000.00  | 40 | 290  | 18 |
| Mandatory                 | 41      | 13 | 662,000.00   | 11 | 55   | 39 |
| Discretionary             | 40      | 13 | 1,042,000.00 | 17 | 135  | 9  |
| Differing site conditions | 46      | 15 | 772,000.00   | 13 | 410  | 9  |
| Weather                   | 29      | 9  | -            | 0  | 560  | 15 |
| Strike                    | 5       | 2  | -            | 0  | 400  | 25 |
| Others                    | 7       | 2  | 1,202,000.00 | 19 | 3    | 0  |

Divya and Ramya (2015) acknowledged in another paper that, the ten most essential causes are improper planning by contractors, poor site management by contractors, inadequate contractor experience, inadequate client’s finance and delayed payment of completed works, subcontracting issues, material shortage, labor supply, availability of appropriate equipment, communication gap and construction errors. In another development, the cause of time extension in the Malaysian construction industry was investigated by Yusuwan and Adnan (2013). The write-up viewed the assessment of several professionals on construction projects on time extension application. They were able to conclude from the analysis of correspondence of questionnaires that, successful contractual claims and project management are only possible if an efficient contract administration and well-organized records are kept. Accordingly, if implemented, it will help improve project management in the industry and time extension might not be necessary.

Marzouk and El-Rasas (2012), utilized frequency index, severity index, and importance index to ascertain the ten top causes of delays on construction projects. In their documentation, they related delays in the United States to weather, labor supply, and sub-contractors; however, in Hong Kong, the delays were associated with reduced risk management, inadequate supervision, unforeseen site conditions, slow decision making. Also, in Indonesia delays were related to design changes, reduced labor productivity, inadequate planning, and resources, whereas in Nigeria delays were attributed to financing and payment of completed works, poor contract management, shortage of materials and changes in site conditions. Marzouk and El-Rasas (2012), categorized causes of delay resulting in time extension on construction projects into seven (7) significant groups. They are; the owner’s slow decision-making process, consultants with inadequate experience, contract or shaving financing difficulties or inadequate financial resources, on-site material shortage and delivery issues, labor and equipment: labor shortage and equipment failure or not performing to the maximum capacity, project site (ground or subsurface) conditions and external (weather effect) factors.

Rodriguez (2017) likewise outlined the following status quo as valid for time extensions: “legal issues are affecting the project’s completion or contractor’s performance; New or extra work not included in the original scope or contract; unusual or adverse weather conditions; and encountering sub-surface conditions differing from the plans.” Rodriguez (2017) on the other hand, accentuated that “delays caused by as Subcontractor; insufficient or inadequate workforce; contractor underperforming by procuring long lead items; project affected by normal weather delays; “insufficient proof or evidence that the critical path method has suffered an irrecoverable delay caused by the contractor or third parties may not be granted time extension. A common theoretical framework for construction delays resulting in possible time and cost overrun, disputes, litigation, arbitration, and total abandonment is outlined in Figure 2.

**Interventions:** Interventions are readily available to avert construction delays resulting in time extension. Divya and Ramya (2015) outlined the following for avoidance or minimization of delays provided instituted and adhered to:

- Progress meetings are held regularly to update stakeholders.
- Utilization of current technology, appropriate equipment and construction methods in the execution of projects.
- Applicable strategic planning, use of appropriate material procurement plan, and ensure initial cost estimates are accurate.
- Use of appropriate information and communication transfer channels and ensure collaboration between parties.
- Suitable planning, scheduling, and emphasis on experience from previous works carried out.
- Ensure that designs are complete, proper site management and supervision, collaborative working in construction, and compression of construction durations.

Bakhary et al. (2015) studied the problems associated with construction claim management associated with delays and time extension in Malaysia. They concluded that in a good number of cases studied, the lack of awareness on the part of the site staff to detect claims proactively necessitated time extension. Also, Bakhary et al. (2015) stated that the inability to produce relevant documentation as well as owner/contractor negotiations resulting in conflicts are some of the problems that have a lot to do with claim management and ultimately occasioning in delays.

**Time Extension and Claim Preparation Guide:** Time extension request and claims due to delays are very cumbersome and time-consuming, especially on massive and complex projects. However, with enough quality site or records and appropriate explanations, the request for time extension may be granted, and suitable related cost paid accordingly. Consequently, there is a need to have a guide to help put together all valid documentation to make validation quite simple. Muhamad et al. (2016) emphasized that most players have inadequacies in their skill sets and therefore are unable to implement adequate techniques, programming, and record keeping practices. Muhamad et al. (2016), investigated the analytical procedures in the implementation of delay analysis techniques for projects. Their search was done with questionnaires and literature reviews. They concluded that although the literature has several people adopting the delay analysis methodologies outlined as guides, there are significant flaws or weaknesses. According to Alnaas et al. (2014), the difficulty of requesting for times extension arises from the several interfaces and lots of details coupled with many stakeholders' involvement. There are several handbooks with the Practical guide lines but do not meet some of the needed means in order to meet new complexities in construction projects. Appropriately, Alnaas et al. (2014) have suggested that any request for time extension should include the ability to authenticate the causativeness and obligation satisfactorily. This may be linked to the request for time extension to direct events. The prove of events is not static and therefore would require contributions of all departments as a planning team. Alnaas et al. (2014) propose that for a proper guide to be attained, both the theoretical and field experiences should be combined.

**Assessment of Time Extension and Impact:** A time extension, when requested at any stage of a project, requires that proper justifications be made. Upon receipt of such justifications, the owner or the representative would evaluate, and analyze to ensure the time extension required is deserved, and the appropriate compensation due to each of the parties (owner or contractor) are formalized. Nevertheless, documentary evidence is necessary to arrive at a resolution of the excusable or non-excusable time extension. Jergeas and Hartman (1994) outlined the following as essential guidelines (i to v), and Harbans Singh (2002) stipulated (vi to xi) to form the typical basis of assessment for dealing with time extension at any stage of the project:

- Record keeping
- Knowledge of the contract
- Preservation of rights
- Qualify change orders
- Proactive actions
- If the procedures in the contract are adhered to, then the extension of time may be binding.

- Extension of time considers relevant event stated in the contract as anticipation to cause or likely to delay the completion of a project
- The expected delay should have little or no float so that its effect will not impact other works needed to be completed after.
- Based on the approved work program of the contractor, the net effect of the delay must be assessed.
- The analysis of the assessment must be made logically in a methodological way to understand the most relevant impacts.
- The overriding requirement is the satisfaction of the 'Fair and Reasonableness Test' on the part of the assessor.

Yusuwan and Adnan (2013) in a delay analysis for a time extension, there must include the duration of the delay, as planned and as built, impacted as planned, collapse as built, window analysis, and time impact analysis. Despite that, there is a controversy in the assessment of the impact delays on the total project duration and allocation of delay liabilities. Due to this claim, Yang and Chih-Kuei (2012) asserted that none of the existing methods of assessing delays with the elements of assumptions are perfect because of the following shortfalls.

- Some methods are not able to estimate or identify concurrent delays
- Execution of critical path methods are not executable in some existing methods thus changes cannot be well-thought-out.
- With the delay, the time analysis is not connected.
- The time-shortened activities effects are ignored on the total project duration instead focus placed on only delay activities.

Consequently, Yang and Chih-Kuei (2012) proposed the effect-based delay analysis method (EDAM) as an excellent schedule delay analysis process for construction projects. EDAM was applied to hypothetical cases, compared with other known methods such as global impact, impacted as-planned, net impact, time impact, collapsing, isolated delay type, snapshot, window analysis, and isolated collapse. In analyzing delays requiring time extension, the following questions need adequate answers.

- What was supposed to happen?
- What did happen?
- What were the variances?
- How did they affect the project schedules?

Time impact analysis in the construction process is needed to determine the extent of impact from potential delay and may be relied on at any negotiations, as well as an agreement of delay claims later. Time impact analysis is performed with the use of existing schedules and on all relevant contributions to validate the possible reason and effect on schedule. Rodriguez (2017), proposes the use of time impact analysis when remediation instructions expected to be made available by the contractor was not provided and again not able to reorganize his workforce. Time impact analysis can also be applicable if external and internal circumstances delays are expected. In some scenario, reduction in time to enable early completion of the project by increasing the number workforce and extension of working hours to ensure early completion remains an issue.

The consequence is a decline in the quality of completed work leading to loss of productivity and efficiency, and eventually increasing the project cost.

**Cost Impact:** The cost impact is usually classified under damages in the contract. Costs associated with delays at each stage of the project would require time extension. The extension of project duration due to a setback would have the term “delay damages” defined as only the damages resulting from extending the project’s duration. Enforceable liquidated damages are the only practical ways of ensuring the collection of the cost incurred by the owner or contractor. The cost impact may be a direct and indirect cost. According to Chester and Hendrickson (2005), not only time extension granted during projects results in cost overrun, but the acceleration of jobs to complete projects before schedule could also be costly to the project at completion. Zack and Badala (2017) narrated, “Put into the context of basic contract law these are damages that are the direct result of a breach of contract; that was within the contemplation of the parties at the time the contract was bid and executed and can be documented or proven within reasonable certainty.” According to the documentation of American Bar Association damages may be placed under liquidated damages provisions, consequential damages provisions and no damages for delay provisions. Zack and Badala (2017), states that there are no strict rules in accounting for damages. The following is a general list that could help in the determination of cost impact associated with time extensions of a project.

#### •Labor Costs

- Additional labor hours.
- Overtime and premium pay
- Loss of efficiency or loss of productivity
- Increased Wage rates

#### •Equipment Costs

- Increased rental or ownership costs
- Inefficient use of equipment
- Additional equipment needed
- More expensive equipment

#### Material Costs

- Additional material
- More expensive material
- Material cost increases
- Increased material storage

#### Subcontractor Costs

- Extended labor, equipment and material costs
- Extended jobsite overhead costs
- Extended home office overhead cost Jobsite Overhead Costs
- Added supervision and project management
- Extended supervision and project management
- Increased and extended jobsite resources (office trailers, site utilities).
- Home Office Overhead Costs
- Additional home office overhead costs
- Extended/unabsorbed home office overhead

Chester and Hendrickson (2005), in an investigation, considered and presented seven scenarios for the cost impact of the delays and acceleration are as shown in Table 1. In another development, Diekmann and Nelson (1985) studied contract change orders, claims, the causes of the change orders and the cost impact resulting from time extension. The original cost of the 22 federal funded construction projects studied was \$103,900,000; however, the resulting delays coupled with cost impact as results of the delays are summarized in Table 2.

## DISCUSSION

Delays in execution of projection generally cause time extensions. Delays could result as a result of several factors of which could be due to the client and its associates or the contractor and subcontractors. Others could be due natural occurrences of which no stakeholder has control over. In any of these conditions, projected times for execution of the project are likely to be overrun thus, time extension. The impact of time extensions impacts all stakeholders directly or indirectly and therefore resulting in financial burden. The factors are either excusable and compensable in cost implication and time as delays occurred, whereas others are only compensable with time. Then on-excusable delays are related to contractors and its associates, therefore warrant not compensation in any form. The contractor, therefore, picks up all cost and the necessary corrective methods. Consequently, it is bestowed on every participant of any project to ensure accountability of the progress of work through the appropriate project management and control strategies. To facilitate and successfully settle disputes that may arise among all the stakeholders, there is a need for proper documentation at every phase of execution. In addition to the documentation as a burden for proof, proper preparation of claims accelerates payments of commitments and does away with conflicts.

## Conclusion

Analyzing and evaluating the time extension concerning causes and cost impact is essential to the construction industry because the construction industry is suffering from its detrimental effects. The occurrence necessitates the time extension for construction projects. However, the process of time extension becomes very complicated and frustrating as there is a need to proof (burden of proof) beyond every reasonable doubt for the need of such an extension. In most cases, parties do not have appropriate, updated or synchronous documentation for justification hitherto, improve the understanding of stakeholders’ time extension and its potential impacts. The inevitable extension would usually come with cost implications causing project schedules and budget to stand overrun. Depending on the causes and the extended time extensions, cost overrun could be substantial to stakeholders of the project. In addition to the cost implications, there could be prolonged legal battles which could eventually ruin the relationship between the parties involved. It is therefore crucial for stakeholders to study and work towards minimizing the causes of several project delays resulting in time extension and cost overrun. The success of the industry is dependent on minimizing time extension, cost/budget overrun and improve contribution to the GDP of any economy.

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