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A Review on Risk Factors Encountered by Contractors in Construction Projects

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Abstract

Construction projects are very complex and may carry various risks. The risk of construction projects are natural because internal factors that occur during the period are bound to develop. Mega projects are subject to crucial risks during construction and for completion within schedule and planned budget. Therefore, due to various risks associated with mega-building, such as commercial centers, bridges and skyscrapers, a large number of losses occur. The purpose of this review is to analyze risk factors focused on Drewin's Open Conversion System (DOCS) theoretical framework for the development of hold-up on the construction industries in time. This paper reviewed 77 published articles relevant to the study of risks in construction projects. Throughout the studies, the authors stated the internal factors that later were classified according to their risk categories. By adapting DOCS to classify those internal factors in this study, three foundations are identified namely internal environment, input factor, and external factor. This framework identifies items that cause delays in construction projects, which will enable practitioners through their initiatives to manage risk analysis. The implication of this review is now that constructed framework on factors of risks in construction projects will lead to better management of risks

Index Terms; *Construction project, Contractor, Delay in construction, Risk factor.*

I. INTRODUCTION

The principle of risk has a long history starting from the end of World War II. Wayne Snider proposed the creation of an integrated department responsible for risk mitigation in the associated industries [1]. However, during the time there is no systemic approach or scientific method on risk. From this period we observe risks involved the conceptual ideas and theories on how to appropriately assess, evaluate, manage and measure risk.

From a wider point of view, these changes in risk applies particularly to large public corporations; financial institutions, energy and petrochemical companies and construction companies which may lead for the companies that need risk protection, because risks are able simply to increase in nature. Nowadays, in most sectors has encompassing the discipline however insufficient a set of practices by organizations has produce poor results in development. In general, it proves that construction sector is not competent on its risk management, unmethodical and possibly the project success is limiting. The likelihood and the probability is an unpredictable situation involving any exposure [2]. Project administration literature describes a

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particular and extensively regularly occurring the process of controlling, which the key is from four repetition stages; identification, estimation, response planning and execution, and most importantly these all stages have to be included in the organization' s risk management. This administration Has a vital role consequently in direct relation to the profitable project completion.

Traditionally, contractors increased the net profit earnings to cover risk yet the production is an efficacious once the margins decrease [3]. In the last few decades, the experienced learnt from the previous project in aspect of the same system being applied in the management. However, the skill of carrying out a task does not improve the performance because there are still unforeseen circumstances that often interfere and cause delay in the activities [4]. Though, this challenging phenomenon has been noted by the contractors and theorists who have been trying to formulate the issues within an appropriate framework or procedure. The paper's main objective is to undertake a review of recent approaches made in the risk discipline with a significant focus on a novel and the development of multi-risk framework of risk factors encountered by contractors in construction projects.

II. LITERATURE REVIEW

Generic risk analysis is a wide extent definition of science however, scientific applications of the work contributes to new insights, for example a better measurement in calculate the degree of risk to show its critical level. Rather few authors have been discussed on this field.

A. Risk Analysis

In recent years, there has been a noticeably rapid intrigue based on risk issue especially from perspective of the high rise sector. The analysis areas concentrate on recognizing unexpected causes, assessing the possibility of their existence and their effect on a construction project's path.. Reference [5] indicated the issues that often occur in terms of internal risk analysis in his latest publications mentioned are the following:

a) Risk methodology / procedure for a project plan

b) Proposition for threat identification and its implications

c) Identification and feasibility study the better risk management approaches in control programs of the project based

d) Analytical implementation of the procedure to a certain risk management issue

e) Principles and implementation of risk management of infrastructure works

Regardless of dynamic and tremendous site project environment that exists, the uncertainty and critical issues of each project are associated with risk-taking by a firm that undertakes a contract to perform service and provide material or labour. In the work of [6], the unoccupied site is surrounded by numerous dangerous facilities with varying hazards related to security, health and environmental issues which affect the overall level of safety danger. As shown below, the effect can be referred to as weights between risks:

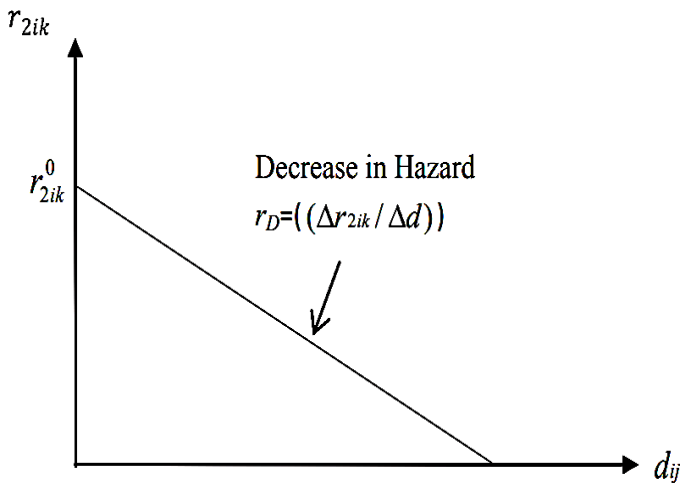

Fig. 1: Linear decrease in hazard at a construction site

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Therefore, every plan must undertake a risk factor assessment along with identifying potential internal threats prior to implementation [7]. The risk analysis criteria are to show the lists of threats, uncertainty and the final impact assessment of the system. As many researchers when reported risks are correlated with the likelihood of technical performance, the possibility of expense of a project differs even throughout time and growth. According [8], the following equation can be used to calculate hazard:

$$R = P * I \qquad \textbf{Eq. (1)}$$

where:

R = the degree of risk

P = probability of occurrence of a risk

I = the perceive or consequences impact on a project

References [9] and [10] stated the risk is an exposure or expected value (EV), however [11] said it is the average risk estimate. Reference [12] studied that somehow the ten leading causes for high rise delays are: insufficient scheduling from the contractor, contractor's failure of site planning, inadequate expertise of the contractor, construction faulty, issues among contractors, material shortages, labour shortages, availability and breakdown of machinery, lack of interparty communication and inadequate financial capability of the company and compensation for the completed project.

B. Critical Risk Factors

Based on the work of [13], the internal factors caused by the contractor is the risk factors identified by [14], [15], [16] and [17] in different types of construction projects and have been recognised as critical; (1) Context and design changes, engineering integration (2) Conditions of the site and uncertain location (3) Economic growth, global economic condition and policy (4) Funds cutbacks, financial failings (5) Minimal management skills, poor group cohesion (6) Resource Supply. Reference [18] listed the responses of the contractor to the ladder position of major factors contributing to delays in construction project, as described below:

Table 1: Ladder position of major factors contributing delay based on contractor' s responses

Hypothesized factors	Relative importance index	Rank
Delays in design information	0.889	1
Long waiting time for approval of drawings	0.822*	2
Poor site management and supervision	0.822	3
Unrealistic contract durations imposed by client	0.817	4
Mistakes and discrepancies in design documents	0.815	5

*Equal comparative value of parameter indexes measured by the number of scoring respondents.

According to [19] and [20], the findings can be applied to a fair degree of objectivity and credibility, especially given the considerable level of experience of contractors. Such findings and resulting results may well offer valuable measures to reduce the problems causing construction site delays. Reference [18] lists some of his recommendations as stated below:

- The partnership with the on-site productivity and competent management teams reflects the need for strong site monitoring and ma nagement oversight. Manpower must upgrade their own skills at both the technological and administrative levels by ongoing professional development schemes. For educational establishments, this can get into the context of training programs even in short access.
- Negligible awareness to site location

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condition causes a lot of construction delays. To reduce the effect of any unexpected soil conditions, the evaluation of site situations should be detailed, accurate and clearly understood before construction begins, along with the layout of groundworks and structures.

- Effective data exchange between project decision makers further illustrate the need for communicating effectively well into the building industry.Throughout order to accelerate coordination and decision-making between all stakeholders, effective general management processes and interaction mechanisms should be built throughout the entire project existence. There should be a clear definition of the duties and obligations of those working in the project team which clearly identify the decision-makers specified.

- The most effective technique for that differences is called a straightforward and comprehensive consumer summary. For unavoidable changes, contingency measures may be implemented. Use risk analysis methods, these deductions can be accurately quantified. Methods approaches should also be developed to mitigate the impact of these unforeseen variables to receive experienced professional feedback on their cost and time effects, along with the contractor's insights. Quality management techniques can be helpful both in the conceptual design process in designing the project from the brief and in restricting any changes to those that are absolutely essential.

- The discrepancies in understanding between the various groups of market stakeholders should be acknowledged and addressed in relevant forums to order to overcome gaps to prevent and resolve some of those that can be minimized issues outlined herein.

III. FRAMEWORK OF RISK FACTOR

The integration of risk perspective and better methodology allow us to easily observe its presence before undergoing operation of risk measures. Thus, this section will discuss onrisk factors based on Drewin's Open Conversion System (DOCS) for the development of a theoretical framework that causes delay in construction industries.

A. Input Factor

The study by [21]stated that the input variable is the predictor of the qualified result of the construction project; money, labour, power and land which construction team cannot be fully regulated. This theory is crucial for the business development activity, since it does not increase their productivity. In Figure 3.1, it shows three output groups consisting of 16 factor variables factor class creation and basic comprehension based on earlier work from reputable journals.

Monetary value representation may be the best technique to integrate all output types. Nonetheless, it is difficult to fully measure and transform some of the outputs like equity to correct monetary values. The business cycle cost influence, such as deflation, influences the quality artificially [22]. This is a case of improving the construction process until completion. Capital consists of five considerations based on previous analyses of literature.

Labour has always been the major factor in overall construction productivity and constitutes a large proportion of construction costs; it is more vulnerable to management decisions than other commodities and is easier to quantify [23]. Therefore, for the construction industry, labour productivity is more important and its production can be calculated as man-hours and man-days. In this analysis, the labour variable influences the efficiency of labour in a construction project while all types of machinery in the assembly process; the task needs to be completed. In aspect of the machineries and equipment at the project site could impact the equipment.

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B. External Factor

External factor is an exogenous act; a variable in project construction work that cannot be managed by the construction team, even so these exogenous variables can affect the overall process of construction implementation. The exogenous variable is completely distinct from the productivity perspective, centered on DOCS Model. It is possible to calculate efficiency by assessing the input value of the process and receiving the production from an event. Therefore, to go through this phase to get production in the form of job and task performance, the output variables those in all probability to presence in the delivery of a high rise project and it seems to be an issue. The exogenous variable has been included in this analysis as the last factor group. The exogenous variable is the result of past research into every production influencing factors the structure's quality. Several previous studies have addressed exogenous effects on the efficiency of construction labour, including [24], [25] and [26]. This research collected and defined performance factors in five categories of function as such economic, local authorities, public, site conditions, and weather.

Weather is the circumstances that are predetermined or uncontrollable at the venue and around the construction project area. These involve heat, high temperatures, storms of dust, high winds, and may impact construction project execution. Local authorities are all issues related to laws and initiatives of state that can impact construction projects. Due to the infringement of government regulations, the procedures include approval and cessation of work activity orders. The population or public is made up of events surrounding them and adverse social circumstances. The conditions of the site are all issues relating to the conditions of the site that may conflict with the construction process. Site conditions in the DOCS Model consist of two variable products. All issues linked to a country's economic situation are economic conditions. The economic conditions in this analysis consist of variations in oil prices and rates of natural gas. Figure 3 illustrates the constituent elements of each class of exogenous factors [27].

C. Internal Environment Factor

In this analysis, the internal environmental variable is described as everything in the form of construction-related inputs regulated and fully managed by the construction party at the construction site. The highlight in this review would be on the theoretical framework laid out in this paper, based on the 1982 Open Conversion System of Drewin. Between the duration of the construction project and completion date, the inner environmental factor, it is one of the key inputs that impact the construction team's performance and activity. Inner climate comprises of seven groups of identified variables based on previous studies [7], [28], [29], [30], [31], [32], [33], and [34].Construction progress is controlled by these internal environment factors.

Figure 2 indicates that the classification of internal environmental factor comprises of communication, quality, management, scheduling and planning, site management, occupational safety and health, and decision making. Those seven types of internal environmental factor are then grouped into 16 factors that can influence inner environmental factors to increase the efficiency of productivity. Similar internal environmental factors found were focused on the vital comprehension of prior studies in several countries, particularly in emerging countries.

Theoretical framework is an exploded view that demonstrates and will be used in this analysis the interaction between interrelated variables. There are a number of studies that cumulate the origin of the construction sector delays. It is packed into the structure of the principle. This paper uses DOCS as the foundation of the theoretical framework for the purposes of the method. A DOCS is a framework which represents project operation input and output

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[35]. Drewin's implemented framework is used to characterize the construction process's efficiency [36]. Output is correlated with efficiency, which is often described as the work done per time unit [37]. Through reducing one of the variables for production and vice versa, output may be improved. Hence, in comparing efficiency, it is necessary to relate the relationship between variables and their effects [38]. Many reports in the construction industry were recorded to gather the trigger of slowdown.

In this analysis, the DOCS applied to identify the causes for delays for construction projects as listed. A traditional construction framework is usually demonstrated by DOCS which requires interoperability among influences. It also reveals the disruption and input during project delivery that occurs naturally. Three primary delay variables identified; output, internal and external variable. This is a theoretical framework as it is systematic as it is implemented in construction projects depending on the system and scenario. As shown below, the author has changed the model from DOCS to match the triggers of development slowdown:

Fig. 2: Simplified DOCS for causes of construction delay

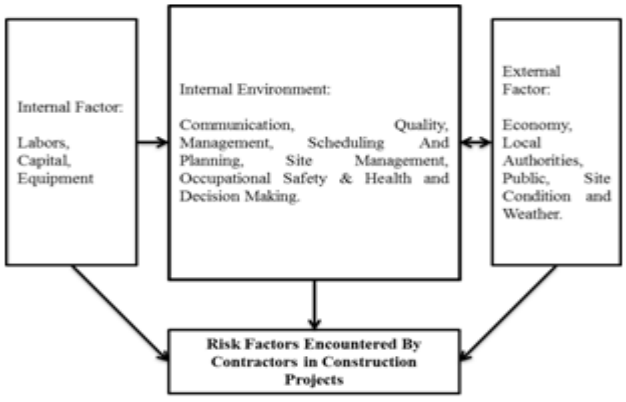

Fig. 3 displays the database of delay factors based on the classification according to the theoretical framework of delay study.

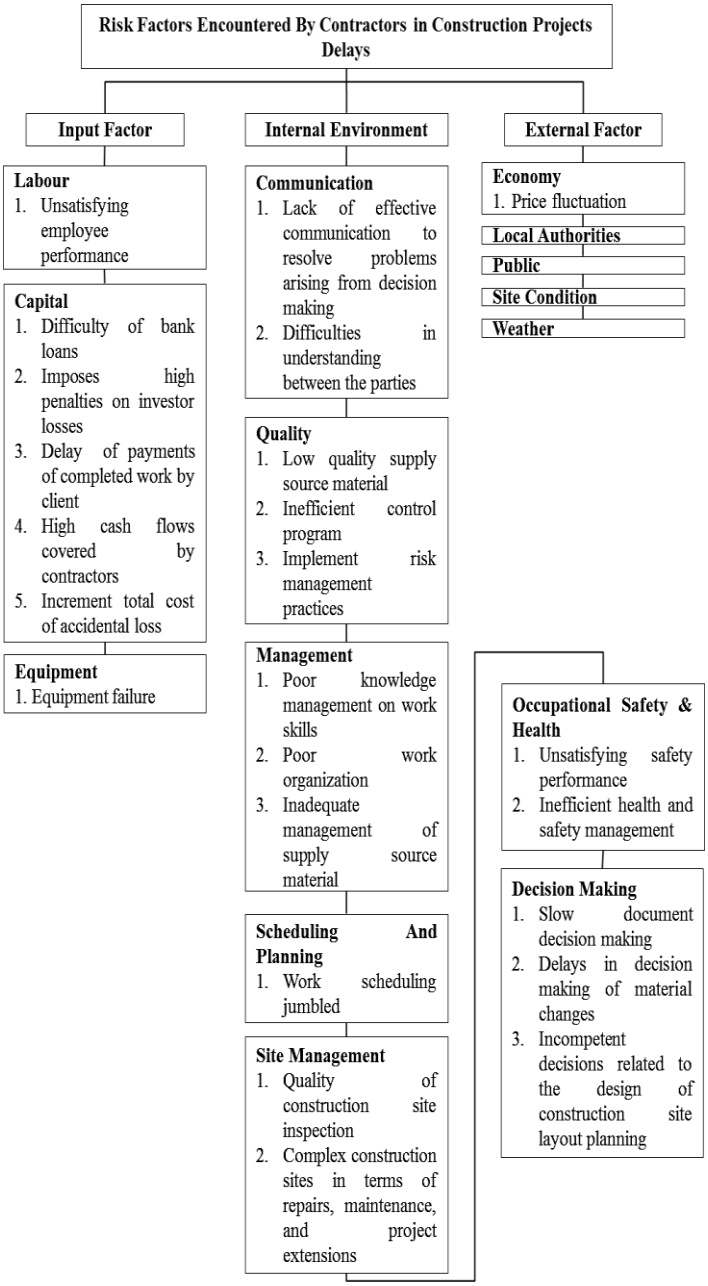

Fig. 1: Input factors category & Internal Environment Factors Category

IV. CONCLUSION

Risk factors are present in a construction activity since the tender stage. Basic theories and better methods to handle risks are sufficient and significant to so that the progress of construction is on schedule, and under or at the cost of capital. Here a review seeks to studies objectively on risk factors influencing construction setbacks also identify such variables were based on previous studies in different countries in classifications of variables.. Based on

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various study results vital understanding and apply the Open Conversion System (DOCS) from Drewin, there are three key important result for achieving the goals. These variables of input factors, internal environment factors and external factors namely identified. This content includes a group of variables that are capital, equipment and labour. Internal environment comprises of groups of factors such as, management, scheduling and planning, site management, occupational safety and health, and decision making.

V. ACKNOWLEDGEMENT

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