Analysis of Delay Impact on Construction Project Based on RII and Correlation Coefficient: Empirical Study

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\textbf{Abstract}

The occurrence of a delay in the construction projects is common and significantly affects by enormous ways. This study investigates the typical causes of delay at different stages of construction and its effect in the Ethiopian construction projects. Using a questionnaire with 52 causes and 5 effects of delay, data were collected from 77 participants' selected based on purposive sampling from the different contracting organizations. The methodologies used in this research are relative important index (RII) and correlation coefficient. Based on the comparison, the impact of delay is found as, construction stage, pre-construction stage, and post-construction stage sequentially. The analysis of the relation in construction process shows; the average/overall is highly related, construction stage is the second related, post-construction stage is the third related and pre-construction stage is far part of all stages. As far as, overall/average causes of delay are comparable to all stages. So from the overall, the influential causes of delay investigated are corruption, unavailability of utilities at site, inflation/price increases in materials, lack of quality materials, late design and design documents, slow delivery of materials, late in approving and receiving of complete project work, poor site management and performance, late release budget/funds, and ineffective project planning and scheduling successively as unique to the Ethiopian construction project. The critical effects of delay investigated are cost overrun, time overrun, termination of contract, arbitration, and litigation sequentially. Although, the research is conducted on the Ethiopian construction projects, but it can also apply to other countries and further study.

\textbf{Keywords:} Causes and Effects of delay; Construction Project; Ethiopia

1. Introduction

A construction project is commonly admitted as successful when it complete on time, with budget, according the specifications, and stakeholder satisfaction. However, most of the projects did not finish as the expected timetable. Instead, they completed before or after the schedule due to uncertainties of events and its uniqueness [1]. Construction projects experienced 70% of time overruns and 76% of contractors and 56% of consultants have indicated that they have been facing average time overrun of 10 to 30% from the original duration that causes 50% cost overrun [2]. Elsewhere, 50% of the construction projects in the United Arab Emirates (UAE) encountered construction delay [3]. Therefore, delay considered as one of the most common problems causing a multitude negative effect on projects, and its participating parties [5]. Ethiopia one of the fastest growing, developing country; uses construction industry as the main input for growth, employment, and infrastructure expansion. Yet, not contributed to the development of the country as desired due to it faces various problems, limitations, and drawbacks. Among those, impact of delay in construction project is a common, and a predominant. Various researchers had been studying the causes and effects of delays in construction projects all over the world and in domestic in numerous manners for decades. The problem studied in different countries with different scholars; due to the reason that, it differs from one country to another; in time variation or even one project to another. And to find the various factors and groups of factors that causing delay. Some of those countries that investigated the problem of the causes and effects of delay include; China[12]; Thailand[11]; India[8]; Nigeria[6]; Ghana[7]; Egypt[4]; Saudi Arabia[2]; UAE[3] and Iran[5]. Among those
researches, some of them focus on causes and effects, and the other only on cause or effect. The survey of Ghana housing projects conducted to evaluate 37 causes with effects of delay. Then found six most critical factors of delay as delay in payment to contractor/supplier, inflation/price fluctuation, price increases in materials, funding from the sponsor/client, variation orders, and poor financial/capital market [7]. Mahamid [9] made an analysis of total of 52 causes of delay and find the most contribute factors as political situation, segmentation of the west bank and limited movement between areas, award project to lowest bid price, progress payment delay by the owner, and shortages of equipment. From the total 43 examined causes of delay categorized under seven main groups. The predominant were investigated shortage of construction materials in market, fluctuations in cost/currency, late financing and payments of completed work by the owner, effects of subsurface conditions, shortage of labors, inadequate experience of consultant, difficulties in financing project by the contractor, low productivity level of labors, unqualified workforce, and variation orders/changes of scope by the owner during construction [4]. The investigation of causes of delay in gas pipeline construction projects that found ten most important causes of the project delay among 43 factors as imported materials, unrealistic project duration, client-related materials, land expropriation, change orders, contractor selection methods, payments to contractors, obtaining permits, late delivery of ordered materials by the suppliers, and contractors’ cash flows[5]. The evaluation of the effect of 26 factors on time, cost, and quality in public construction projects and identified five main causes of delay as unsettled or lack of the project funding, delay or long process times caused by other authorities, unsettled or lack of project planning, errors or omissions in construction work, and lack of identification of needs [10]. From this brief review of the literature, the problem studied in different countries with different scholars; resulted in all with different causes and effects of delay. Most researches focus on the general causes of delay, whereas; this study focuses on the objectives of; (1) The causes of delay in construction process, which comprises pre-construction, construction, and post-construction. (2) There has not been any study that investigated the tie between the main stockholders responsibility, resource, contract and external in relate to the construction process at different type of contracting organizations (general contractor, building contractor, road contractor, water work construction contractor, pile foundation work contractor, electro mechanical contractor, consulting and architecture). (3) There has not been any study, investigate the causes and effects of construction project delay in the case of Ethiopia.

2. Research methodology

The research methodology presents processes and techniques that used in this research.

2.1. Data collection and sampling design

The processes of data collection and the design of the questionnaire start with the development of sample questionnaire with an intensive review of literature. A pilot study conducting on 14 contracting organizations with an interview and questioner to select the significant causes and effects of delay. Finally, six higher experts conducted the validity of the questionnaire. As a result; the clarity, completeness, and applicability of the questionnaire are confirmed. Based on the design a list of 52 causes under four main categories with different sub category and 5 critical effects of delay in the Ethiopian construction projects were established. The data were collected from 77 experienced participants. The analysis of causes and effects of delay in construction project using relative important index (RII) and correlation coefficient. The major steps of the research methodology include; (1) selecting significant causes and effects, (2) selection of participants using purposive sampling, (3) assessing using a questionnaire survey, (4) comparing using correlation coefficient, and (5) analysis of the causes and effects of delay using relative importance index (RII).

2.2. Ranking and computation of relative importance index (RII)

Relative Importance Index (RII): used to determine the relative importance of the various causes and effects of delay using five-point Likert scale. The higher value of the relative important index (RII) represents the important cause or effect of delay and vise verse [1]. Computed by Equation (1);

\[
RII = \frac{\sum WiFi}{A \times N} = 1F1 + 2F2 + 3F3 + 4F4 + 5F5/SN
\]

Where: \( i \) - response category index, \( Wi \) - is the weight given by respondents, \( Fi \) - is the frequency of respondent for each weight, \( A \) - is the highest weight and \( N \) - is the total number of respondents. The relative important index (RII) ranges from 0 to 1 (0 not inclusive).
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