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Mitigation Measures in Dealing with Delays and Cost Overrun in Public Building Projects in Dar-Es-Salaam, Tanzania

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Abstract A building construction project is a high risk activity which must be managed effectively in all stages, in order to avoid delays and cost overruns, which in most cases are part of it, and a common problem. These problems occur frequently during project life-time leading to disputes and litigation. There are numerous factors causing delays and cost overrun in building construction projects, and in order to mitigate these causes; the study aimed at identifying the mitigation measures in dealing with delay and cost overrun in public building project in Dar-Es-Salaam, Tanzania. This research presents a list of construction delay and cost overrun causes and mitigation retrieved from literature. The feedback from building construction experts was obtained through questionnaires. Subsequently, a questionnaire containing list of construction delays and cost overrun mitigations retrieved from literature was prepared. The questionnaire survey was distributed to 75 building construction experts, from the clients, consultants, and contractor's organizations side. Out of 75 distributed questionnaires, only 49 were returned. The data were analysed using Microsoft excel and ranked according to mean score for contractor, consultant and client. The general response from both parties were analysed, high scored factors were discussed. Effective project planning and scheduling; design change should be controlled; effective coordination and communication between parties; client, promptly paying the parties progressively; having accurate cost estimates; appoint competent site and project manager; comprehensive contract administration; ensuring prompt resolution in design change queries, issues and authorization report; efficient and effective planning time schedule for material procurement delivery process; developing effective strategic planning for solving identified risks; and ensuring on the timely availability of finance; were identified as the most effective mitigation measures in dealing with delay and cost overrun in public building project, due to having a mean score above 4.00.

Keywords Mitigation Measures, Delays, Cost Overrun, Construction, Building Projects, Dar-Es-Salaam, Tanzania

1. Introduction

Delay and cost overruns are common issues in the building construction industry, in developed and developing countries, [1, 6, 19, 29, 30, 50, 62]. This makes it difficult for building construction projects, which in most cases are complex endeavours, associated with large costs and long duration, to achieve their major criteria in terms of success (i.e. project completion within budget, time, best quality and the satisfaction of the client's requirement), [18, 59, 66, 69] asserts that; the achievement of these project success in the building construction industry, is even more critical, as companies work on narrow margins. They further insist that; even with various cost control software and techniques, delay and cost overruns still prevail in building construction projects.

Moreover, [45, 58, 59] reports that; during the last few decades, numerous project control method such as Grantt Bar Chart, Programmed Evaluation and Review Technique (PERT) and Critical Path Method (CPM) have been developed; and a variety of software packages have become available to support the application of these project control method, for example Microsoft Project, Asta Power Point, Primavera etc. Despite the wide use of these software and method, many construction projects still suffer extensive delay and cost overrun. The delay and cost overrun issue in building construction industry is also enlightened by, [12, 34,

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46] writings as they portray how over the years, it has been a challenge worldwide, with the inability to complete the project on time, and within budget being a chronic key problem, despite the advent of advanced technology and construction management techniques.

Most authors affirm that; building construction project usually present delays and time overrun. [18] underlines that; building construction project is a complex task undertaken by participants from multi-discipline construction professionals, which involve construction project control by constantly measuring progress, evaluating plans and taking corrective action when required, and ensuring that the targeted project objectives are achieved without delay and cost overruns. Moreover, despite building construction project involves huge contract values, more specialized works, tighter schedule, stringent quality standards, etc. as per [18], it is rarely to find construction project completed without cost and time overrun; because there are some instances were construction project are completely unpredictable, [6]. Furthermore, [43] contends that; the project contractors and owners do not use management methodologies that are useful to distribute resources properly. Even though the management of project has been studied for many years, most project either failed or present cost or time overrun. [65] insists that; these overruns are considered as critical issues in the construction business, because they represent the loss of money for contractors and owners.

In Sub-Saharan Africa, delay and cost overrun have been observed in different countries. Studies by [12, 31, 55] conducted in Nigeria, South Africa and Ghana, revealed that; most building projects are completed at the cost much higher than initial cost estimate and out of the budget; failure in delivering the project on time; and cost and time overrun existing in more than 40% of building construction project. According to [38, 46] delays and disruption are among the challenges faced in the course of executing construction projects in Sub-Saharan Africa. It may sometimes exceed 100% of the anticipated cost of the project. Additionally [38, 46] reports that; Tanzania also face challenges on importation of industrial plants and equipment, due to its unlimited purchasing power caused by foreign exchange problems, that leads to some of building construction works previously planned, encountering with delays and cost overruns. Also [42, 46] affirm that; the extent of poor planning, contributes to the delay on construction works in Tanzania, causing wastage of time and money, that results to price escalation.

Numerous studies by [13, 38, 61] on delay and cost overrun in building construction industry have been conducted, focusing on identifying factors that leads to delays and cost overrun, and none has been done on mitigation measures in dealing with delays and cost overrun in public building projects.

1.1. Problem Statement

The building construction industry in Tanzania, contributes greatly to the overall economy, but it is plagued by delay and cost overrun due to various causes. [47] asserts that; the construction industry contributed 13.6% to Tanzania's GDP during 2015, reaching almost USD6 Billion, and in 2010 the sector accounted for only 7.8% of the country's GDP or USD1.6 Billion. In order for the industry to effortlessly growth more and add more value to the country's economy, delay and cost overruns which are common in building construction industry must be mitigated, because they have been, and continues to be a major problem to both private and public building projects; resulting into shortfall on meeting the original budget, and the expected client satisfaction, [46]. According to [19]; delay and cost overruns during the building construction phase may seriously over-extend the client financially, resulting to a failure or an unfinished building project as per the expected standards, or may even have to be abandoned.

Moreover, [19] adds that; the fact that delay and cost overruns reduce the effectiveness of building investments, alongside demanding additional finance due to an additional building construction cost, makes it even more important on studying its mitigations. Moreover, [19, 22, 46] affirms more on the importance of mitigating the delay and cost overrun as they trigger incapacitating effect on clients, consultant and contractor in terms of growth in adversarial relationship among project participants, mistrust, disputes, litigation, arbitration, cash-flow problems, frustrating project objectives, and a general feeling of trepidation toward each other. Furthermore, as non-mitigation of delay and cost overruns in building construction, results to unanticipated and unexpected impact, [48, 64]. Therefore; this study focuses on identifying by ranking the mitigation measures in dealing with delay and cost overrun in public building project in Dar-Es-Salaam, Tanzania, through mean score.

2. Delay and Cost Overruns in Building Construction

[17] reports that; a construction project is a high value, time bound, special construction mission of creating a construction facility or service, with predetermined performance objectives defined in terms of quality specification, completion time, budgeted cost and other specified constraints. Cost and time are among five main parameters that can sufficiently define a construction project. Other parameters are scope, quality and resources. The five parameters are interactive, in which each parameter is a function of other. The evaluation and balancing of interrelationship among the five project parameters is a complicated process. However, in a given project, the scope and quality of work in terms of quantity and specifications are specified and these parameters are not subjected to change (unless scope changes substantially), [70]. Resources and costs are co-related. Therefore, for a given quality, in such situation, time, cost and scope are core parameters.

These parameters are interlinked and must be kept in balance to achieve project objective efficiently and effectively within changing environments, [17]. Moreover, organizations face a major challenge in controlling building project budgets over the time span between project initiation and the completion of construction. The development of time and cost estimates that accurately reflect project scope, economic conditions, and are attuned to community interest and the macroeconomic conditions provide a baseline cost and time that management can use to impart discipline into the design process. [68] asserts that; one of the most vital tasks for completing a project successfully is to have a good management of construction cost in order to avoid delay and cost overruns.

2.1. Cost Overrun

Cost Overrun or "Cost Escalation", or "Cost Increase", or "Budget Overrun", is defined as excess of actual cost over budget, [46]. Basically, it happens when the final cost of the project exceeds the original approved cost estimates, unlike the client's expectations, [19, 46]. [46] also details that; cost overrun may also be defined as the change in contract amount, divided by the original contract award amount; OR the difference between the actual cost and the initially projected cost, whereby its calculations can be converted to a percentage (%) for ease comparison. [42] defines cost overrun as the difference between the final actual cost of construction project at completion, and the contract amount agreed between the client and the contractor during signing of the contract, is used. [66] affirms that; the cost of building construction project which in most cases its growth is "amoebic" in nature, escalating in an exponential manner and not linearly, is affected by a large number of factors, making it a bit difficult in tracking down, what drives total cost overrun.

Basically, a global problem as most of the construction industry around the world, do exceeds the expected budget often. A global study by [25, 68] on construction projects has found that; cost overrun is the most faced problem, with an estimation of 9 out of 10 projects facing the problem with an overrun of 50% to 100%. Likewise, another investigation on 87 projects conducted by [68] has revealed that; the problem of cost overrun exists in projects by an average of 10.3%, giving an example of the United Kingdom (UK) where nearly one third of all clients files complains about their projects exceeding their allocated budget. Malaysia is also another country being affected severely by cost overrun, in which only 46.8% of public sector and 37.2% of private sector projects are being finished within the allocated budget, [64, 68].

2.2. Delay or Time Overrun

Delay or Time Overrun in building construction project is the late in progress or actual completion of work, compared to the baseline construction schedule or contract schedule, [46], i.e. the non-completion of building projects on time by the contractor, [22]. Moreover, they assert that; majority of project delays occur during the construction phase, where many unforeseen factors are always involved. [42] defined "Time Overrun", as the difference between the Actual Project Duration and the Estimated Project Duration. According to [14] the term 'delay' in construction contracts has no precise technical meaning, as it can be used in different sense refereeing different conditions in project execution. However, the term is often used in its basic sense to mean any occurrences or events that extend the duration or delay the start or finish of any of the activities of a project, [46]. [22], claims that; apart from delays being rampant across the world, they are invariably accompanied by cost and time overruns.

2.3. Types of Delay or Time Overrun

[15] details there are four types of construction delay encountered in building projects, which includes:-

a) Excusable delay or non-excusable delay,
b) Concurrent delay or non-concurrent delay,
c) Compensable delay and non-compensable delay, and
d) Critical delay or non-critical delay.

Excusable Delay; as per [15], are unforeseeable events which are beyond anyone control, and they are broken down into compensable and non-compensable delays. If the delay is considered to be compensable, then the contractor is entitled to compensate the additional financial and extra time, but when the delay is uncompensated excusable delay the contractor will receive extra time but not extra money. Likewise, [69] narrates that; excusable delays are occurrences over which neither the owner, nor the contractor have any control, giving example of extreme weather conditions, acts of God and other unforeseen future events.

Non-Excusable Delay; [15], reports that; these are foreseeable from which the activities or events are within the control of the contractor. In case of this situation the contractor is not able to receive any extra time or compensation for the work. The owner and designer are liable to make sure that the contract document are made clear. Excusable and non-excusable delay can occur concurrent, non-concurrent or simultaneously in a project. Concurrent delays occur at the same time or close to the same time. They can also contain critical and non-critical delays. Critical delays are delay claims that they affect the progress time and compensation. Non-critical delays do not affect the completion date of the project. They affect the succeeding activities that are not on the critical path of the schedule. [69] details in this case; apart from the main contractor being entitled neither to time extension nor to monetary recompense from the owner, may end up paying liquidated damages according to the contract.

Concurrent Delay; [1] narrates that; these are delay which occur at the same time or close to the same time that is when one factor delays the project at the same time or in overlapping periods of time. This delay is caused by the owner and the contractor.

Compensable Delay; [27] underlines that; these are delays which caused due to inadequate drawings and a specification which arises from the owner failure to respond in a timely request for information or owner may cause changes in design or materials. These delays are compensable to an adjustment for any increase cost caused by delay. According to [69] a delay is compensable to the contractor when it is caused by the owner, giving example of an incomplete drawing and specification, changes in scope or late possession of site, in which the conditions of contract allow the contractor to be entitled to a time extension, and to monetary recompense for extra costs caused by the delay.

Critical Delay; As per [63] these are delay claims that affect the progress, time and compensation. Non critical delays do not affect the completion date of the project. They affect the succeeding activities that are not on the critical path of the schedule. This can set back activities if they do not a float in the schedule.

2.4. Causes of Delay and Cost Overruns

Given the fact that; delay and cost overruns are a global problem in all building construction industry, as per [71] its causes whether due to cost estimation errors or any other reasons, still differs from one country to another depending on the political, economic and cultural reasons, [66]. Besides, delay and cost overruns may lead to an abandonment or termination of a building construction project, [22], if the causes are not well mitigated. Voluminous studies have been conducted to identify the causes of delay and cost overrun in building construction projects, as summarized in Table 2.1.

2.5. Mitigation Measures for Controlling Delays and Cost Overrun

Building construction project delays and cost overruns, have been a major setback in the last decades, especially in developing countries. This is due to the fact that; keeping building construction projects within estimated costs and schedules, requires sound strategies, good practices, and careful judgment. Moreover, [22] asserts that; there are steps which can be taken to minimize their causes and effects of delay and cost overrun, as long as they are identified, and countermeasures are taken. These can be summarized as shown in Table 2.2, which show the mitigation measures on dealing with delays and cost overruns in building construction project.

Table 2.1. Summary of causes of delays and cost overrun as retrieved from different literature review

SN.	Causes of Delay and Cost Overrun	Sources
01.	Absence of consultants site staff, and the relationship between management and labour,	[11, 53, 56].
02.	Poor material handling on site,	[19, 56, 66]
03.	Dispute on site,	[22].
04.	Unrealistic contract duration imposed by the owner,	[11, 53, 56].
05.	Act of God (weather),	[19, 36, 65].
06.	Delay of material and equipment delivery,	[5, 11, 18-19, 22] [36, 40, 53, 56] [66, 68, 71].
07.	Strikes by site personnel,	[32].
08.	Low productivity of labor, and equipment	[36, 56, 71].
09.	Poor contract management; and poor project management,	[10, 23, 56, 66] [69].
10.	Omission and errors in the Bill of Quantity,	[42, 56].
11.	Government interference,	[54, 65-66].
12.	Slowness or delay in giving instruction,	[42, 36, 56].
13.	Political instability,	[66].
14.	Price fluctuation,	[10, 18, 23, 66] [68].
15.	Lack of cost and monitoring planning; poor cost control,	[10, 23, 66-67].
16.	Poor economic condition,	[56, 66];
17.	Shortage of material in the market,	[23, 33, 36, 40]; [56, 65-67].
18.	Delay of material approval by consultant,	[56].
19.	Variation at the design stage,	[33, 65].
20.	Problems with neighbours,	[56].
21.	Large and complex projects,	[56, 66].
22.	Equipment and tool shortage on site,	[36, 56, 67].
23.	Unskilled operators or workforce, and lack of experience for the work force and contactors,	[5, 11, 53, 56, 69]
24.	Incomplete design and estimate at the time of tender, as well as lack of design details and specifications	[11, 40, 42, 53] [65-66, 69].
25.	Owner or user interference,	[8, 56, 66].
26.	Poor or lack of communication and coordination between parties,	[2, 19, 36, 50, 67]

SN.	Causes of Delay and Cost Overrun	Sources
27.	Improvement of standard drawing during, construction stage,	[33, 42, 65, 67].
28.	Poor site condition,	[33, 54, 56, 65].
29.	Delay or slowness in decision making,	[5, 11, 29, 36, 42] [53, 69, 71].
30.	Poor site management and supervision,	[2, 22, 29, 50]; [56, 67].
31.	Deficient estimation of cost,	[66].
32.	Shortage of manpower, and insufficient number of staff,	[5, 19, 29, 36, 56] [67].
33.	Corruption and bureaucracy in government,	[66, 68];
34.	Financial difficulties of the owner and the contractor,	[2, 5, 22, 36, 62]; [66, 68].
35.	Inadequate project formulation; and midstream changes in scope and volume of work,	[66].
36.	Design changes, and delay in approving the changes,	[19, 30, 36, 59]; [62, 66].
37.	Risks and uncertainties associated with projects, as well as lack of project risk analysis	[59, 66, 69];
38.	Inaccurate evaluation of projects time/ duration against the project complexity,	[59, 66];
39.	Non-performance of main contractors, subcontractors and nominated suppliers,	[2, 5, 29, 59, 66]
40.	Design documentation error and discrepancy,	[36, 69].
41.	Design error and inappropriate design solution	[2, 36, 62, 69].
42.	Delay in progress payment; site mobilization; and, in obtaining permits from municipality	[19, 29, 36].
43.	Change in orders by the owner during construction	[36].
44.	Re-work due to errors during construction	[36].
45.	Ineffective planning and scheduling of project	[2, 19, 30, 36, 50] [62].

Source: Adapted from [46] modified by Authors, (2019).

Table 2.2. Summary of mitigation measure against delays and cost overrun as retrieved from different literature review

SN.	Mitigation Measures Against Delay and Cost Overrun	Sources
01.	Accurate cost estimation	[35-36].
02.	Allocate adequate contingency allowances	[24, 26, 35].
03.	Adopt clear information and communication channel	[20].
04.	Adopt effective and efficient material procurement system	[11, 26].
05.	Allocate sufficient time and finance (money)	[40, 44].
06.	Application of professional construction management (CM)	[40].
07.	Appointment of competent site manager	[8].
08.	Appropriate scope definition	[34-35].
09.	Approval projects from relevant parties	[24, 35, 49].
10.	Choose experienced subcontractor with good reputation	[40, 66, 68].
11.	Close monitoring	[20].
12.	Competent architectural and engineering designs	[35].
13.	Competent project manager	[21].
14.	Comprehensive contract administration	[20].
15.	Conducting a process mapping exercise	[59].
16.	Contractors should improve their project management skills and articulate their resources	[57].
17.	Control the design change	[60].
18.	Design changes should be adequately highlighted and updated on all relevant project documentation	[59].
19.	Designing the project to a great detail at the onset whenever possible	[59].
20.	Develop strategy for solving identified risk.	[59].
21.	Developing project programme based on experienced planners.	[59].
22.	Development of comprehensive financial plan and cash flow.	[57].
23.	Development of cost monitoring and periodic reporting of critical and long lead items.	[20].
24.	Developing good monitoring and controlling system	[49].
25.	Develops realistic planning and scheduling for the project	[49].
26.	Effective coordination between parties involved	[24, 36].

SN.	Mitigation Measures Against Delay and Cost Overrun	Sources
27.	Effective financial management and control	[53].
28.	Effective planning and scheduling	[34, 36, 52].
29.	Enough number of labour	[60].
30.	Ensure there adequate time to complete the work	[59].
31.	Ensure design changes are reasonable timed when possible	[59].
32.	Ensuring prompt resolution to design change quarries, issues and authorisation	[59].
33.	Ensuring the time and cost implication of design change are always determined and agreed	[59].
34.	Having a design manager to responsible for the design changes	[59].
35.	Having enough resources to deal with the complexity	[59].
36.	Hire competent labour	[28].
37.	Incentive schemes	[8].
38.	Making the risk register is a live document that is updated regularly	[59].
39.	Must ensure the timely availability of required finance	[40].
40.	Advance thought on permission from law enforcement agencies to beef up on site security	[7].
41.	Plan a time schedule for delivery process	[52];
42.	Producing design document at time	[60].
43.	Progress payment of subcontractor/suppliers must be made on time	[52].
44.	Promote open communication	[57];
45.	Promote team building communication process	[34].
46.	Prompt progress payment from clients	[60].
47.	Proper motivation and safety system	[24].
48.	Provide training to unskilled workers based on the scope of work	[24, 60].
49.	Quick design approval	[57].
50.	Quickly informed relevant parties when unforeseen circumstances affect the programme/ lead-in time	[59].
51.	Reliable contractor	[28, 35, 40, 49]; [60].
52.	Safety and health program	[57].
53.	Select experienced and cable subcontractor	[59].
54.	Selecting a consultant who has sufficient experiences in similar nature of works and has good reputation	[59].
55.	Team work between the client (owner) and architects in completing the design drawings before project estimate are prepared or the contract is awarded	[66].
56.	Subcontractor with enough experience and capability in dealing with the project complexity	[49, 52, 59, 68].
57.	Efficient management of site and supervision of the project	[36, 68].

3. Methodology

The methodology and research design used in this study was case study survey, in which apart from literature review; instruments like questionnaire and interview were used by approaching various consultants, local building contractors registered under Class I to Class II, and their workers. The unit of analysis based on the public building projects in Dar-Es-Salaam, Tanzania. The case study was employed because it can bring an understanding of a complex issue or object, and extend experience or add strength to what is already known through previous research, and it emphasize detailed contextual analysis of a limited number of events or conditions and their relationships. Also, the study used both qualitative and quantitative approach, which made it easier in determining the intended objectives, samples and design of the study, as well as ranking the factor causing delay and cost overrun in building projects.

3.1. Data Collection Methods

Generally, both primary and secondary data collection, were done using multiple sources of evidence. Questionnaire survey was used to collect primary data from CRB, client, consultants, and local building contractors, in which the respondents answered the questions on their own, [72]. Some of the questions were close ended and others were open ended to the respondent to attest their own opinion, and give more information. Furthermore, secondary data concerning the influencing causes and mitigation measures of delays and cost overruns in building construction projects, were collected from literature review via published and unpublished books, journals, articles and papers. Literature was reviewed to determine the meaning of Delay and Cost Overruns; Types of Delay or Time Overrun; Causes of Delay or Time and Cost Overrun; and Mitigation Measures for Controlling Delays and Cost Overrun. All respondents had

different years of experience in the construction industry.

3.2. Questionnaire Design

In this study, the questionnaires were prepared in accordance with objectives of the research. The questionnaire was divided into two parts which covered for both client, consultants, and building contractors; first part requested on general information about respondent, second part covered the possible mitigation measures in dealing with delays and cost overrun in building construction projects. Through a quantitative approach, data used were acquired with a questionnaire survey, in which the closed ended questionnaire was compiled based on the refined list above, after a pilot study. Closed-ended questions were used as they are very convenient for collecting factual data and are simpler to analyze because the range of potential answers is limited, [4]. However, open ended questions were also incorporated to get further opinions from respondents. The pilot study was carried out to mark better the quality of the questionnaire and improve reliability of the questions. Through using 5-point likert scale, and by using [39] writings in scaling; the respondents (clients, building contractors and consultants) were asked to respond to each statements, by indicating which statement is Very Important(VI)=5; Important(I)=4; Moderate(M)=3; Unimportant(U)=2; and Very Unimportant(VU)=1, so as to identify possible mitigation measures in dealing with the delays and cost overrun in building construction projects. This type of scale has been found to be acceptable in other construction management research.

3.3. The Study Sample and Population

[42] defines population as the entire mass of observations, which is the parent group from which a sample is to be formed. Additionally, [39] affirms that; this is a group of individuals, objects or items from which the sample is taken for measurement, and it refers to an entire group of person or elements which have one thing in common. In this study, the sample population includes building Contractors from class I – II, registered by CRB, consultants, and clients. The study employed both probability and non-probability sampling. Depending on the nature of respondents, different sampling technique were used:

- For the building contractor's population, stratified probability sampling was used, with the rationale behind the technique being the heterogeneity of the building contractor's population in Tanzania, which is categorized into strata such as class I – VII. [42] insists that; the technique is precise, and it includes all important subpopulation; it is free from bias, and it ensures a sample that accurately reflects the population being studied.
- For the client population, Purposive non-probability sampling was used. The rationale behind the technique is, as per [47] that; the client population undertaking building project is infinite, hence the personal judgment should be used.
- For the consultant population, systematic probability sampling was used, the rationale being as per [47] that; the consultant population is large and homogeneous.

Furthermore, the sample size is proposed to determine what is termed by [39] as precision rate of and confidence rate. The size of sample should be optimum, neither large nor small. Strata sample size are determined by writings by [39] that;

$$n = \left[\frac{z^2 pqN]}{[e^2(N-1) + Z^2 pq}\right]$$

Where: n = the sample size
N = the total number of population
Z = the confidence level
e = the margin/sampling error
p = the degree variability, which is 50%
q = 1- p.

Data used in sampling are confidence level (Z) - 95% (1.96) and margin/sampling error (e) - 5%. A study by [37, 51] shows that; these values are economical to be used and they have been used in various studies, including theirs.

For the Building Contractors

- Class I

$$\frac{1.96^2 * 0.02 * 0.98 * 85}{0.05^2(85-1) * 1.96^2 * 0.02 * 0.98} = \mathbf{23}$$

- Class II

$$\frac{1.96^2 * 0.02 * 0.98 * 32}{0.05^2(32-1) * 1.96^2 * 0.02 * 0.98} = \mathbf{16}$$

Table 3.1. The number of sample size from each of the local building contractors in Dar-Es-Salaam and distributed questionnaire

SN.	Registration Class	Contractors Population in Dar	Proposed Sample(n)
01.	Class I	85	23
02.	Class II	32	16
	Total Population	277	39

From the Table 3.1; the total proposed sample size selected is 39 local building contractors from class I and II, in Dar-Es-Salaam. The rationale behind selecting class I and II, is as per [42] writings that; delays and cost overrun are most common and frequent problem in large building projects, which most of them are undertaken by Class I and II.

For the Building Consultants

The population of consulting firm includes Quantity Surveying, Architectural and Engineering Firms, in which this study will concentrate more on a large number of Quantity Surveying Firms and few Architectural and Engineering Firms. There are 102 registered local Quantity Surveying firms in Dar-Es-Salam, i.e. $N = 102$. By applying the same formula by [39] in determining the sample size using confidence level:-

$$\frac{1.96^2 * 0.02 * 0.98 * 102}{0.05^2(102-1) * 1.96^2 * 0.02 * 0.98} = \mathbf{24}$$

Systematic sampling procedure;- the sampling starts by selecting an element from the list at random and every k^{th} element in the frame is selected, where k= the sampling interval (sometimes known as skip),

$$k = \frac{N}{n}$$

Where "N" is the population size and "n" is the sample size

$$k = \frac{102}{24} = \mathbf{4.25}$$

0 1 2 3 **4** 5 6 7 **8** 9 10 11 12 **13** 14 15 16 **17** 18 19 20 **21** 22 23 24 25 **26** 27 28 29 **30** 31 32 33 **34** 35 36 37 **38** 39 40 41 42 **43** 44 45 46 **47** 48 49 50 **51** 52 53 54 55 **56** 57 58 59 **60** 61 62 63 **64** 65 66 67 68 **69** 70 71 72 **73** 74 75 76 77 78 79 80 **81** 82 83 84 85 **86** 87 88 89 **90** 91 92 93 94 95 96 97 98 **99** 100 101 **102**.

For architectural and engineering firms, a sample of 6 firms was taken.

For the Client or Project Financier

The number of sample size for client through purposive sampling was 6. Finally; the total proposed sample size i.e. (building contractors, consultants and clients) is 79.

4. Results, Analysis and Discussion

Main parameters used for investigation in this study was the identification of mitigation measures in dealing with the delays and cost overrun in public building construction projects. Data were collected, analyzed and presented using Microsoft Word and Excel (Tables) in order to get more accurate computation that mapped out a pattern or relationship between measured or comparable variables. The study adopted the use of quantitative analysis method by using syntax mathematical operation in determining the mean score,

- Mean Score Value = $\sum \frac{FXS}{N}$

Where: ***F*** = Frequency of response for each score
S = Score given each cause
N = The total number of respondent for each factor

Table 4.1. Mean score values (M) comparison table

SN.	Mean Score (M)	Ranking	Colour
01.	4.0 ≤ M ≤5.0	High Mean Score	
02.	3.0 ≤ M ≤ 3.9	Medium/Moderate Mean Score	
03.	1.0 ≤ M ≤ 2.9	Low Mean Score	

4.1. Population Characteristics

This part mainly designed to provide general information about the respondents in terms of category of the organization, type of work executed, designation, experience, age and gender.

4.1.1. Age Distribution

Age is the critical factor in analyzing delay and cost overrun in building construction projects, because different parties with different age, has different approach in construction project. In this study the respondents age distribution, is as shown in Table 4.2.

Table 4.2. The Age of respondents

SN.	Age	Frequency	Percentage (%)	Cumulative Percentage
01.	Below 21	0	0.0%	0.0%
02.	21 – 35	27	57.5%	57.5%
03.	35 – 50	15	31.9%	89.4%
04.	Above 50	5	10.6%	100.0%
	Total	47	100.0%	

4.1.2. The Gender Distribution

The gender was also an important factor considered, as it constitutes other responsibilities apart from professional, which affect quality and commitments to project implementation, as shown in Table 4.3.

Table 4.3. The gender distribution

SN.	Gender	Frequency	Percentage (%)	Cumulative Percentage
01.	Male	29	61.7%	61.7%
02.	Female	18	38.3%	100.0%
	Total	47	100.0%	

4.1.3. Category of Organization

The category of the respondent in the construction was another important factor considered, in order to obtain views from parties undertaking building projects in Dar-Es-Salaam, as seen in Table 4.4.

Table 4.4. The categories of respondents

SN.	Respondent	Questionnaire Distributed		Questionnaire Returned		Response rate
		No	%	No	%	%
01.	Client	6	8.0%	4	8.5%	66.7%
02.	Consultant	30	40.0%	24	51.1%	80.0%
03.	Contractors	39	52.0%	19	40.4%	48.7%
	Total	75	100.0%	47	100.0%	62.7%

Furthermore, building contractors of Class I and II were selected, as seen in Table 4.5.

Table 4.5. The categories of building contractors

SN.	Classes of Contractors	Questionnaire Distributed		Questionnaire Returned		Response Rate
		No	%	No	%	%
01.	I	23	59.0%	5	26.3%	21.7%
02.	II	16	41.0%	14	73.7%	87.5%
	Total	39	100.0%	19	100.0%	48.7%

Likewise, client can be either public or private. Due to the study nature, public developers were selected, due to their knowledge on building construction industry. Furthermore,

consultants were categorized into Quantity Surveying, Architectural and Engineering consulting firm as shown below.

Table 4.6. The category of consultant

SN.	Category of Consultant	Questionnaire Distributed		Questionnaire Returned		Response Rate
		No	%	No	%	%
01.	Quantity Surveying	24	80.0%	18	75.0%	75.0%
02.	Architectural	4	13.3%	5	20.8%	125.0%
03.	Engineering	2	6.7%	1	4.2%	50.0%
	Total	30	100.0%	24	100.0%	80.0%

4.1.4. Type of Work Executed by the Respondents

The building construction projects executed and considered in this study are of different categories, which includes Residential, Commercial, Offices, Hospitals, Schools, etc.

4.1.5. Respondents Designation

There are various designations in construction industry which includes Quantity Surveyors, Architects, Engineers, Project Managers, Site Manager etc.

Table 4.7. The respondent designation

SN.	Respondent	Frequency	Percentage (%)	Cumulative Percent
01.	Quantity Surveyor	44	93.62%	93.6%
02.	Architects	2	4.26%	97.9%
03.	Engineers	1	2.13%	100.0%
	Total	47	100.0%	

4.1.6. Experience of the Respondents

The respondents experience in relation to building construction project was a major factor to be considered in this study as seen in Table 4.8.

Table 4.8. Experience of the respondents

SN.	Years	Frequency	Percentage (%)	Cumulative Percent
01.	Below 4	25	53.2%	53.2%
02.	50 – 10	14	29.8%	82.9%
03.	Above 10	8	17.0%	100.0%
	Total	47	100.0%	

4.2. Possible Mitigation Measures in Dealing with the Delay and Cost Overrun in Building Projects

4.2.1. The Client or Project Financier's Perspective

Where by **TNR** = Total Number of Response, and **M.S** = Mean Score.

Table 4.9 indicates that; Control design change was very important mitigation measure in dealing with the delays and cost overrun. Other mitigation measure were Plan a time schedule for material delivery process; Effective planning and scheduling, Comprehensive contract administration; Comprehensive contract administration; Accurate cost estimate; Adopt effective and efficient material procurement; Appoint competent site and project manager; Developed strategy for solving identified risk; Owners are recommended to review and improve bid document and Quickly informed the relevant parties when unforeseen circumstances affect the programme having mean score greater than 4.5.

4.2.2. The Building Consultant's Perspective

Where by **TNR** = Total Number of Response, and **M.S** = Mean Score.

Table 4.10 point out that; effective coordination and communication was very important mitigation measure in dealing with delays and cost overrun. The other mitigation measure includes prompt progress payment from payment having mean score greater than 4.

4.2.3. The Building Contractor's Perspective

Where by **TNR** = Total Number of Response, and **M.S** = Mean Score.

Table 4.11 enlightens that; effective planning and scheduling was very important mitigation measure in dealing with delays and cost overrun having mean score 4.89. Other mitigation measure were comprehensive contract administration; accurate cost estimate; control change; prompt progress from client; quickly informed the relevant parties when unforeseen circumstances affect the programme; appoint competent site and project manager; make sure the timely availability of finance; effective coordination and communication; adopt effective and efficient material procurement; ensuring prompt resolution in designing change queries; issues and authorization report and hire competent labour having mean score greater than 4.

4.2.4. General Response

Where by **TNR** = Total Number of Response, and **M.S** = Mean Score.

Table 4.12, effective planning and scheduling was very important mitigation measure in dealing with delays and cost overrun having mean score 4.38. Other mitigation measures were control design change; Effective coordination and communication; Prompt progress payment from payment; Accurate cost estimate; Appoint competent site and project manager; Comprehensive contract administration; Ensuring prompt resolution in design change queries; issues and authorization report; Plan a time schedule for material delivery process; and Adopt effective and efficient material procurement.

Table 4.9. Possible mitigation measures in dealing with delay and cost overrun in building project – The Client or Project Financier's Perspective

SN.	MEASURES	TNR	M.S	RANK
01.	Accurate cost estimate	4	4.75	2
02.	Adopt effective and efficient material procurement	4	4.50	6
03.	Appoint competent site and project manager	4	4.50	6
04.	Comprehensive contract administration	4	4.75	2
05.	Control design change	4	5.00	1
06.	Developed strategy for solving identified risk	4	4.50	6
07.	Developing project programme based on experienced planner	4	3.50	21
08.	Effective coordination & communication	4	3.50	21
09.	Effective planning and scheduling	4	4.75	2
10.	Enough number of labour	4	2.75	25
11.	Ensuring prompt resolution in design change	4	4.25	12
12.	Having enough resources to deal with the complexity	4	4.50	6
13.	Hire competent labour	4	4.00	17
14.	Incentive scheme	4	3.50	21
15.	Making sure the risk registered is live document that is updated regularly	4	4.00	17
16.	Make sure the timely availability of finance	4	4.25	12
17.	Owners are recommended to review and improve bid document	4	4.50	6
18.	Permission from law enforced agencies should be sought in advance to beef up on site security	4	4.00	17
19.	Plan a time schedule for material delivery process	4	4.75	2
20.	Producing design document	4	4.25	12
21.	Prompt progress payment from client	4	3.50	21
22.	Providing training to unskilled workers based on their scope of work	4	4.25	12
23.	Quick design approval	4	4.25	12
24.	Quickly informed the relevant parties when unforeseen circumstances affect the programme	4	4.50	6
25.	Subcontractor has capability to deal with complexity	4	3.75	20

Table 4.10. Possible mitigation measures in dealing with delay and cost overrun in building project – The Building Consultant's Perspectives

SN.	MEASURES	TNR	M.S	RANK
01.	Accurate cost estimate	24	3.79	6
02.	Adopt effective and efficient material procurement	24	3.67	9
03.	Appoint competent site and project manager	24	3.88	5
04.	Comprehensive contract administration	24	3.63	10
05.	Control design change	24	3.96	3
06.	Developed strategy for solving identified risk	24	3.75	7
07.	Developing project programme based on experienced planner	24	3.54	13
08.	Effective coordination and communication	24	4.17	1
09.	Effective planning and scheduling	24	3.92	4
10.	Enough number of labour	24	3.54	13
11.	Ensuring prompt resolution in design change	24	3.04	22
12.	Having enough resources to deal with the complexity	24	3.58	11
13.	Hire competent labour	24	3.29	18
14.	Incentive scheme	24	3.08	21
15.	Making sure the risk registered is live document that is updated regularly	24	3.42	16
16.	Make sure the timely availability of finance	24	3.58	11
17.	Owners are recommended to review and improve bid document	24	3.04	22
18.	Permission from law enforced agencies should be sought in advance to beef up on site security	24	2.92	25
19.	Plan a time schedule for material delivery process	24	3.71	8
20.	Producing design document	24	3.54	13

SN.	MEASURES	TNR	M.S	RANK
21.	Prompt progress payment from payment	24	4.08	2
22.	Proving training to unskilled workers based on their scope of work	24	3.25	20
23.	Quick design approval	24	3.33	17
24.	Quickly informed the relevant parties when unforeseen circumstances affect the programme	24	3.04	22
25.	Subcontractor has capability to deal with complexity	24	3.29	18

Table 4.11. Possible mitigation measures in dealing with delay and cost overrun in building project – The Building Contractor's Perspectives

SN.	MEASURES	TNR	M.S	RANK
01.	Accurate cost estimate	19	4.79	3
02.	Adopt effective and efficient material procurement	19	4.47	10
03.	Appoint competent site and project manager	19	4.68	6
04.	Comprehensive contract administration	19	4.84	2
05.	Control design change	19	4.74	4
06.	Developed strategy for solving identified risk	19	4.32	15
07.	Developing project programme based on experienced planner	19	4.05	20
08.	Effective coordination and communication	19	4.63	8
09.	Effective planning and scheduling	19	4.89	1
10.	Enough number of labour	19	3.74	22
11.	Ensuring prompt resolution in design change queries, issues and authorization report	19	4.47	10
12.	Having enough resources to deal with the complexity	19	3.58	25
13.	Hire competent labour	19	4.47	10
14.	Incentive scheme	19	3.74	22
15.	Making sure the risk registered is live document that is updated regularly	19	4.11	19
16.	Make sure the timely availability of finance	19	4.53	9
17.	Owners are recommended to review and improve bid document	19	4.21	18
18.	Permission from law enforced agencies should be sought in advance to beef up on site security	19	4.05	20
19.	Subcontractors' capability in dealing with complexity construction projects	19	3.68	24
20.	Plan a time schedule for material delivery process	19	4.47	10
21.	Producing design document	19	4.32	15
22.	Prompt progress payment from client	19	4.74	4
23.	Proving training to unskilled workers based on their scope of work	19	4.32	15
24.	Quickly informed the relevant parties when unforeseen circumstances affect the programme	19	4.68	6
25.	Quick design approval	19	4.37	14

Table 4.12. Possible measures in dealing with delay and cost overrun in building project – The General Perspective

SN.	MEASURES	TNR	M.S	RANK
01.	Accurate cost estimate	47	4.28	5
02.	Adopt effective and efficient material procurement	47	4.06	10
03.	Appointment of competent site and project manager	47	4.26	6
04.	Comprehensive contract administration	47	4.21	7
05.	Controlling design change	47	4.36	2
06.	Developing effective strategic planning for solving identified risks;	47	4.04	11
07.	Developing project programme based on experienced planner	47	3.74	18
08.	Effective coordination and communication	47	4.30	3
09.	Effective planning and scheduling	47	4.38	1
10.	Enough number of labour	47	3.55	22
11.	Ensuring prompt resolution in design change queries, issues and authorization report	42	4.17	8
12.	Having enough resources to deal with the complexity	47	3.66	20
13.	Hire competent labour	47	3.83	14
14.	Incentive scheme	47	3.38	25

SN.	MEASURES	TNR	M.S	RANK
15.	Making sure the risk registered is live document that is updated regularly	47	3.74	18
16.	Ensuring the timely availability of finance	47	4.02	12
17.	Owners are recommended to review and improve bid document	47	3.64	21
18.	Permission from law enforced agencies should be sought in advance to beef up on site security	47	3.47	24
19.	Efficient and effective planning time schedule for material procurement and delivery process	47	4.11	9
20.	Producing design document	47	3.91	13
21.	Prompt progress payment from client	47	4.30	3
22.	Proving training to unskilled workers based on their scope of work	47	3.77	17
23.	Quick design approval	47	3.83	14
24.	Quickly informed the relevant parties when unforeseen circumstances affect the programme	47	3.83	14
25.	Subcontractors' capability in dealing with complexity construction projects	47	3.49	23

Furthermore, respondents suggested other mitigation measure, which includes; design competition instead of quality cost based procurement; searching of the contractors as per the recent work done i.e. due diligence; selecting consultants and contractors via design competition; and understating client's budget; participatory approach (which may include; donor, users, caretaker/estate office, consultants, contractors) during design and project execution. Also, respondents propose on; the type of contract format in relation to the nature and complexity of the building project, giving an example of FIDIC format used in design and built project. Most respondents, insisted on the government agencies in charge of issuing different building permits (e.g. local government agencies and national environmental management councils, NEMC) working together as a team, in order to reduce bureaucracy. They also enlightened on the agreed mode of handling queries on site before official approval, as well as consultants minimizing the use of imported foreign materials whenever necessary.

5. Discussion

Effective Planning and Scheduling:— was ranked first with mean score 4.38, as seen in Table 4.12 whereby, in general 66% of the respondent considered this as the very important mitigation measure, while 17% of the respondent considered this as important, 11% considered as the factor as moderate and 24% of the respondent considered as unimportant. The important of this measure, is even emphasized by [9, 22, 34, 52] who insists on proper and project planning, and scheduling in mitigating delay and cost overruns. They narrate that; contractors should appoint project manager, who are expected to draw up a workable project plan, and strategies which should implement the project activities in the proper sequence, to complete the defined stages of the project within the stipulated time frame, with designated resources. [66] asserts on improving the ability of managers and engineers which may mitigate delay and cost overrun as they reduce the human and management problems. Furthermore, [40, 66] also insists on performing appropriate and proper preconstruction planning on tasks and resources, which may help on monitoring the project progress against stipulated time and budget. A faulty planning and scheduling may lead to delays and cost overrun e.g. due to poor site management and supervision; hence leading to the misunderstanding between owner, consultant and building contractors, [5].

Controlling Design Changes:— was ranked second with mean score 4.36, as seen in Table 4.12 whereby, in general 60% of the respondent considered this as the very important mitigation measure, while 26% of the respondent considered this as important, 9% considered as the factor as moderate and 4% of the respondent considered as unimportant. This can be achieved by selecting a competent and reliable building consultant team and contractor team, which prepares appropriates standard drawings at the early construction stage, that are reviewed, and amended several times, for construction work, [8, 40, 66]. This concurs with [65] writings that; designs have high level of influence on the estimated project cost, and sometimes unsatisfactory design performance can lead to cost and time overrun. [66] suggests the need for project owners, architects and the design team, to work together to complete the design drawings, before project estimates are prepared or contracts are awarded in order to prevent inaccurate project estimates design changes, delay and cost overruns subsequently.

Effective Coordination and Communication Between Parties:— was ranked third with mean score 4.30, as seen in Table 4.12 whereby, in general 53% of the respondent considered this as the very important mitigation measure, while 32% of the respondent considered this as important, 9% considered as the factor as moderate, 4% of the respondent considered as unimportant and 2% considered as very unimportant. Project issues or contractor request should be addressed timeously and information should be effectively managed. There must be a good communication management plan in place which take into account the agreed mode, hierarchy and channel, so as the site information is properly channeled and coordinated. In that way, most of delays and cost overrun in building project resulted by the slowness in giving instruction specifically from the architect, as part of the communication breakdown,

as per [42, 56] can be avoided.

Prompt Progressively Payment from Client:— was ranked third with mean score 4.30, as seen in Table 4.12 whereby, in generally 51% of the respondent considered this as the very important mitigation measure, while 34% of the respondent considered this as important, 11% considered as the factor as moderate, 2% of the respondent considered as unimportant and 2% considered as very unimportant. The agreed milestones for payment should be followed, alongside following the cash flow projection in project implementation plan, hence avoiding [3, 5, 8] writings that; building contractors cash flow problems, naturally affect the project's completion.

Accurate Cost Estimates:— was ranked fifth with mean score 4.28, as seen in Table 4.12 whereby, in general 60% of the respondent considered this as the very important mitigation measure, while 23% of the respondent considered this as important, 6% considered as the factor as moderate and 6% of the respondent considered as unimportant. Having accurate cost estimates,

Appointment of Competent Site and Project Manager:— was ranked sixth with mean score 4.26, as seen in Table 4.12 whereby, in general 55% of the respondent considered this as the very important mitigation measure, while 28% of the respondent considered this as important, 9% considered as the factor as moderate and 4% of the respondent considered as unimportant.

Comprehensive Contract Administration:— was ranked seventh with mean score 4.21, as seen in Table 4.12 whereby, in general 55% of the respondent considered this as the very important mitigation measure, while 23% of the respondent considered this as important, 13% considered as the factor as moderate, 4% of the respondent considered as unimportant and 4% considered as very unimportant. Most of the projects have consultant as project manager, who liaise between client and contractor, in making sure that the contract is administered compressively,[9]. The required management principle should be utilized during project execution to mitigate delays and cost overrun.

Ensuring Prompt Resolution in Design Change Queries, Issues and Authorization Report:— was ranked eighth with mean score 4.17, as seen in Table 4.12 whereby, in general 43% of the respondent considered this as the very important mitigation measure, while 40% of the respondent considered this as important, 10% considered as the factor as moderate, 5% of the respondent considered as unimportant and 2% considered as very unimportant. When queries are observed in the design, construction ceases until the query is resolved. This stalls the construction process leading to delay in completing the project. Thus, queries should be promptly resolved, and consultant should promptly resolve all the quarries in the design to ensure smoothly progress of work. [8, 56] asserts that; projects are required to be completed on schedule, within budget and according to the specification; if the consultant does not identify errors and omission in the design or bill of quantity early enough, lead to delay and cost overrun, which can be resolved by having prompt resolution.

Adopt Effective and Efficient Planning Time Schedule for Material Procurement and Delivery Process:— was ranked ninth with mean score 4.11, as seen in Table 4.12 whereby, in general 49% of the respondent considered this as the very important mitigation measure, while 21% of the respondent considered this as important, 21% considered as the factor as moderate, 4% of the respondent considered as unimportant and 4% considered as very unimportant. [26] affirms that; responsible party should have early procurement plan to ensure building materials are available on-site when needed. Responsible party should plan a time schedule for material delivery process to ensure the availability of material when needed, in order to avoid delay and cost overrun.

Ensuring on the Timely Availability of Finance:— was ranked twelfth with mean score 4.02, as seen in Table 4.12 whereby, in general 17% of the respondent considered this as the factors very important, while 51% of the respondent considered this as important, 26% considered as the factor as moderate, 2% of the respondent considered as unimportant and 4% considered as very unimportant. Even [40, 66] insists on ensuring that funds are adequately released during relevant phases of projects execution. Milestones payment should be made on time due to organizational lapses or bureaucracy.

Other possible mitigation measures in dealing with delay and cost overrun in public building project, as suggested by the respondents includes: - frequent progress management meeting; consistent supervision, site and technical meetings; frequent coordination between the parties involved; use of up-to-date technology and construction methods; clear information and communication channel among project team members; and delay in decision making. Clients are the project owner, when they do not make decisions on time regarding project matters, they slow down on site project activities. This compliments [23] writings that; slow decision making could be caused by an organization's internal bureaucracy, or wrong channel of communication in building projects.

6. Conclusions

This study identified mitigation measures in dealing with delay and cost overrun in public building project, in which out of 25 mitigation measures, effective project planning and scheduling was ranked first; followed by controlling design changes, and effective coordination and communication between parties. Furthermore, the respondents insisted on more attention to be paid on the progressively payment to the parties by the client; having accurate cost estimates; as well as appointment of competent site and project manager. Other included, comprehensive contract administration; ensuring prompt resolution in design change queries, issues and authorization report; efficient and effective planning time schedule for material procurement delivery process; developing effective strategic planning for solving identified

risks; and ensuring on the timely availability of finance.

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