

Risk Factors Causing Variations on Forecasted Construction Cash Flows of Building Projects in Dar es Salaam, Tanzania

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Abstract The risk factors involved in construction projects make difficulties in attaining an accurate forecast of construction cash flow. Most of construction projects experience large variations on forecasted construction cash flows due to the risk factors involved in these projects. The objective of this research is to analyze and identify the significant risk factors causing variations on forecasted construction cash flows for various work stages/parts of building projects in Dar es Salaam, Tanzania. Also, the effects of project scheduling and resources price changes were investigated. This paper reports part of an on-going research concerned with modelling the construction cash flows. The study was conducted through questionnaire survey and interview administered on different building contractors and consultants respectively in Dar es Salaam, Tanzania. An analysis was carried out using statistical package for social sciences (SPSS) Version 20.0 for the data's obtained from questionnaires whereby the risk factors causing variations on forecasted construction cash flows in building projects were analyzed. The study found ten significant risk factors that cause variations on forecasted construction cash flows for all work stages/parts in building projects in Tanzania. These risk factors are errors in project documents (Bills of Quantities), poor communication among project participants, consultants' lack of experience and technical skills, different meanings of specifications, unethical practices to consultants, unclarity of clients' requirements, clients' lack of financial resources, design errors, poor/incomplete design and incomplete information at tender stage. The identified effects of project scheduling includes change of project value, delay of the projects, poor workmanship of the project, and conflicts between the parties. While the effects of resources price changes includes delay of the projects, poor quality of the projects and termination of the contract by client. The study recommends proper communication among project participants during execution of building projects for minimizing the significant risk factors, and detailed examination of the identified significant risk factors in causing the variations on forecasted construction cash flows should be done using contract documents such as cash flow projections, Bills of Quantities, interim valuations for payments, work programme and site instructions.

Keywords Construction cash flows, Risk factors, Variations, Building projects, Tanzania

1. Introduction

Always client wants to meet up with the contractors' expectations from a clear and appropriate project cash flow during execution of the works in construction projects especially during the construction phase [20]. The project cash flow is mostly included as monthly cash flow, staged cash flow or Turnkey cash flow [12, 34]. Although, construction cash flow is used as monitoring tool for cost control in the construction projects [12], but there are lots of risk factors which affect those cash flows of the construction projects [20].

Normally, those risk factors cause variations between the actual and forecasted cash flows in construction projects [29]. Also, those risks make difficulties in attaining an accurate forecast of construction cash flows in construction projects [32]. Related studies [26, 29, 30, 32] revealed that most of construction projects experience large variations on forecasted construction cash flows due to risks involved in construction projects.

These variations happened on forecasted construction cash flow may cause serious impacts of cash flow on the failure of a construction project. The impacts can be in terms of cost overruns and delays. For instance in Tanzanian construction industry, overall performance in terms of the key project objectives like cost objective is poor whereby most of construction projects are completed with many cost variations compared to their initial budget [8, 18, 24].

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The aim of this study is to find out the significant risk factors involved in causing variations between forecasted and actual construction cash flows in building projects. Also, this paper investigates the effects of project scheduling and resource price change in execution of building projects.

As far as the objective of identifying the significant risk factors causing variations on forecasted cash flows is concerned, this study is delimited to positive construction cash flows derived from staged cash flows in building projects. It should also be noted that wherever the word building projects used in this study implies the building projects that are procured under fixed price contracts.

2. Construction Project Cash Flows

The cash flow forecast of a construction contract or project deals specifically with the payments under a particular construction contract. In this construction cash flow forecast, it is important to note that cash flow can travel from the employer to the main contractor during execution of construction project [34].

2.1. Concept of Construction Cash Flows

The cash flow is basically the actual movement of money in and out of a business such as construction business. Money flowing into a business is called the positive cash flow while monies paid out are named as negative cash flow. The difference between the positive and negative cash flows is called the net cash flow [26].

In addition, client is always interested with positive cash flow, which means the movement of money from client to contractor during execution of construction project [20]. Therefore, positive construction cash flows in building projects means the movement of money from client to contractor during construction phase of building project.

Furthermore, positive cash flows in construction projects are commonly derived from monies received by contractor in the form of staged cash flows or monthly cash flows [12, 28, 34]. Both forms of positive cash flows include payments to works performed, release of retention, settlements of final account, interest on delayed payments/suspensions of various works and settlements of profit lost due to termination of contract as exhausted from various materials such as [23, 7].

2.2. Payment Systems for Execution of Construction Project Cash Flows

Basically, there are payment systems which replicate the delivery of payment to contractor during execution of construction project cash flows, such as Turnkey where payment occurs at handover stage only (Turnkey cash flow), but monthly progress payments (or monthly cash flow) and staged payments (or staged cash flows) are commonly used in project financial management [34].

2.2.1. Staged Cash Flow

In staged payment system (staged cash flow), a builder is entitled only to payments at the completion of certain work stages in the progress of the works [34, 12]. This implies that works done are paid upon completion of various elements. In its simplest form this could constitute a single payment at the completion of the certain stage of construction works, but they will be based on elements (e.g. completion of substructure works, completion of frames) [6]. The more prescriptive the staged payments in execution of the construction project the more accurate the assessment of works will be in that execution. Therefore, in a staged cash flow, certification is done once the work element is completed [34].

2.2.2. Monthly Cash Flow

In this monthly payment system (monthly cash flow), the periodic positive cash flows are derived mainly from funds received in the form of monthly payments to the construction works performed by contractor. Normally a third party measures and values the works performed at the site [12, 34].

2.2.3. Turnkey Cash Flow

A single payment is only provided for at the conclusion of the project (i.e. at practical completion of the project). This requires the builder to finance the project during construction phase [12], but this is rarely practiced compared to the previous two payment systems in construction industry [34].

2.3. Methodologies of Forecasting Construction Cash Flows

There are many methods used in cash flow forecasting, but these methods may be mainly grouped into schedule-based or cost profile methods. Furthermore, the cost profile based method can be divided into value and cost approach to cash flow forecasting [12]. In this study, the forecasting methodologies are discussed basing on the types of construction cash flows.

2.3.1. Positive Cash Flow Methodologies

A lot of positive cash flow methodologies have been developed. These methodologies are mainly based on S-curve, logit model (idiographic approach) and advanced construction cash flow approach as discussed hereafter.

The S-curve stands for 'standard' curve, but it appears as the shape of the letter 'S' when presented on a graph. It predicts the cash flow forecast for a standard development project type, but their use is diminished when dealing with very complicated projects [34]. Normally, these S-curves are expressed using the polynomial regression or mathematical functions which use data from previously similar construction projects [2]. However, the S-curves can be questioned from the point of accuracy and flexibility [17]. The models based on S-curve include the British Department of Health and Social Security (DHSS) model [34], Bromilow

model and Peer model [12]. Also, computer modelling, simulations and artificial intelligence techniques have been employed in developing the standard value curves [34].

Logit model (idiographic approach) is also used for cash flow forecasting. It is based on the hypothesis that each project is unique and the cash-flow model cannot be developed from grouped data. It shows the cash flow forecast in cumulative form which allows progress payments to be identified. This idiographic methodology is applied to fit cash flow data using the logit transformation technique. It is the simplest of the sigmoid transformation that allows S-curve to be presented in linear format [13].

Advanced cash flow forecasting approach is the detailed and confident approach to positive cash flow prediction flows [23, 34]. The contract programme and a bill of quantities are normally used to provide a more accurate construction cash flow forecasts compared to other methods of cash flow forecasting [23]. As stated earlier in types of construction project cash flow forecast, advanced cash flow forecasting involves preparation of cash flow which is based on either monthly cash flows or staged cash flows. In case of staged cash flows, preparation of construction cash flows is based on progress payments (cash flows) upon completion of various work elements of construction project [17].

2.3.2. Negative Cash Flow Methodologies

In forecasting the negative cash flows, researchers have developed the standard cost curves, researchers such Zoisner (1974) (cited by [28]), and [10] developed special cost curves by using mathematical approaches in forecasting costs of projects. Other researchers such as [2] and [3] developed standard cost curves using computerized approach (e.g. fuzzy technique). All these curves were based on periodic cost flow delivery.

2.3.3. Net Cash Flow Methodologies

For net cash flow methodologies, some researchers have developed standard single net cash flow curves such as O'Keefe (1971) (cited by [28]). These curves were generally based on periodic net cash flows delivery [11]). In spite of some attempts in these methodologies, the developed curves appeared as poor bases to use in forecasting net cash flows because they tend to fluctuate so much depending on the data available in their use.

2.4. Forecasted and Actual Construction Cash Flows

Specifically, construction project cash flows are the amounts of money that the contractor will receive from client after completion of various work stages of the project [20]. In that manner, forecasted construction cash flows in this study means the estimated/projected amounts of money to be received by contractor from client after completion of various work stages of the project. While actual construction cash flows are the actual amounts of money paid to contractor for the various completed work stages of the

project after being valued at the site and certified.

2.4.1. Variations between Actual and Forecasted Construction Cash Flows

According to [29], the difference between actual and forecasted construction cash flows in executing the construction project is referred as variations. These variations are caused by risk factors as discussed in section 2.5. If the variation is positive, the actual construction cash flow has exceeded the forecasted construction cash flow for the specific work stage performed and vice versa.

2.5. Risk Factors Causing Variations on Construction Project Cash Flows

According to [31], risks are the factors that can cause a project to fail in meeting its goals. For example, as [29] pointed out, positive variations between actual and forecasted cash flows are the impacts of risk factors which occur during construction. It should also be noted that wherever word risk factor used in this study implies the factor that can cause variations on forecasted construction cash flows for a certain work part of building project.

Normally, the variations are caused by risk factors inherent in construction cash flow forecast [29]. Moreover, many construction activities are subjected to more risks than other industries [20]. This implies that there are also lots of risk factors affecting the construction cash flows of the projects.

During the construction process, there are many influential risk factors on the cash flows related to cost overruns, time delays, variations and technical changes [25]. According to [30], the significant risk factors that cause variations on forecasted construction cash flows include changes to initial design, inclement weather, changes to works, labour shortage, problems with foundations, project complexity, and estimating error. Furthermore, according to [29], three significant risk factors were changes in initial design, inclement weather and changes to works while three least risk factors are labour strikes, civil disturbances and changes in currency exchange rates.

Moreover, there is tendency for most of risk factors affecting cost performance in executing construction projects to affect other parameters of construction projects. This has been revealed in the study done by [38], whereby most of risks affect both cost and time aspects in executing the project. This implies that most of the risk factors affecting construction cash flows cause also cost overruns and time overruns in the implementation of construction projects and vice versa because these risk factors have relationships with all project objectives.

Therefore, based on broad literature review from different perceptions of the authors on cost issues during executing the construction project, the following are the risk factors causing variations on forecasted construction cash flows as shown in Table 1.

2.6. Dealing with Risk Factors Causing Variations to Construction cash Flows

Since risk factors affecting forecasted construction cash flows are treated the same way as other risks in different types of projects, therefore, dealing with those risk factors during implementation of building projects is the subject matter embedded in risk management. According to [18], risk management is the way of dealing with risks by including planning for risks, identifying and analysing the risk issues, developing risk response action plans, and monitoring project risks. Basically, according to [14], risk management process consists of generic steps which include risk identification, risk analysis, risk controlling (risk response planning) and risk monitoring, but this study focuses mainly on the risk identification and risk analysis.

Table 1. Summary of Risk Factors Causing Variations on Forecasted Construction Cash Flows

Risk factors causing variations on forecasted construction cash flows
a. Incomplete project design and specifications [34]
b. Changes in geological conditions [38, 27]
c. Project complexity, estimating error specifications [27]
d. Inclement weather, shortage of key resources, compliance with regulations, contractor's lack of resources [30]
e. Contractor's lack of experience and technical skills, civil disturbances [20]
f. Unclearity of client's requirements [34, 38, 21]
g. Different meanings of specifications, changes in currency exchange rates, misunderstanding of contract clauses [21]
h. Level of bureaucracy [4]
i. Clients' lack of financial resources [1, 38]
j. Consultants' lack of experience and technical skills, incomplete information at tender stage [38]
k. Unethical practices [9]
l. Design errors [5]
m. Poor communication among project participants [14, 13]

2.6.1. Risk Identification

Risk identification deals with identifying which risks can affect the project. Risk can be identified using the recorded experience (historical data) from past projects and the current projects or from experiences based upon knowledgeable experts. Tools and techniques for risk identification includes documentation reviews, interviewing, brainstorming and expert judgement [18].

2.6.2. Risk Analysis

Risk analysis involves analyzing the risk issues in terms of the potential impacts using either qualitative or quantitative tools for enabling the risk response planning actions to be set. In addition, quantitative tools aim to analyze numerically all the risk issues [14].

3. Methodology

Both questionnaires and interview were organized to

collect the data for the purpose of addressing the objectives of the research. The questionnaire was divided into two parts; first part was about the general introduction of the respondent, second part focused on risk factors that cause variations on forecasted construction cash flows during construction phase in building projects. All the questions in the second part of questionnaire were delimited to positive construction cash flows derived from staged cash flows as discussed in section 2.2.1 (i.e. based on staged progress payments upon completion of various work stages/parts of building projects). The work parts used in questionnaires of this research are substructure, superstructure, finishing and services installations (see Table 4). The superstructure part consisted of frames, upper floors, stairs, walls, partitions and roof elements of buildings. While finishing consisted of all finishes, doors, windows, fixtures and fittings, and external works. For the case of services installations consisted of electrical, plumbing, fire fighting, air conditioning, data cabling, and lift installations).

3.1. Questionnaire Design

This study intended to find out the significant risk factors involved in causing variations between forecasted and actual construction cash flows in building projects. The questionnaire design targeted building contractors based in Dar es Salaam City (from class I to class VII). The risk factors were obtained from broad literature review. Then, the questionnaire was finally compiled by basing on the refined list of risk factors causing variations on forecasted construction cash flows after a pilot study. The pilot study was carried out to test the variables used in designing the questionnaire and improve reliability of the questions. The data used were collected using a questionnaire survey through quantitative approach. The closed ended questions were used in questionnaires as they can be analyzed easily [22]. The respondents were asked to provide their views on how the risk factors cause variations on forecasted construction cash flows during construction phase using a 5-point Likert scale. The views were based on the experiences of respondents from the recently completed building projects or on-going building projects executed by them. The ratings used were: Very high = 5; High = 4; Medium = 3; Low = 2; and Very low = 1. Each respondent was asked to rate each of the statements in terms of these rating scales.

3.2. Data Collection

The data were collected using multiple sources of evidence. These sources have been good in facilitating the data collection process. Literature review was done to identify the risk factors affecting the construction cash flows in construction projects, whereby the list of those risk factors was refined using the pilot study. Questionnaires survey was also used to collect primary data on risk factors causing the variations on forecasted construction cash flows from building contractors. Finally, interview was used to collect

the data on the effects of project scheduling and resource price change from consultants. Most of respondents had experience of more than 10 years in executing the building projects. This indicates that most of respondents have enough experience in managing the building projects. Therefore, this study consisted of questionnaires and interview that required information from building contractors and consultants.

3.3. Sample Size

The proposed sample size for building contractors for questionnaire survey was calculated using the statistical model presented by [16] as shown in equation 1.

$$n = \frac{z^2 \cdot p \cdot q \cdot N}{e^2(N-1) + z^2 \cdot p \cdot q} \quad (1)$$

Where:

n stands for the sample size

N stands for the total number of population

Z stands for the confidence level

e stands for the margin/sampling error

p stands for degree variability, which is 50%

q stands for 1-p.

Data used in sampling are confidence level (Z) - 90% (1.645) and margin/sampling error (e) - 10%. Note that these values are economical to be used and they have been used in various studies like [37, 19, 15].

According to [36], the total population for building contractors based in Dar es Salaam was 1082 (class I-76, II-18, III-31, IV-97, V-264, VI-235, and VII-361). Hence, the sample size for all classes of building contractors was 281 building contractors as shown in Table 2. Based on research population which is heterogeneous, the researcher used stratified random sampling so as to establish the general sample size according to their classes as indicated in Table 2. However, an additional of 3 to 5 building contractors to most of classes was added during distribution of questionnaires in order to overcome the shortage for the case of those questionnaires which were not returned (see distributed questionnaires in Table 2).

Table 2. Sample Size of Building Contractors and Distributed Questionnaires

Class of registration	Population	Proposed sample	Distributed questionnaires
I	76	37	41
II	18	15	15
III	31	22	25
IV	97	41	46
V	264	55	60
VI	235	53	57
VII	361	58	63
Total	1082	281	307

Also, a total of 40 consultants were interviewed to investigate the effects of project scheduling and resource

change price.

3.4. Response to Questionnaires

The overall percentage of respondents was 92.51% (284) out of 307 distributed questionnaires as shown in Table 3. The number of respondents was 284 which is still above the proposed sample size (see Table 2). Therefore, the number of respondents was good representation and it was used in the analysis of this study. Respondents' distribution is as shown in Table 3.

Table 3. Respondents' Distribution

Class of registration	Distributed questionnaires	Returned questionnaires	
		Number	Percentage
I	41	39	95.12%
II	15	14	93.33%
III	25	22	88.00%
IV	46	43	93.48%
V	60	58	96.67%
VI	57	56	98.25%
VII	63	52	82.54%
Total	307	284	92.51%

4. Results and Discussion

The method of data analysis was conducted using statistical package for social sciences (SPSS) Version 20.0 for the data's obtained from questionnaires. Basically, various categories of descriptive statistics that measures of central tendency, measures of variability (dispersion) and measures of relative position to analyze its data were used by the researcher.

The indices, variance and degree of variability of the data were calculated by using the following formulae:

$$I_j = \sum_{k=1}^5 (Rpjk \times \frac{nRjk}{N}) \quad (2)$$

$$\text{Std. Dev. } (\sigma) = \sqrt{\frac{\sum (X_j - \bar{X})^2}{N}} \quad (3)$$

$$\text{Deg. of Var.} = \frac{SD}{I_j} \times 100 \quad (4)$$

Where:

I_j = Index for risk factor j

$Rpjk$ = Rating point (ranging from 1-5)

$nRjk$ = number of respondents belongs to rating point k , for risk factor j

N = Number of respondents

\bar{X} = Mean

X_j = values of the risk factor j

The analysis was performed on the responses (from 284 respondents) as shown in Table 4 to identify the significant risk factors that cause variations on construction cash flows

in various parts of building projects. The risk factors have been presented in abbreviations (short forms) in this study so as to save space during presenting the data in tabulation form. The clarifications of abbreviations are given in Table 6. Other short forms used in this study are Std. Dev. (Standard Deviation); Deg. of Var. (Degree of Variability); Index Rank (IR); and GMI (Grand Mean Index) which is the mean of means of all sub-samples within the sample.

In this study, the risk factors that have indices above 3 (i.e. $3/5 = 60\%$) are termed as significant risk factors (as pointed out by [29]), but their indices should also be greater than grand mean index in the respective activity part of building projects. These are passing criteria in this study for the risk factors to be significant in causing variations on forecasted construction cash flows in building projects. Note that grand mean index has been used in this study because there were sub-samples of various classes within the general sample (see Table 2).

From Table 4, it was found that there are eleven

significant risk factors causing variations on construction cash flows for substructure works of building projects which have indices above both passing index of 3.0 and grand mean index, but top three significant risk factors are errors in project documents (Bills of Quantities), poor communication among project participants, and incomplete information at tender stage. Also, these top three significant risk factors have low degree of dispersion ranges from 24.94% to 31.50%. From these results, it was so expected for incomplete information at tendering stage to be one of top significant risk factors causing variations on forecasted construction cash flows related to substructure works because sometimes the nature of ground is not clearly known to participants during tendering period. That's why in practice, work items in substructure part are provisionally measured for preparing tendering documents. Therefore, this situation of having incomplete information at tender stage causes variations between actual and forecasted construction cash flows during construction phase of building projects.

Table 4. Risk Factors Causing Variations on Forecasted Construction Cash Flows for Various Work Stages/Parts of Building Projects

Risk factors	Substructure				Superstructure				Finishings				Services Installations			
	Index	Std. Dev.	Deg. of Var.	IR	Index	Std. Dev.	Deg. of Var.	IR	Index	Std. Dev.	Deg. of Var.	IR	Index	Std. Dev.	Deg. of Var.	IR
EPDB	4.294	1.071	24.942	1	3.428	1.397	40.753	3	3.363	1.408	41.867	3	3.296	1.460	44.296	8
PCAPP	3.890	1.070	27.506	2	3.533	1.281	36.258	1	3.587	1.231	34.318	1	3.464	1.341	38.712	1
CLETS	3.702	1.155	31.199	4	3.42	1.253	36.637	6	3.359	1.269	37.779	4	3.429	1.262	36.804	2
DMS	3.553	1.196	33.662	8	3.263	1.257	38.523	9	3.302	1.206	36.523	6	3.325	1.208	36.331	6
UPC	3.585	1.241	34.616	6	3.197	1.254	39.224	11	3.171	1.253	39.514	10	3.318	1.299	39.150	7
UCR	3.578	1.206	33.706	7	3.347	1.237	36.958	8	3.299	1.258	38.133	7	3.275	1.244	37.985	9
CLFR	3.624	1.181	32.588	5	3.427	1.257	36.679	4	3.441	1.253	36.414	2	3.354	1.230	36.673	4
DE	3.440	1.112	32.326	10	3.464	1.192	34.411	2	3.356	1.217	36.263	5	3.329	1.264	37.969	5
P/ID	3.362	1.247	37.091	11	3.423	1.111	32.457	5	3.249	1.22	37.550	9	3.371	1.280	37.971	3
IITS	3.759	1.184	31.498	3	3.412	1.174	34.408	7	3.267	1.311	40.129	8	3.261	1.267	38.853	10
IW	3.525	1.249	35.433	9	3.241	1.223	37.735	10	3.160	1.347	42.627	11	3.061	1.322	43.189	18
LS	3.150	1.353	42.952	15	3.033	1.241	40.917	21	2.904	1.342	46.212	26	2.971	1.386	46.651	21
CD	2.979	1.378	46.257	26	2.792	1.291	46.239	26	2.915	1.401	48.062	25	2.989	1.382	46.236	20
CxD	3.060	1.366	44.641	22	2.942	1.416	48.131	24	2.947	1.42	48.185	21	3.032	1.369	45.152	19
NPLR	3.067	1.326	43.234	21	3.048	1.299	42.618	19	2.954	1.329	44.990	20	2.946	1.315	44.637	22
CGC	3.043	1.368	44.956	23	NOT APPLICABLE											
CSL	3.099	1.267	40.884	17	2.934	1.327	45.228	25	2.925	1.351	46.188	24	2.857	1.336	46.762	26
SKR	3.072	1.170	38.086	19	3.047	1.335	43.814	20	3.05	1.314	43.082	17	2.861	1.319	46.103	25
MCC	3.039	1.220	40.145	24	2.993	1.243	41.53	22	3.064	1.305	42.591	16	2.932	1.416	48.295	23
SLETS	3.071	1.289	41.973	20	2.945	1.235	41.935	23	2.94	1.298	44.150	22	2.904	1.371	47.211	24
SLFR	3.199	1.191	37.230	14	3.102	1.233	39.749	15	3.114	1.302	41.811	13	3.114	1.368	43.931	16
CLETS	3.277	1.283	39.152	12	3.124	1.225	39.213	14	3.146	1.313	41.736	12	3.139	1.297	41.319	15
CLFS	3.202	1.270	39.663	13	3.139	1.299	41.383	13	3.111	1.322	42.494	14	3.199	1.308	40.888	11
LB	3.142	1.255	39.943	16	3.146	1.337	42.498	12	3.11	1.325	42.605	15	3.107	1.356	43.643	17
CCR	3.078	1.326	43.080	18	3.088	1.361	44.074	17	3.043	1.292	42.458	18	3.189	1.327	41.612	13
CAPP	3.035	1.301	42.867	25	3.095	1.355	43.780	16	2.929	1.324	45.203	23	3.179	1.353	42.561	14
IG	2.957	1.419	47.988	27	3.055	1.401	45.859	18	3.032	1.425	46.999	19	3.193	1.396	43.721	12
GMI	3.282				3.144				3.121				3.149			

Table 5. Significant Risk Factors Causing Variations on Forecasted Construction cash Flows for Various Work parts

Risk factors	Substructure	Superstructure	Finishings	Services Installations
EPDB	x	x	x	x
PCAPP	x	x	x	x
CLETS	x	x	x	x
DMS	x	x	x	x
UPC	x	x	x	x
UCR	x	x	x	x
CLFR	x	x	x	x
DE	x	x	x	x
P/ID	x	x	x	x
IITS	x	x	x	x
IW	x	x	x	
CLETS			x	
CLFS				x
LB		x		
CCR				x
CAPP				x
IG				x

For construction cash flows based on superstructure, the results showed that top three significant risk factors are poor communication among project participants, design errors and errors in project documents (Bills of Quantities). The degree of variability of these most three significant risk factors ranged from 34.41% to 40.75%. According to these results, it can be noted that the construction cash flows related to superstructure are much affected by poor communication among project participants. Hence, for minimizing the variations between actual and forecasted construction cash flows as one of the cost issues, [33] insisted that proper communication is important for successful completion of any project in terms of all cost issues (including cash flows). Actually, proper communication links all project participants, and information that are necessary for success.

Also, in construction cash flows for finishing works, the study found that there are also twelve significant risk factors as per passing criteria. Poor communication among project participants, clients' lack of financial resources and errors in project documents (Bills of Quantities) are the top three significant risk factors, and their degree of variability ranged from 34.32% to 41.87%. Twelve significant risk factors were expected to cause variations on construction cash flows in the finishing works because according to [25], nowadays there are new finishing materials in the building industry in Tanzania which bring challenges in selection of building materials, measurements, construction and appearance of the project. These challenges may increase the possibility for many risks to happen in executing these works and affect the cash flows in finishing works of building projects.

Finally, in construction cash flows for services

installations, the results showed that there are fourteen significant risk factors causing variations on these cash flows and their degree of variability ranged from 36.33% to 43.72%. From these results, there are many significant risk factors which cause variations on construction cash flows for services installations compared to other parts of building projects. These fourteen significant risk factors happen in this activity part of building projects because in Tanzanian practice, services installations require specialized skills, various contract arrangements and many project participants compared to other work parts of building projects. Therefore, these working environments increase the possibility for many significant risk factors to happen in executing these works. Actually, the presence of many significant risk factors affect much construction cash flows to that part as revealed in the above results.

4.1. Significant Risk Factors Identified through Analysis

Basing on the passing criteria mentioned above (i.e. the significant risk factors should have indices greater than 3.0 and above grand mean index in the respective activity part). From Table 5, ten significant risk factors namely errors in project documents (Bills of Quantities), poor communication among project participants, consultants' lack of experience and technical skills, different meanings of specifications, unethical practices to consultants, unclarity of clients' requirements, clients' lack of financial resources, design errors, poor/incomplete design and incomplete information at tender stage were identified to cause significantly the variations on construction cash flows for all work parts of building projects (i.e. substructure, superstructure, finishing and services installations). These ten significant risk factors

are equivalent to 37.04% of all potential risk factors causing variations on construction cash flows (i.e. 10/27). From Table 5, it shows that ten risk factors were also identified as insignificant factors in causing variations on construction cash flows to any work part of building projects. This is also equivalent to 37.04% of all potential risk factors (i.e. 10/27).

Table 6. S List of Abbreviations of the Risk Factors

STATEMENT	ABBREVIATION
Errors in project documents (Bills of Quantities)	EPDB
Poor communication among project participants	PCAPP
Consultants' lack of experience and technical skills	CLETS
Different meanings of specifications	DMS
Unethical practices to consultants	UPC
Unclearity of clients' requirements	UCR
Clients' lack of financial resources	CLFR
Design errors	DE
Poor/Incomplete design	P/ID
Incomplete Information at tender stage	IITS
Inclement weather	IW
Labour strike	LS
Civil disturbances	CD
Complexity of designs	CxD
Non-adherence to public laws and regulations	NPLR
Change in geological conditions	CGC
Change in site layout	CSL
Shortage of key resources	SKR
Misunderstanding of contract clauses	MCC
Subcontractor/supplier's lack of experience and technical skills	SLETS
Subcontractor/supplier's lack of financial resources	SLFR
Contractor's lack of experience and technical skills	CLETS
Contractor's lack of financial resources	CLFS
Level of bureaucracy	LB
Changes in currency rates	CCR
Conflicts among project participants	CAPP
Instability of Government	IG

4.2. Effects of Project Scheduling

The study also investigated different effects of project scheduling during construction phase. These effects are:

4.2.1. Change of Project Value

If there is poor project scheduling which resulted into extension of time during construction stage, there is also a tendency of the cost of the overheads and preliminaries of the project to change. Hence, these cost changes affect the total project value in managing the building project. If poor

project scheduling is influenced by client side, the contractor will claim more money for extension of time to cover the cost of overheads and some preliminary items as explained earlier. For instance additional works require more time compared to the first proposed schedule, this will cause also extra costs to contractor that would be resulted due to extension of the time. Therefore, those extra costs should be claimed by contractor and added to the total project value.

4.2.2. Delays of the Projects

The study found that when there is more time required during construction of building project, the project completion period will increase too. Hence, this situation causes the delays in completing the building project. This will affect also the cash flows due to either extension of time or changes of project values influenced by that extension.

4.2.3. Poor Workmanship of the Projects

It was also found that when there is a tight project schedule, this situation affects the workmanship of the contractor in performing the works at the site. Hence, the value for money is not achieved properly.

4.2.4. Conflicts between the Parties

The change of the project schedule during construction phase may result into the conflicts between project members. This may happen especially when the client/consultant has added the works which need extension of time, but the client refuse to pay extra costs for overheads and some preliminary items due to that extension of time given to contractor.

4.3. Effects of Resources Price Changes

The effects of resources price changes were investigated, but the change of project value is not among of those effects because the building projects are procured under fixed price contracts. These effects are:

4.3.1. Delays of the Projects

The study found that when there are high prices of resources such as labourers and plants in the market (different from the original prices during tendering period), contractor tends to use more time in re-doing market survey and bargaining so that they can get reasonable prices for those resources as per tendered amounts. This situation affects the original schedule and makes the contractor to request extension of time from the consultants. In that manner, the changes of resources prices cause the delays in completing the building project. The periodic cash flows are also affected by this extension of time.

4.3.2. Poor Quality of the Projects

Also, when there are high prices of resources (materials, labourers and plants in the market) different from the original prices during tendering period, contractor tends to use substandard materials and cheap (unskilled) labourers to execute the works in order to compensate the tendered

amounts. This creates poor quality of the work and value for money is not achieved.

4.3.3. Termination of the Contract by Client

It was found that the performance of contractor in terms of the quality and scheduling are affected due to high prices of resources (materials, labourers and plants in the market) during construction period. Due to this situation, sometimes the clients may terminate the contract due to poor performance of the contractor. The termination of contract will affect also the cash flow projections.

5. Conclusions and Recommendations

The emphasis of this paper has been on identifying the significant risk factors causing variations on construction cash flows for various work parts of building projects during construction phase. The identified risk factors have been analyzed basing mainly on index analysis. From the risk factors identified as potentially causing variations on forecasted construction cash flows in building projects, only ten risk factors were identified as the significant risk factors which cause variations on forecasted construction cash flows for all work stages/parts of building projects in Tanzania (i.e. substructure, superstructure, finishing, and services installations). Therefore, it can be concluded that errors in project documents (Bills of Quantities), poor communication among project participants, consultants' lack of experience and technical skills, different meanings of specifications, unethical practices to consultants, unclarity of clients' requirements, clients' lack of financial resources, design errors, poor/incomplete design and incomplete information at tender stage are the significant risk factors that cause variations on forecasted construction cash flows for all work parts in building projects in Tanzania.

Furthermore, poor communication among project participants is one of the most three significant risk factors which cause variations on forecasted construction cash flows for all work stages/parts in building projects in Tanzania. Also, risk of errors in project documents (Bills of Quantities) was identified to be one of the most three significant risk factors in causing variations on construction cash flows for substructure, superstructure and finishing works.

The identified significant risk factors are of important value in providing a reduction of the risk factors and they subsequently provide direction for further analysis in confirming those risk factors to still be significant or not in execution of building projects.

The most common effects of project scheduling were change of project value, delays of the projects, poor workmanship of the project, and conflicts between the parties. For the case of effects of resources price changes were delays of the projects, poor quality of the projects and termination of the contract by client.

Finally, the study recommends the following measures to be taken so as to minimize the occurrence of unnecessary

variations on forecasted construction cash flows and confirm those significant risk factors. Proper communication should be exercised during implementation of building projects so as to link all project participants and necessary documents required for the successful completion of building projects. This will minimize the risk factors which happen due to improper communication or breakdown of communication.

Detailed examination of the identified significant risk factors in causing the variations on forecasted construction cash flows should be done using contract documents such as cash flow projections, Bills of Quantities, interim valuations for payments, correspondences, work programme, site instructions, drawing revisions and contractor's claim.

Also, the identified significant risk factors are required to be confirmed by using the recommended confirmatory analysis methods such structural equation modeling (SEM). This will allow further analysis to those identified significant risk factors to check if they are still significant or not. Also it will check their correlations among themselves in execution of building projects.

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