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Assessments of the Application of Earned Value Management System for Construction Project Performance Measurement in Zanzibar

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ABSTRACT

Many construction projects in developing countries including in Zanzibar suffer from time and budget overruns. The Revolution Government of Zanzibar established different bodies such as Zanzibar Contractors Registration Board (ZCRB), Zanzibar Architects, Engineers and Quantity Surveyors Registration Board (ZAEQRB), Zanzibar Public Procurement and Disposal of Public Asset Authority (ZPPDA), among others with the aim of controlling the performance of project. Often scope creep, time and cost overruns are very common problems in construction projects. This study aims at addressing those problems by assessing the use of Earned Value Management (EVM) methodology in measuring construction industry performance in Zanzibar. The study used purposive sampling to select the sample. A self-administered questionnaire and round table discussions were deployed to architects, engineers, project managers, and quantity surveyors for data collection. Also, a case study design was employed whereby four ongoing construction projects were used as samples to collect data. The data were processed using Microsoft Excel where Chi-square, ANOVA, and Earned Value Analysis (EVA) were used to analyze the data. The study findings indicate that majority of key players of construction industry of Zanzibar were unaware of the EVA as a tool for monitoring the performance of the projects, although they practice EVMS to some extent. Also, all four cases used in this study, indicated underperformances in terms of scope, time and cost parameters.

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INTRODUCTION

Regardless of many decades of the practice and academic attention of the project management, the performance of construction projects remains problematic. Empirical evidence suggests that projects do not achieve their scope and planned budget (Padalkar & Gopinath, 2015). As construction projects continue to grow, they involve more complex processes which justify the need for tools and techniques for the performance and development of projects (Candido, *et al*., 2014). The main goal of project management is to deliver the project within the planned schedule, cost, and scope (Hasseb, 2011). Among the biggest challenges for monitoring

construction projects is the selection of the appropriate monitoring methodology. Earned Value Management (EVM) is the best tool or technique for project performance. Earned Value Management (EVM) tracks the progress of a construction project. It integrates the scope, the time, and the cost factors to evaluate its performance and forecast its completion time and cost.

Earned Value Management (EVM) is carried out by using three variables, namely the Planned Value, Earned Value, and Actual cost. The other variables include schedule variance, cost variance, cost performance index or indicator, schedule performance index or indicator, budget at completion, and critical ratio. All these are computed. From these entire variables, the performance of the project can be maintained or improved. This is achieved by providing insights into what has been accomplished compared with what was planned to be accomplished to get an accurate picture of the current status for cost and schedule positions for the sake of taking corrective actions (Rao & Jacob, 2015). Traditional methods discuss only planned and an actual cost while Earned Value goes further and show the manager early warning for problems on the project before they become uncontrollable. Earned Value Management (EVM) is a set of guidelines that guide a company's management control system (Avlijas, *et al.,* 2015). This study aims at reducing the gap between theory and practice and to contribute to the wider use of Earned Value Management (EVM) methodology in the construction industry in Zanzibar.

LITERATURE REVIEW

Construction project performance

Identification of key performance indicators (KPIs) helps decision-makers on the performance levels of projects (Chan &Hiap, 2012). According to Elshakour, (2012) *et al.* Key Performance Indicators (KPIs) are benchmarks of ''the continuous process of measuring works, services, and practices". From the various studies conducted by the Construction Industry Institute in the United States of America (USA), it was established that key performance indicators (KPIs) for the construction industry at the project level are cost, time scope, and quality.

Construction performance measurement using Earned value Technique

There are many project monitoring and control techniques such as Earned Value Management (EVM), Line of Balance (LOB), Time Chain Age Technique, Program Evaluation and Review Technique (PERT). EVM is the best because of its ability to measure project performance and progress and integrate both scope, schedule, and cost. Various studies prove that Earned Value Management (EVM) provides accurate results for project performance (Chowdhury, 2013).

Earned value management term and methodology

For the successful implementation of Earned Value Management system the following are the basic key steps:

Organisation Policy: For top management to be committed for the implementation of Earned Value Management system (EVMS) it requires an organisation to establish a policy. The policy will provide rules, guidelines, and information regarding to how the organisation will implement EVMS.

Project Objectives: The project objectives include broad explanation of the technical requirements, budget, and the time outline which includes commencing and completion date (Humphreys, 2011 & 2014).

Work Scope Definition: Earned Value Management (EVM) requires decomposing the scope of the works by using work break down structure (WBS), to break down activities into minor management tasks (Humphreys, 2011 & 2014).

Responsibility Assignment Work Teams: Once the scope is defined, the next step is to assign the responsible persons for performing the work. Then one should divide the team works and each task activity should be assigned to a special person who has knowledge, skills, and experience to perform with regard to quality, time, and budget (Humphreys, 2014).

Setting baseline plan: According to Bhosekar and Vyas (2014), describe baseline as the original approved project scope, time and cost.

Schedule baseline: According to Bhosekar and Vyas (2014), define the baseline schedule as a fixed project schedule. It is the standard by which project performance is measured. The current schedule is copied into the baseline schedule which remains frozen until it is reset.

Cost baseline: At the end of the planning stage, the cost information is translated to become baseline cost. In Earned Value terms, this cost is also referred to as the Budget at Completion (BAC) Kahkonen (2014). This BAC cost is calculated for tasks, resources, and assignments, and then distributed over all the activities in the project schedule. By accumulating these budgeted costs over time, the first measure obtained is the Planned Value (PV**)**. Planned Value (PV) is budget planned to be spent according to the original plan at any given point in time. This is also known as the Budgeted Cost of Work Scheduled (BCWS) Kahkonen (2014).

METHODS AND MATERIALS

The methodologies adopted in this study were combination of case study and survey where qualitative and quantitative data were collected for analysis. The study targeted architects, engineers, project managers and quantity surveyors. A sample of 66 respondents was used. Whereas of the 66 copies of questionnaire distributed, 62 were responded. Questionnaires and structured interviews were used to collect data and data were processed using Microsoft Excel and SPSS. Chi-square and EVA formula were used to analyze the relationships between the independent and dependent variables.

Determination of Earned Value analysis: During project execution, as a project progresses, the status date will change and two more measures are obtained so that a comparison can be made between realities and Earned Value (EV). EV can be determined by multiplying the Planned Value (PV) at a point in time and the percentage of work completed at a certain point in time (PC) as:

EV=% Complete (PC) × PV (BCWS) (1)

Earned Value Analysis performance measures

Variance: Variances represent the variation between the present status of the project and its baseline, in monetary terms include; Schedule Variance and Cost Variance

Schedule Variance (SV): It is the difference between the Planned Value (PV) and Earned Value (EV**),** which is used to determine whether a project is ahead of or behind schedule.

$$SV = EV - PV \quad (2)$$

A positive value indicates a favorable condition (behind the schedule) and a negative indicates unfavorable condition (ahead of the schedule) (Kahkonen, 2014).

Cost Variance (CV): It is the difference between the Earned Value and Actual Cost. Cost variance shows whether a project is under or over budget.

$$CV = EV - AC \quad (3)$$

Negative value indicates the project is over the budget and positive value points out that the project has been less spent (under the budget)

Indices: These are Cost Performance Index and Schedule Performance Index, which expresses the efficiency of the executed work.

Cost Performance Index (CPI): This is calculated by dividing the Earned Value (EV) and Actual Cost (AC). CPI shows whether a project is under or over budget.

$$CPI = EV/AC \quad (4)$$

If CPI is less than one, it means that the project is currently running over the budget and if it is more than one the project is running under the budget (Kahkonen, 2014).

Schedule Performance Index (SPI): This is calculated by dividing the (EV) and (PV) which are used to determine whether a project is ahead of or behind schedule.

$$SPI = EV/PV \quad (5)$$

If SPI is less than one, it means that the project is behind plan and if it is more than one, it will be pointing out that the project is ahead of the schedule (Verma, 2014).

Forecasting cost and time at completion: Predicting the future with Earned Value Management (EVM) is to predict the expected final project cost and time for rebase line. It helps managers determine how efficiently they must use their remaining resources (Marco, 2013). Estimated Cost at Completion (EAC) and Estimated Time at Completion (ETC) are calculated as follows:

$$\mathbf{EAC} = \frac{BAC}{CPI} \quad (6)$$

$$\mathbf{ETC} = \frac{BAC}{SPI} \quad (7)$$

Critical Ratio (CR): This is the product between Cost Performance Index (CPI) and Schedule Performance Index (SPI). It represents the overall status of the project and how well the overall project is healthy. If the ratio is equal to one, it indicates that the project is on target. If is lower than one, it indicates the less performance. (De Marco, 2013).

Re-base lining: This can be due to the change of scope, time, and cost of the project. If the original baseline becomes unrealistic as a basis for management control, a new plan for scope and budget and corrective actions will be needed to bring the project back on plan BIS (2013).

RESULTS AND DISCUSSIONS

Assessment of the level of awareness and skills for Zanzibar Construction Project practitioners on Earned Value Management System

Table 1: Level of Awareness of Respondents on Earned Value Management (EVM)

Sample	Awareness of EVMS			Total
	Yes	No	Not Sure	
Engineer	15	27	0	42
Architect	5	7	0	12
QS	1	4	0	5
PM	3	0	0	3
Total	**24**	**38**	**0**	**62**
Percentage	**39%**	**61%**	**0%**	**100%**

The results and findings show that the majority that is 38 (61%) of the respondents were not aware of the Earned Value management system 61% (38), and 24 (39%) respondents were aware. There was no respondent who responded that was not sure (Refer Table 1). To confirm this, inferential statistics was done to draw conclusions. The Chi Square Test method was adopted.

Table 2: Chi Square Test

Chi Square Value (X2)	Degree of Freedom (d.f)	Critical Value (μX2)	P - Value	Level of significance (α)
5.69	3	6.25	0.13	0.1

From Table 2 it was observed that the calculated value of Chi square which is 5.69 is smaller than the critical value (Chi-square table value) which is 6.25, hence the null

hypothesis (Ho) cannot be rejected. And the p – Value which is 0.13 is higher than the level of significance which is 0.05; we fail to reject the null hypothesis. It can, thus, be concluded that there is sufficient evidence that the key players in construction industry were not aware of the Earned Value Management System (EVMS).

Source of knowledge for awareness of Earned Value Management System (EVMS)

It was very important to measure where the respondents get the skills or knowledge of Earned Value Management System (EVMS). The results and findings reported only one source of information through formal training from universities and short courses which were 79 per cent. However, respondents did not get chances to use EVMS and the rest 21 per cent they use it by following the order from the project managers.

Level of skills or knowledge on EVMS to the professionals who practice the construction industry of Zanzibar

The results and findings from Table 3 indicate that the level of awareness is low but the skill in project management (EVM) was noted to be high. They are indirectly practicing part of EVM. In this study, 55 respondents (88%) demonstrated that they understood the objective of the projects in which they were participating. At the same time, 54 respondents (87%) said that project team established the scope of work using work break down structure (WBS). Besides, 58 respondents (93%) agreed that project managers assigned the responsibility for each person for the implementation of a particular task on project. Additionally, 47 respondents (77%) supported the project team which established project cost, and time baseline. However, 17 (28%) and 20 (33%) respondents mentioned that there was great desire on knowledge of project performance analysis including computations using EVA and the use of Project Management Software for monitoring the project respectively.

Factors that hinder and enhance the effective application of EVMS

The results and findings from Table 4 and Table 5 indicate that the major threat for implementation of EVMS on which 44 (71%) respondents agree were level of professionalism and experience which were 44 respondents (71%), lack of adequate research and development was proposed by 48 (78%), political interference and corruption were proposed by 50 respondents (81%). Whereas 56 (90%) respondents point out regulations and construction industry standards. At the same time, 86 respondents (53%) pointed out the lack of top management support while 47 respondents pointed out poor financial planning and time estimations. We can mitigate those threats by expertise of project management staff, top management to support, and with commitment to use EVA, sufficient well allocated resources and budget estimations, the use of tools for planning and monitoring project scope cost and time, adoption of EVM construction industry standard and the use of different Project Management Software on monitoring the project.

Table 3: The level of skill on EVMS to the respondent

	The level of skills/knowledge on EVMS to the key players	**Very high**	**high**	**Moderate**	**Low**
1	Project team understands the objective of the projects in which they participate	25	30	6	1
2	The project team establishes the scopes of works using WBS.	22	32	6	2
3	P.M. assigns the responsibilities for each person for implementation of the particular task.	35	23	3	1
4	Estimation of costs for resources and schedule for baselines and tools used for schedule and cost	27	20	7	8
5	Calculation for performance analysis (schedule and cost variances) from the baselines for more decision	9	8	20	25
6	The use of different PM Software on monitoring the project	9	11	19	23

Table 4: Factors which hinder the effective application of EVMS

	C1: Factors that will hinder the effective application of EVMS	**Very high**	**high**	**Moderate**	**Low**
1	Level of professional and Experience	20	24	14	4
2	Lack of adequate research and development	19	29	11	3
3	Political interference and Corruption	26	24	5	7
4	Regulation and Industrial standard	35	21	3	3
5	Lack of top management support	29	24	7	2
6	Poor financial planning and time estimations	18	29	7	8

Table 5: Factors that will enhance the effective application of EVMS

	CII: Factors that will enhance the effective application of EVMS.	**Very high**	**high**	**Moderate**	**Low**
1	Expertise of project management staff	29	20	8	5
2	Top management support	31	15	10	6
3	Well allocation resources and budget	26	15	12	9
4	Use tools for planning, and monitoring of project	30	19	8	5
5	Adoption of EVM industry standard	35	18	5	4
6	The use of PM Software	37	21	3	1

Construction project performance using Earned Value Analysis (EVA) in Zanzibar

This analysis reveals the efficiency at which the work was done and the rate at which it was completed. It also shows the additional profit or loss the contractors, consultants or clients are likely to make with respect to what was originally planned. Based on the analysis and the planned profit and loss sheet prepared before the commencement of the project the cumulative Planned Value (PV) is established. Also, from the actual work completed the percent of completion is estimated. The Earned Value (EV) is computed by multiplying from the percent completed and PV. Finally, from the accounts department, the actual expenditure for the work done at a given point is acquired. This is called the Actual Cost (AC). Based on these three parameters the EVA derived performance metrics are computed.

Case study one: Water Supply Project

It is a heavy civil engineering public project, with lump sum contract and planned duration of 18 months. Its Estimated Project Budget at Completion (BAC) is USD 20,000,000. At the end of 12 months of the project, it was estimated to have reached the 40 per cent of its completion target as presented in Table 6. Whereas EVA results are presented in Figure 1 and Table 7

Table 6: Earned Value Analysis for activities done for the 12 months

Metric Definition	Value (USD)/Ratio
A: Cumulative PV	USD 13,050,000
B: % Complete	40%
Cumulative EV = A×B	USD 6,264,000
Cumulative Actual Cost	USD 7,360,000

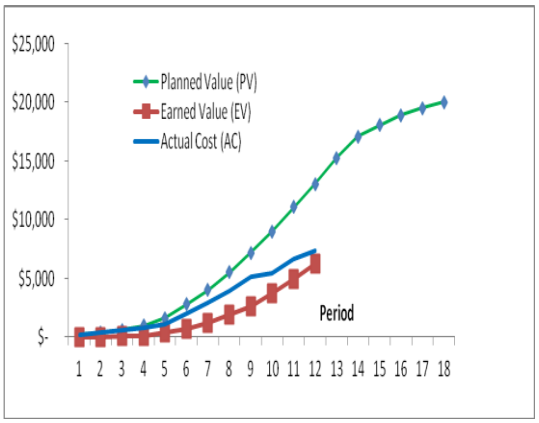

Figure 1: Planned Value (PV), Earned Value (EV) and Actual Cost (AC) for Water Supply Project in Zanzibar

Table 7: Earned Value (EV) performance metrics

Metric Definition	Value (USD)/Ratio
CV= BCWP - ACWP	-1,096,000 (USD)
SV = BCWP - BCWS	-6,786,000 (USD)
CPI=BCWP ÷ ACWP	0.851
SPI=BCWP ÷ BCWS	0.48
EAC= BAC ÷ CPI	23,499,361 (USD)
EAT= ETC ÷ SPI	37.5
CR = CPI × SPI	0.408

According to EVA analysis, this project has an unfavorable Cost Variance (CV)= -1,096,000 (negative value) and Cost Performance Index (CPI) = 0.851 < 1. This means that the project is over budgeted for the work performed. Also, the project has an unfavorable Schedule Variance (SV) = -6,786,000 is negative value and Schedule Performance Index (SPI) = 0.48 < 1. This means that the project is behind schedule. The project critical ratio (CR) = 0.408 < 1, It can be concluded that the project has not been managed as per the expected performance. As per EVA analysis results, this project is estimated to be completed within 37.5 months and not 18 months as planned before (2 times planned duration). The cost estimate at completion of this project is forecasted to be USD 23,499,361.

Case study two: Construction of Hotel in Zanzibar

It is fixed price contract with duration of 9 month. The Estimated Project Budget (BAC) was TZS 2,242,798,865 as presented in Table 8. Whereas EVA results are presented in Figure 2 and Table 9

Table 8: Earned Value Analysis for activities done in 9 months

Metric Definition	Value (TZS)/Ratio
A: Cumulative PV	TZS 2,243,000,000
B: % Complete	78%
Cumulative EV = A×B	TZS 1,749,000,000
Cumulative Actual Cost	TZS 1,582,000,000

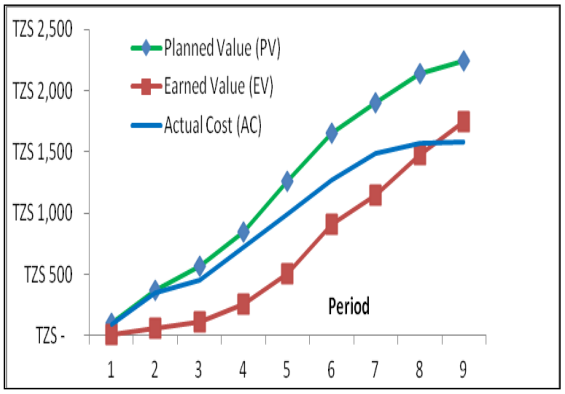

Figure 2: Planned Value (PV), Earned Value (EV), and Actual Cost (AC) for Hotel construction in Zanzibar

Table 9: Earned Value (EV) performance metrics

Metric Definition	Value (TZS)/Ratio
CV= BCWP - ACWP	167,000,000
SV = BCWP - BCWS	-494,000,000
CPI=BCWP ÷ ACWP	1.1
SPI=BCWP ÷ BCWS	0.78
EAC= BAC ÷ CPI	2,029,000,000
EAT= ETC ÷ SPI	12
CR = CPI × SPI	0.86

According to the referred case study, this project has a favorable Cost Variance (CV) which is 167,000,000 positive value and Cost Performance Index (CPI) = 1.1 > 1. This means that the project is under budget for the work performed. Also, the project has an unfavorable Schedule Variance (SV) = -494,000,000 is negative value and Schedule Performance Index (SPI) = 0.78 < 1. This means that the project was behind schedule. The project critical ratio (CR) is 0.78 ×1= 0.78 < 1. It can be concluded that the project was less performed. As per EVA analysis, this project was estimated to be completed in 12 months instead of 9 months. That is to say 3 months more than what was planned. The cost estimate at the completion of this project was forecasted to be TZS 2,029,000,000 which is less than PV.

Case study three: Road Upgrading Project in Zanzibar (35km)

This is civil works project with a lump sum contract and duration of 16 months and the Estimated Project Budget (BAC) is TZS 26,445,000,000 as presented in Table 10. Whereas EVA results are presented in Figure 3 and Table 11

Table 10: Earned Value Analysis for activities done for 9 months

Metric Definition	Value (TZS)/Ratio
A: Cumulative PV	TZS 18,670,000,000
B: % Complete	37%
Cumulative EV = A×B	TZS 6,908,000,000
Cumulative Actual Cost	TZS 9,897,392,241

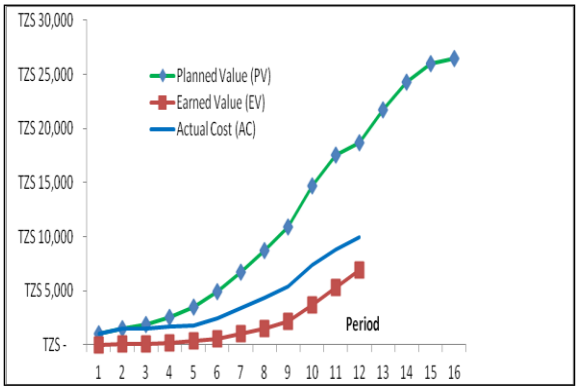

Figure 3: Planned Value (PV), Earned Value (EV), and Actual Cost (AC) for Road construction project

Table 11: Earned Value (EV performance metrics

Metric Definition	Value (TZS)/Ratio
CV= BCWP - ACWP	(2,989,392,241)
SV = BCWP - BCWS	(11,762,000,000)
CPI=BCWP ÷ ACWP	0.70
SPI=BCWP ÷ BCWS	0.37
EAC= BAC ÷ CPI	37,888,902,405
EAT= ETC ÷ SPI	43
CR = CPI × SPI	0.26

According to the referred case study, this project has an unfavorable Cost Variance (CV)= -2,989,392,241 negative value and Cost Performance Index (CPI) = 0.7 < 1. This means that the project is over budgeted for the work performed. Also, the project has an unfavorable Schedule Variance (SV) = -11,762,000,000 which is negative value and Schedule Performance Index (SPI) = 0.37 < 1. This means that the project is behind schedule. The project critical ratio (CR) is 0.26 < 1. It can be concluded that the project is less performed. This project is estimated to be completed in 43 months and not 16 months. Whereas the Estimate at Completion of this project is forecasted to be TZS 37,888,902,405 and not TZS 26,445,000,000.

Case study four: Construction of the Secondary School in Zanzibar

It is one storey public secondary school with the lump sum contract and duration of 12 months. The Estimated Project Budget (BAC) is TZS 3,340,000,000 target as presented in Table 12. Whereas EVA results are presented in Figure 4 and Table 13

Table 12: Earned Value Analysis for activities done for 9 months

Metric Definition	Value (TZS)/Ratio
A: Cumulative PV	TZS 3,246,541,317
B: % Complete	90%
Cumulative EV = A×B	TZS 2,921,887,185
Cumulative Actual Cost	TZS 2,874,594,388

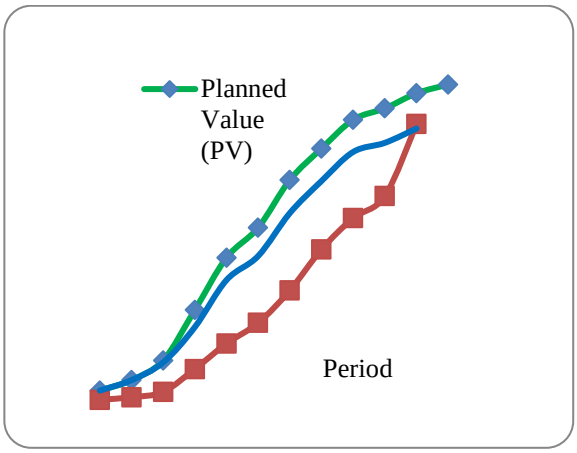

Figure 4: Planned Value (PV), Earned Value (EV), and Actual Cost (AC) for Secondary School project

Table 13: Earned Value (EV performance metrics

Metric Definition	Value (TZS)/Ratio
CV= BCWP - ACWP	47,292,797
SV = BCWP - BCWS	(324,654,132)
CPI=BCWP ÷ ACWP	1.02
SPI=BCWP ÷ BCWS	0.9
EAC= BAC ÷ CPI	3,285,554,445
EAT= ETC ÷ SPI	13
CR = CPI × SPI	0.91

According to the referred case study, this project has favorable Cost Variance (CV)= 47,292,797 positive value and Cost Performance Index (CPI) = 1.02 > 1. This means that the project is under budgeted for the work performed tough it is generally running well. Also, the project has an unfavorable Schedule Variance (SV) = -324,654,132 which is negative value and Schedule Performance Index (SPI) = 0.9 < 1. This means that the Project was behind schedule. The project critical ratio (CR) is 0.91< 1. It can be concluded that the project is less performed. This project was estimated to be completed in 13 months and not 12 months. One month more than what was planned. The cost estimate at completion of this Project was forecasted to be TZS 3,285,554,445 less than what was planned TZS 3,340,000,000.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions: This study aimed to assess the level of awareness and skills for the Zanzibar Construction project practitioners on Earned Value Management System (EVMS). It was found that the majority of the architects, engineers, project managers, and quantity surveyors were unaware of the Earned Value analysis tools for monitoring the performance of construction projects. However, it is important to note that some EVMS elements such as Work Breakdown Structure (WBS) are being practiced at an infant stage by a few construction industry practitioners. Also, it can be concluded that project team members had very high understanding of the project objectives. Project teams also understood well tools for project scoping such as WBS and there was clear assignment of responsibilities among the technical team members which are part of important elements for implementation of EVMS. It is important to note that in Zanzibar construction industry, the estimation for resource is properly done during planning phases of construction projects. The project schedule and cost baselines are set clear before signing of project contract. This was proved by the respondents who ranked this practice to be very high. However, the study discovered that there was infant application of project management packages such as project management software in Zanzibar which could enhance use of EVMS in construction projects. The factors which affect the implementation of Earned Value Management (EVM) in construction projects in Zanzibar include; the level of professional capacity and experience, lack of adequate research and development, political interference and corruption, regulations and industrial standard, lack of top management support, and poor financial planning and time estimations. Nevertheless, there is inadequate support of top management about the implementation of the EVM in Zanzibar causing adverse effects on projects. The findings from all four cases have proven that there was a problem of underperformance of the project, either the project running over budget or significantly delay of the project completion. The study shows that the establishment of EVMS for the construction industry in Zanzibar is unavoidable for better performance of the projects. That will help increase accountabilities, the use of professional tools, monitoring and evaluation of project as well as conduction proper project performance review. EVMS is a systemic approach that integrates measurement of cost, schedule, and scope. It is easier to implement and monitor the project status and performance to determine the trend of variation between the original planned budget and the actual budget with the proper use of EVMS. The EVMS can be used to forecast time and cost estimates at completion at any stage of construction project especially during erections. This will bring light or early warning signals to the project managers and influence them to take appropriate corrective actions.

Recommendations: On the basis of these findings, the following recommendations are made:

There is a need of the intervention of academics, researchers, and major stakeholders from the construction industries to conduct scientific studies on other factors which constrain or enhance the success of project management in public and private sectors. Also, a study on the level of project management performance between foreign and domestic firms should be conducted. These empirical studies will provide a clear picture to all stakeholders, clients, designers, contractors, users, financers, and donors on how to mitigate or reduce project failures.

There is a need of institutionalizing effective project management practice and make proper use of Earned Value Management System in construction industry in Zanzibar. Ministries, Departments and Agencies dealing with construction projects in Zanzibar should establish proper departments or units for construction projects/programs managements. This will help to provide substantive professional project management

for the national and state construction project planning, execution, monitoring and control, and closeout.

The construction industry of Zanzibar operates with inadequate construction project management standards and regulations. It is proposed that the Government of Zanzibar should develop or adopt appropriate standard tools and regulations for the planning, designing, and management of the construction project. This will provide the limits, guidelines, consistency, and unified approaches in construction project management and provide proper coordination of project scope, schedule and cost objectives. There is a need for construction project practitioners such as engineers, architects, quantity surveyors and related professionals in Zanzibar to be trained on the use of EVMS. This should go in hand with continuous professional development seminars and trainings for both key private and government construction project stakeholders. This will enhance skills, knowledge, competence, honesty, accountability, self-regulation, and overcome construction project management challenges.

The study shows that there is a problem of delays and cost overruns during project implementation which partly are attributed by scope of design changes. The researcher recommends that during development of project ideas, all key stakeholders from all levels of decision making (political, senior staff, professionals, and public) should be involved to at appropriate project planning stages to address all needs of the specific target groups. This will minimize the risk of expensive changes during project execution, delay, reworks, cost overruns, schedule overruns, and project failures.

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