CHAPTER 3

EARNED VALUE MANAGEMENT FRAMEWORK

3.1 Introduction

This chapter presents a basic Framework of EVM method. It is derived by understanding the theory of project management and by reviewing EVM Standards as developed by American National Standard Institute (ANSI), Project Management Institute (PMI) and Standards Australia (SA). The elements of this Framework interact with each other to form an integrated EVM System for the performance measurement of projects. This Framework is not intended to encompass all, but it provides a basic understanding about the processes of EVM method.

3.2 Elements of EVM Framework

A basic Framework of Earned Value Management (EVM) is shown in Figure 3.1. It comprises of four fundamental elements as mentioned below;

- Organizational policy
- Planning
- Measurement, analysis and reporting
- Management performance review

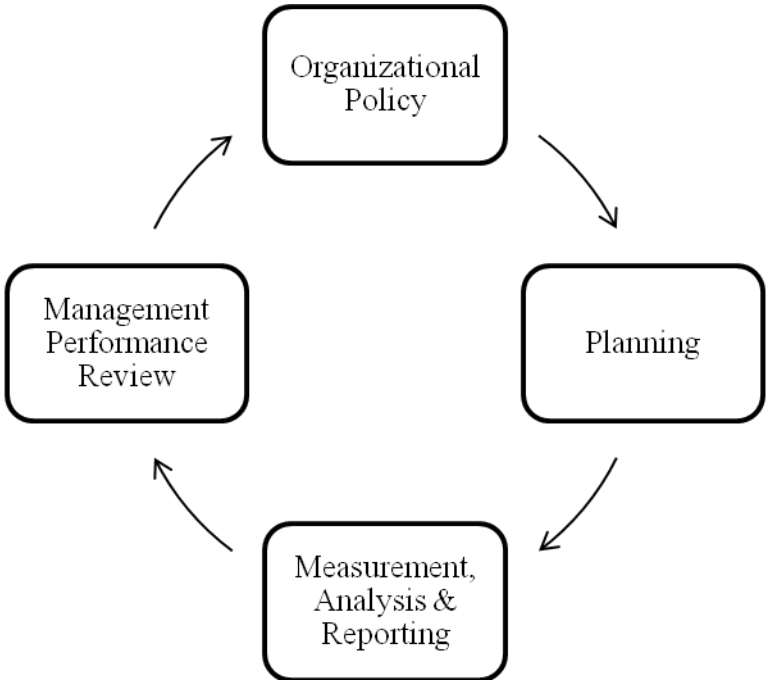

Figure 3.1: Process Flow of EVM Framework.

3.2.1 Organizational Policy

Top management commitment is indispensable for the adoption and implementation of a well structured EVM System. This will require an organizational policy that set forth the ground rules to support the system. Essentially, without it, the best laid plans are often doomed for failure.

An organizational EVM policy should consider the following requirements, but are not limited to these [57];

- It must set up criteria to prioritize the projects for which EVM System applies.
- It must provide sufficient information regarding organizational process and procedures in order to plan and implement the EVM System.
- It must be consistent with the EVM Standards.
- It must provide guidelines for the training of project team members/staff in order to understand the principles of EVM and its practical usage in project management.

- It must be equipped with an effective and efficient data collection, reporting and analysis system.
- It must be communicated to all stakeholders involved in planning, implementation and use of EVM System.

3.2.2 Planning

Planning of EVM System is a core process after setting up an organizational policy. It provides a basis for a precise estimation of project progress [58]. It consists of all the processes with specific requirements that are essential for the implementation of an EVM System and are aligned with the EVM Standards. These are as follows;

3.2.2.1 Define and Decomposing the Project Scope

The planning process starts with the definition of project scope. It is defined as the work that needs to be accomplished to deliver a product, services or results with the specified features and functions [10]. The project scope is then decomposed into discrete elements or work tasks by using work breakdown structure (WBS) tool. WBS helps and organizes the project scope to a lowest level i.e. work package levels where cost and schedule development, estimation and control can be managed [59]. A typical level 4 WBS format is shown in Figure 3.2.

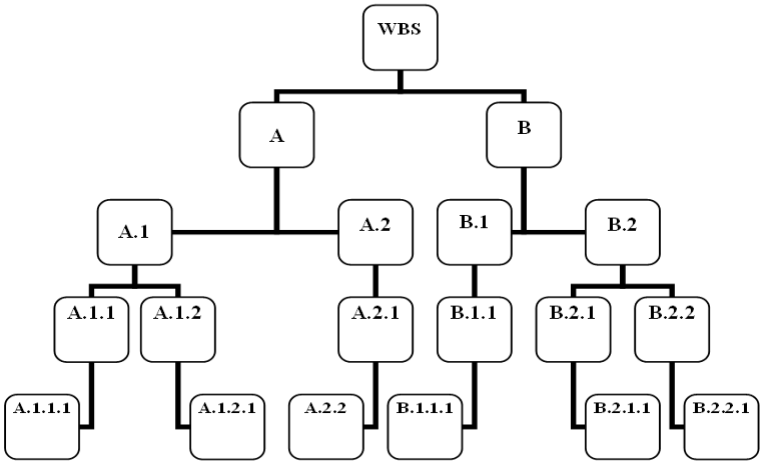

Figure 3.2: Schematic of Work Breakdown Structure.

3.2.2.2 Assign Responsibility

Roles and responsibilities for the execution of various work package activities need to be defined and assigned accordingly to the project team. This process can be achieved by the use of Responsibility Assignment Matrix (RAM). It describes the association between the work package activities and the project team [60]. RAM is also known as RACI matrix and it is derived from the four key responsibilities most typically used;

i. R: Responsible

ii. A: Accountable

iii. C: Consulted

iv. I: Informed

Table 3.1 illustrates an example of RACI matrix. Left hand column shows the work package activities as a deliverable and the top horizontal axis represents the assigned roles and responsibilities to each individual member of the project team.

Table 3.1: RACI Chart

RACI CHART				
Activity	**Project Team Member**			
	X	***Y***	***Z***	***Z_1***
Design	R	C	A	I
Review	C	R	I	A
Approve	I	A	R	C
Execute	A	I	C	R

3.2.2.3 Schedule Project Work

A project schedule consists of work package activities with planned start and finish dates. As stated earlier, work package activities are the lowest level activities in a

work break down structure, which can not be further subdivided. Each of these activities is then estimated in terms of resource requirement and time. Project schedule describe the sequence of work and identify all interdependencies required to deliver the project scope [61].

3.2.2.4 Develop Time-Phased Budget

Project schedule integrates the scope, time and cost for the work package activities and results in a time-phased budget. This is also known as Performance Measurement Baseline (PMB) as shown in Figure 3.3. PMB is developed as a summation of the approved budgets by time and is typically displayed in the form of S – curve [62].

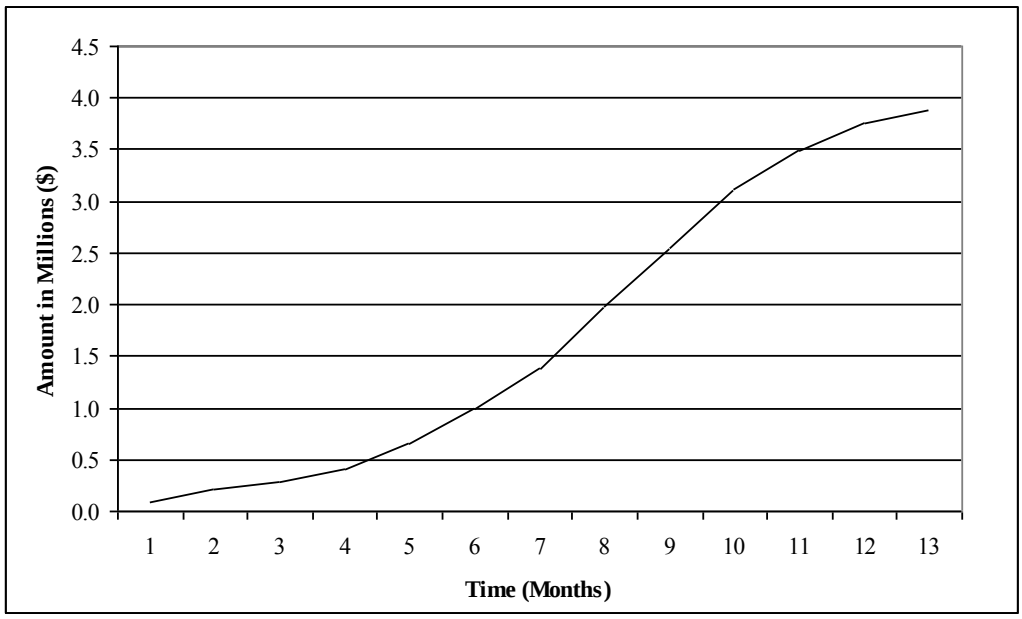

Figure 3.3: Performance Measurement Baseline as S-Curve.

3.2.2.5 Select and Apply the Earned Value Technique (EVT)

Earned Value Technique (EVT) is used for the performance measurement of work package activities. It is an objective measure of work performed. An appropriate EVT is applied for each work package to facilitate progress assessment. Table 3.2 shows some common EVT techniques based upon their measurement methods [46];

Table 3.2: Earned Value Measurement Techniques

Product of Work	**Duration of Work Effort**	
	1 – 2 Measurement Periods	> 2 Measurement Periods
Tangible	Fixed Formula	Weighted Milestone Percent Complete
Intangible	Apportioned Effort Level of Effort	

3.2.2.6 Set and Maintain the Performance Measurement Baseline (PMB)

PMB is considered as a plan against which the project performance is measured and compared with the stipulated performance level. It is therefore necessary that the PMB must be realistic and rational. Its sustainability must be ensured throughout the project life cycle as a standard stable baseline to measure the overall project progress [63]. However, PMB may be changed or updated as a result of unavoidable circumstances during the project cycle. The following are some of the reasons but not limited to these;

- Change of project scope
- Time delays
- Cost overruns
- Residual risks

3.2.3 Measurement, Analysis and Reporting

This is an essential element of the EVM Framework and ensures that the system is implemented as planned. This process requires a prime concern in order to measure the physical progress of work in an accurate and precise manner. For this function,

an expert judgement is required to select an appropriate EVT [64]. The pre-defined earned value crediting techniques of the planning phase is now used to determine the physical progress in an objective manner. During the measurement process, Planned Value (PV), Actual Cost (AC), and Earned Value (EV) of the work package activities are periodically tracked to observe the validity of PMB. In addition to the PV, AC and EV, there are other indices and forecasting parameters that require truthful interpretation. Table 3.3 shows a list of these parameters [65];

Table 3.3: EVA Parameters

S.NO.	Variances	Indices	Forecast
1	Schedule Variance (SV)	Schedule Performance Index (SPI)	Time Estimate at Completion (EAC_t)
2	Cost Variance (CV)	Cost Performance Index (CPI)	Cost Estimate at Completion (EAC_c)
3	Variance at-Completion (VAC)	To Completion Performance Index (TCPI)	Estimate to Complete (ETC)

3.2.4 Management Performance Review

Management review is an important and a final element of EVM Framework. It must be done at specified intervals to review the EVM performance measures for answering the management questions. Management performance review of EVM System may include but not limited to these:

- Objectives and targets
- Timelines for project deliverables
- Schedule analysis
- Cost analysis
- Project performance analysis
- Risk related issues
- Identification and remedial measures for problematic areas
- Corrective/preventive measures

It is anticipated that after the management review, the PMB will be revised or updated to replicate the outcome of the review process. By doing this, the integrity of PMB is maintained as a standard baseline for future performance evaluations.

3.3 Summary

This chapter has presented EVM Framework for time and cost performance measurements of construction projects. The Framework is derived by reviewing the theory of project management and EVM Standards as currently available. It is comprised of four fundamental elements i.e. organizational policy; planning; measurement, analysis and reporting; and management performance review. This Framework defines a general implementation approach of an EVM System. It has outlined basic process and procedures to carry out an effective Earned Value Analysis (EVA). It also supports the project practitioners to streamline their current practices with the EVM performance assessment method in order to extend the scope of their monitoring practices.