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APPLICATION OF EARN VALUE IN CONSTRUCTION PROJECT MANAGEMENT

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Abstract - Adaptation and understanding the importance of advance methodology with new technology instead of using traditional methods in practice and putting effort for its application at project are the major concern companies are facing today in implementation of EVM. The research presents the result of the questionnaires survey conducted to identify and evaluate the relative importance of the significant factors contributing to increase in cost & effort in implementation of EVM of Construction Projects. Implementation of EVM on Construction projects are getting affected by different stages of activities required for project management. The factors that causes increase in cost & effort needs to be identified. The project and people surveyed in this study were involved in management of 30 different projects such as Highways schemes, High Speed Railway, Hospital, Residential & Commercial Building Solar Power sectors. In this research the project team members i.e. owner, contractor, consultant, Engineers etc. are taken for questionnaire survey to obtain the factors and research to identify the main causes and effects which increases the cost & effort of implementing EVM on construction projects. The responses and comments against each factors identified brings us to the result suggesting the area of need to be emphasised from for adaptation of EVM from inception to completion of a construction project.

***Key Words*:** Project management, Cost efficient, Survey, Relative important index (RII), Importance index (IMPI)

1.INTRODUCTION

The idea behind the Earned Value Management method is to continuously measure the actual deliverables achieved in the project and compare them with the planned progress. Thus, a pre-requisite for the application of the method is that a suitable set of deliverables can be defined and met during the project lifetime. Besides the deliverables a project baseline including the planned schedule/duration and budget is needed. During project execution the amount of completed deliverables at any specific time can be compared to the original plan, and the result be used to compile an assessment of the project status in terms of cost and schedule effectiveness. Extrapolating these values can be used to compile forecasts of the total project duration and final cost.

EVM approach and experience from real projects has been considered as the root for working through this thesis & research. Explaining the origins and history of the technique is followed by a review of the currently available sources such as EVM literature, books and journals. Ease of acceptance project management and current status of application of EVM is outlined. Earned value management methodology is described in detail, including the EVM measures, fixing the baseline cost & schedule, assessment of work in progress, and the estimation of both the final cost at completion and the project's estimated end date. A further discussion addresses the EVM schedule reporting issues, and new approach for assessing project progress to ease of its implementation at construction projects without increasing the associated cost.

This generates requirement of a more precise way to track project performance and improvement in forecasting, all at different the sub-project level. Tools and techniques that can give an improved status of the cost and time situation without adding too much overhead requirement. It was therefore interesting to make an investigation on possible tools and techniques to achieve this, and specifically the possibility to implement the Earned Value Method, which had been covered in the course curriculum.

One key exception was in the area of project performance evaluation and control. I recognised that earned value management (EVM) is one of the few management techniques that are unique to project.

For a large cooperation and large projects, it is possible to prevent this by appointing specialists to continuously review the project portfolio, but for a small organisation that kind of resources are not available.

It would be beneficial if performance could be measured continuously during projects at pre-defined intervals. This would facilitate the possibility to find possible overruns and schedule slippages as well as unintended scope changes at an early stage. This must however be done in such a way that it does not demand significantly increased workload for the project managers.

OBJECTIVE

- To study the Factors affecting implementation of EVM.
- To identify the key factors affecting and increasing on the cost & effort.
- To identify the approaches for solving the problems and making easy to implement.

LITERATURE REVIEW

The Earned Value Method was invented in the USA in the early 1960's to keep track of Client funded defence projects. The reason was that large overruns were seen in some projects and a method to judge the performance was needed. Usage of improved planning techniques had already been established, both the basic Gantt chart and the more advanced network planning methods CPM (Critical Path Method) and PERT (Program Evaluation and Review Technique).

An increased demand for the ability to track not only the schedule but also the budget performance of projects caused the PERT method to be further developed into PERT/COST. This was later extended to also take the value of the work delivered into account, the Earned Value. This was called Cost/Schedule Performance Control Specification (C/SPCS). The US Department of Defence required its contractors to use the method, but it was considered difficult to implement and inflexible by many. Over time the method evolved into EVM

and was more widely adopted, also outside the defence industry. The availability of computers has probably played a large role in this, since the effort of calculating and compiling data became more manageable when more computing power became readily available.

Earned Value Management is now required by a few US Cliental agencies. The method has been standardized in the USA as ANSI EIA 748-A and as AS 4817-2003 and AS 4817-2006 in Australia. For example, NASA requires an ANSI/EIA-748 compliant Earned Value Management System (EVMS) for all contracts exceeding $20 million. (NASA, 2013)

Earned Value Management was included in the PMBOK Project Management Body of Knowledge in 1987 (PMI, 1987), and has been improved in later editions (PMI, 1996), (PMI, 2000), (PMI, 2004), (PMI, 2009) and (PMI, 2013). It is now used in many areas.

The study done by Proaño-Narváez, M.; Flores-Vázquez, C.; Vásquez Quiroz, P.; Avila-Calle, M. Earned Value Method (EVM) for Construction Projects: Current Application and Future Projections. Buildings 2022, I was analysed that the main beneficiaries of the implementation of EVM are project managers, who improve their administrative management; there are other beneficiaries, such as project promoters, who obtain better financial or economic performance due to the suitable and strategic decisions made by the project manager. Finally, another beneficiary is the end-user who uses the product and benefits from a space that is adapted to his or her needs, is of good quality, is delivered at a reasonable cost, and provides satisfaction and security.

According to the study by Sunarti et al. [15], 52% of respondents implemented EVM in their projects; of these, 6% used it for small projects, 28% used it for significant and critical tasks, and 18% used EVM as an organization-wide standard for all types of project control. Conversely, 48% of the respondents did not implement EVM in their projects, perhaps using other tools, such as the S-curve of the Gantt chart, that involve less manipulation of information but do not return informative representative data or alerts that trigger mitigation or prevention.

The analyses in the studies conducted by Doloi et al. [3] and Olatunji [4]showed that variances in time and costs are a common factor in both developed and developing countries. To cite some cases, in India, in a sample of 290 projects, there was an average cost increase of 73%. In addition, about 40% of the projects reported deficiencies in their performance. In Nigeria, 55% of 137 projects had cost overruns ranging from 5% to 808% over the original cost estimate. In Colombia, more than 50% of projects ended up with cost overruns, and more than 80% ended up with delays of between 30 and 80 days [2]. In developed countries such as the United Kingdom, which have multiple techniques and advanced software for project control, it has been noted that many projects, despite having these tools, still do not meet expectations in terms of time and cost [5].

A study by Memon and Rahman [6] highlighted that among the factors that trigger variances in project costs are: the contractor's inadequate administrative management in terms of work supervision, delays in the schedule, inadequate planning of activities and timetables, lack of knowledge on time and cost estimation, and an incorrect definition of the project scope. G Dhamodaran, K. R. Divakar Roy in January 2019 provided technique of Ratio of Value of Work Done to the estimated value at completion for a Construction project using Earned Value Method (EVA).

The closest study is the survey analysis undertaken by Duran (2016) which examined the performance measurement in projects and control efforts in general. While he listed utilities and disadvantages of EVM implementation, the authors conduct a more in-depth analysis of EVM practices. The authors examine both the awareness and implementation in the project-based firms. The authors investigate the frequency of use as well and integrate several factors to analyse the implementation. In addition, in cases of low frequency of use, the authors inquire the underlying reasons.

Morad and El-Sayegh (2016) shown research on the EVM usage and the factors for successful EVM implementation in the United Arab Emirates' construction industry. They identified the level of acceptance among project managers, communication among project team members and support from top management as the most important factors. They also noted that although the majority of the companies confirm the necessity of EVM implementation, many of them do not apply the methodology in practice.

Survey conducted with construction project managers in Malaysia brought similar results. Based on the interview results, Abdul-Rahman et al. (2011) concluded that although EVM offers benefits and there are initiatives to increase its use, it has not been widely used in Malaysian construction industry. Kim et al.'s [16] study investigated the acceptance of EVM application by managers and directors of construction projects registered in the PMI at the international level in private and public sectors. They found that 82% of respondents accepted the implementation of EVM, 52% of which corresponded to the public sector. Most of them considered that EVM applies to large and small projects.

The study conducted by Teixeira et al. [19] suggested measures to overcome the barriers to the implementation of EVM: the training of those involved in the project, the definition of work procedures, and the use of software for data recording. Similarly, Kim and Reinschmidt [20] indicated that for the application of the method to be effective, it is necessary to have discipline in collecting data and managing information in terms of costs and duration. However, this implies an added operating expense to the contracted amount, but this is compensated for by the resulting benefits. We can find techniques for obtaining the percentage of work progress [21].

In contrast with other authors, Nizam et al. [27] concluded that the use of EVM as a tool in project management is not useful, as there is a large gap between the efforts made to implement it and what is achieved. Conclusions suggest that its usefulness depends on the type of project and the conservative approach that project team members employ to determine the measurement baseline. It is used as a comparison to determine the cost and schedule variances, making it very sensitive to evaluation criteria.

The Earned Value Management method (EVM)

To be able to implement the Earned Value method the project needs to have a defined baseline. The three factors that must be decided are:

What shall be done (scope)

When shall it be delivered (time schedule)

What is the cost limit (budget)

These three factors can be described by performing the steps 1-6 in the 10-step model.

Scope

The contents of the project shall be defined. This can be done in different ways; a common practice is to arrange the Activities to be carried out into Work Packages.

All planned project work should be arranged in a way so that it can be "delivered" to the project as packages during the execution time. This means that large tasks my need to be split into sub-parts. A criterion for "completed" status must be agreed for all tasks.

Schedule

A fixed time schedule, containing at least the project start and finalization dates, must be decided. Also, the time-boxes for project evaluation should be decided already on project start, either as fixed duration points or as project milestones.

Project budget

The project must have a defined budget, and this budget must be possible to divide over the project schedule. In its simplest version the budget can be divided with equal portions for each time-box. In a more detailed project plan the resource plan may vary over the project execution cycle and this should then be reflected in the budget plan. An accurate reporting of the current budget spent (in currency and/or man-hours) must be available during the project execution and be possible to correlate to the time-boxes for project reporting.

When tasks are performed by sub-contractors the scope, schedule and budget is commonly determined by a contract.

Basic concepts

The basic factors for the project evaluation are:

Planned Value [PV or BCWS]: The planned budget consumption for the project up to the current date/time-box. (Step 6)

Actual Cost [AC or ACWP]: The budget consumed up to the current date. (Step 7)

Earned Value [EV or BCWP]: The value of all the completed tasks up to the current date. (Steps 8 & 9)

Budget At Completion [BAC]: The total budget for the project, until project end. (Step 6)

Estimate At Completion [EAC]: The estimated final cost for the project (Step 10)

In this report the dominations PV, AC and EV will be used throughout for clarity.

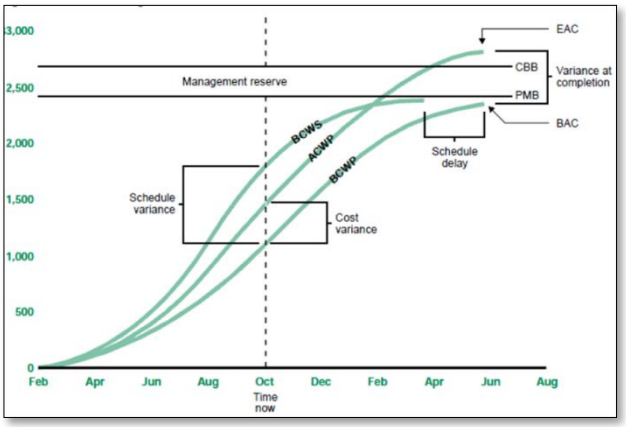


Figure 2.1: Graphical presentation of the concepts described

Variance from planned performance

By comparing the Earned Value to the Planned Value and to the Actual Cost a picture if the current project progress in relation to the plan can be achieved.

Schedule Variance [SVe]: The difference between the planned progress and the achieved progress.

SVe = EV-PV

If SVe is >0 the project is ahead of schedule, if SVe is < 0 it is behind schedule. (This variance is expressed in budget but can be converted to time by comparing it to the cost for man-hours and personnel availability.)

In the performance perspective: SVp= PV-EV. If SVp is >0 the project has achieved more than planned.

Cost Variance [CVe]: The difference between the Earned Value and the Actual Cost at the current date.

CVe = EV-AC

If CVe is > 0 the project is within budget

In the performance perspective: CVp= AC-EV. If SVp is >0 the project has spent more budget than planned to achieve the delivered parts.

Performance Indexes

The same data can also be expressed as performance indexes. These give an indication on the speed and efficiency of the project work and spending. If these indexes are relatively stable, they can also be used to compile forecasts on project duration and total costs.

Schedule Performance Index [SPI]: This index is used to get an idea of the actual speed in the project.

Efficiency perspective:

SPIe = EV/PV

If SPIe is > 1 the project work is proceeding faster than planned.

The work efficiency is higher than planned.

Performance perspective:

SPIp = PV/EV

If SPIp is < 1 the project work is proceeding faster than planned.

Estimated execution time = Duration * SPIp

Cost Performance Index [CPI]: This index describes the financial burn-rate in the project

Efficiency perspective:

CPIe=EV/AC

If CPIe is > 1 the project delivers its objectives at a lower cost than planned.

The cost efficiency is higher than planned.

Performance perspective:

CPIp=AC/EV

If CPIp is > 1 the project consumes its budget faster than planned, needing more funds than budgeted.

Estimated final cost = cost budget * CPIp

Forecasts

The performance factors can be used to compile an estimate of the final cost and time for completion for the project, thus enabling an early detection of schedule slip and accelerating costs. A forecast of this type is naturally true only if the environment remains the same as during the period the forecast is based on. Such factors as change of staffing and scope-creep can influence the performance and must be regarded. Research show that a cost trend established in about 20% of the project duration seldom improves (Antvik, 2013).

Using the performance factors above an estimate of the total project cost can be calculated as Estimate at Completion [EAC]: The total project cost if progress continues at the current speed.

EAC=BAC/ CPIe

A couple of alternative ways of calculating EAC exist (PMI, 2009) and (GAO, 2009):

Estimate At Completion (cumulative CPI):
This method uses the current SPI to calculate the progress, assuming that the cost performance is consistent over the project execution time.

EAC = BAC/ CPIe,cum

Estimate At Completion (SPI & CPI):
This method uses both the SPI and the CPI to calculate the progress. This can be used when the cost performance is negative, and the project needs to meet at firm schedule. It is also possible to weigh the impact of the two factors.

EAC = AC+ (BAC-EV)/(CPIe,cum * SPIe,cum)

Estimate At Completion (Budgeted rate):
This method uses the actual performance up to date but assumes that the rest of the project will have performance according to the original baseline. If the actual performance up to date has been less good than originally planned, this estimate may give a poor forecast.

EAC = AC + BAC -EV

Estimate To Complete [ETC]: This is the estimated cost for the remaining work in the project.

ETC = EAC-AC

The remaining effort
To-Complete Performance Index [TCPI]: The TCPI index describe the effort needed to finalise the project. It can be related to either the planned budget BAC or the revised budget EAC.
The effort needed to meet the original budget:

TCPI(BAC)= (BAC-EV)/(BAC-AC)

The effort needed to meet the revised budget:

TCPI(EAC)= (BAC-EV)/(EAC-AC)

A TCPI >1 means that the project needs to deliver more than planned, but on the same budget as planned for the rest of the planned schedule.

2 METHODOLOGY

General
The process starts with survey, keeping in view and raising with the project managers questionnaires to identify and recommend problem areas and concerns in adaptability of EVM on projects. Then the inputs were used to develop a survey basis of calculation which contains identification of 10 Cost segment grouped into 47 Cost Heads (see Appendix A for a Complete Breakout of Cost segment and Cost Heads).
The survey asked each respondent to provide comments to support any Cost segment to identify the responsible department from project initiation level. Once finalized, the survey was distributed to 50 project managers and engineers (see Appendix D). After completing the survey, the preliminary results were derived by discussion with EVM experts to analyse those results and developing the recommendations.

Figure 3.1 Methodology Steps

DATA Collection
This research is approached mainly in two ways; inductive and deductive. The inductive approach aligns with qualitative techniques while deductive approach aligns with quantitative methods.
Analysis of Data obtained from the survey is carried out. Frequency counts and percentages are used to analyse the respondents' demographic characteristics, and the mean and standard deviation is being used to analyse the distribution of the average opinion of respondents.
Measurement Of Variables
Data on the respondent's views and opinions about EVM obtained using scaled variables from a self-developed questionnaire.
A four-point Likert scale of a= Significant, b= Moderate, c= Neutral and d= Low Impact is used to collect respondents' experience and opinions regarding the proposed factors.

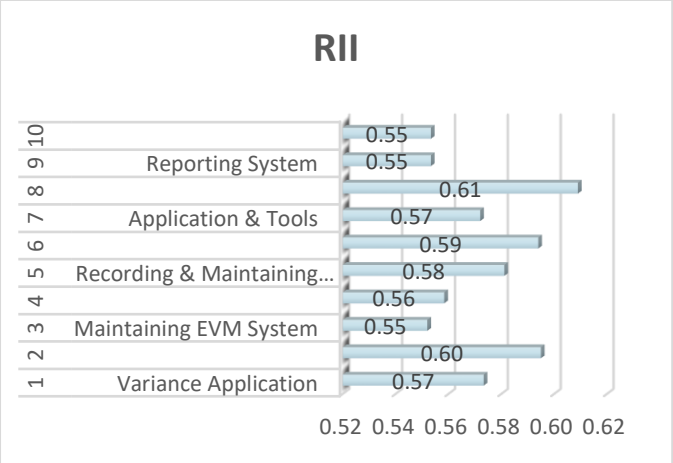
3 RESULS

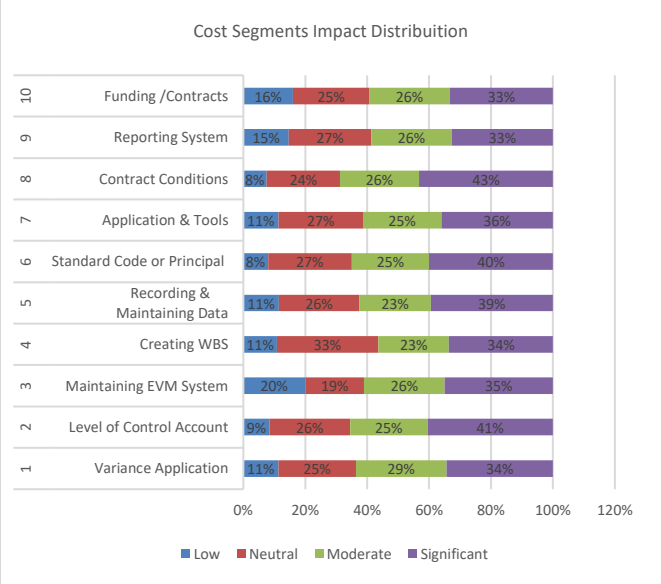
Following are the final observation for Cost effective EVM Implementation described below:

1. The Control Account level (size and number) significantly impacts
When the survey results is reviewed as per the responses of Significant and Moderate impacts and associated comments it helped in identifying multiple linkages between Cost segments.

1) Once the mean was established, a Significant-Moderate Cost Index (SMI) for each Cost segment was generated by dividing the mean of all Cost Head Basic Indices by mean of Cost segment Basic Index.

In this way normalization of the data is done in order to understand how Impacts for Cost segment were relevant to each other.





Observation

A contract execution plan is prepared ignoring careful consideration while establishing the level of Control Accounts this can result in additional effort and cost for planning, analysing, and reporting. The planning should be done considering :

• Control Account must be planned at level identified as important- Set it at much High level so that minimum funding related issues raise.

• Reporting system should not contain the excess number of Control Accounts (CA) as it increases the overhead expenses, since CA is the level at which Project management information documents, Compensation Events Analysis Reports, Estimate to Complete (ETC/EAC), analysis and other activities are being done.

• Project planning should be done uniquely as per project/client's specific requirements

• Current requirements result in significant number of VARs - VAR thresholds are too low for significant analysis.

Based on comments following observations point out the key area:

• The cost is interrelated to the Level of detail applied.

• Project information and variation from Standard Work Breakdown Structure (SWBS) works as driver of project costs, reporting necessities, and reduces the effectiveness of program management.

• Details provided by clients for reporting requirements are sometimes measure as being non-valuable

• Discrepancies between information documents like RFP, Contract Data Requirements List, proposal cause inefficient process of reporting and management.

• Other related issues include Contract BOQ Items and Variance Analysis Reports (VARs), and adherence to and tailoring of guild lines.

The study made the following comments and observations on Control Account level impacting cost:

Reporting level of detail could have a significant impact on the planning infrastructure for the performance measurement baseline.

Level of Control Accounts impacts the span of control discussion.

• The clients WBS reporting level could be unduly influence the requirements of control, rather than providing some degrees of freedom for contractors to establish Control Accounts at the optimal, risk-adjusted level in accordance with their EVMS.

• Companies can use BOQ Item coding or other reporting mechanisms to collect head wise costs. The low level of Control Accounts may be driven by specific client reporting requirement(s), which otherwise could be achieved with the flexible use of a charge number structure. Accounting system data (actual cost) is easy to obtain in comparison to preparing EVM data for budgeted cost of work planned, budgeted cost of work performed, and actual cost of work performed, and a Control Account may not need to be established to collect accounts data. However, actual cost data alone may not always satisfy some clients reporting requirements if there is a requirement to provide all data associated with a Control Account (e.g., Estimate at Complete, etc.).

• If the WBS is Set at the appropriate reporting level, it can lead to more efficient way of executing the program. Contracts programs with higher level WBS (2, 3, or 4) may result in better accuracy and quicker turn-around times in parametric cost-estimating (because they do not rely on physical progress of project).

• For a Major risk end item WBS of level 6 reporting might be appropriate, where a uniform level of reporting in WBS level 6 can cause cost with no added benefit.

• Careful consideration shall be given while deciding the level of detail of management by reviewing insight and reporting needed for specific project and the impacts of the levied requirements. Where while preparing an RFP, the program office sometimes cuts and pastes a previous RFP instead of managers need to understand the linkages between WBS set-up and span of control in project management.

• Lower levels of reporting increase cost in planning infrastructure, but may help management identify risks and problems early, significantly decreasing program execution costs.

4. CONCLUSIONS

It is very necessary to create proper balance between needs of management information and reporting requirements for affordability. The following conclusion can be drawn out form this study:

Prepare WBS, Control Accounts and Reporting Levels in line with the contract type, Project scope, associated risk and value is recommended

Drafting of contract is done by the client PM sets the milestone by defining a work breakdown structure and writing contract requirements. Main Contractors also issues subcontracts in similar way. The contractor refers the framework defined in the contract document along with its EVMS control points to establish Control Accounts, Items of work, code numbers, and its entire planning and management infrastructure. Resources assigned before executing project have comprehensive implications to the in the EVMS and the scheduled submitted to client.

Pre-contract evaluation and discussion is necessary to optimize sources of data for reporting. For competitive procurements, this would take place at the Pre-bid meetings, or during any formal communications. For closed ended contracts it would take place during negotiations. The pre-contract coordination optimize the reporting structure for management, data collection and oversight without requirement of including it into the WBS.

Discussion with the stakeholder at pre- and post-award decision points could ensure:

1) the risk of the projects are aligned with the project management structure.

2) all client data reporting needs are being met

Create a project oriented WBS and without replication of activities or other reporting needs is recommended

Different department in the contract and financial management teams sometimes checks to the project activities structures to meet the reporting needs, and sometimes go so far as to embed all level activities in the WBS. In order to segregate subcontract development costs by individual activities project control groups, cost estimators, audit teams, and other functional stakeholders will sometimes require reporting by activities breakdown.

The activities breakdown can impact the size and number of Control Accounts, because the activities breakdown structure can act as a multiplier to the WBS and subsequently to the number of Control Accounts. The added activities dependencies adds costs to planning, managing and reporting through the life of the program.

Contractors should ensure that they do not unnecessarily create separate control accounts for traceability for internal management control and summarizing cost.

The Contractor Work Breakdown Structure is the contractor's own requirement for extension of the WBS to lower levels. It includes all the elements for the activities and material management that are the responsibility of the contractor.

The lowest CWBS element in itself may not necessarily be a Control Account. A control account is a management control point at which budgets and actual costs are accumulated and compared to earned value for management control purposes.

The preparation of the RFP should have been done by trained personnel having adequate information regarding the impact of requesting a specific level of reporting, as those decisions could unintentionally drive the increase in number of control accounts.

Include EVM expertise in RFP and Proposal Review panels and processes is necessary

Codifying important points of communication between client and contractors, financial managers and system engineers, acquisition professionals, and program managers is critical to Better EVM Implementation. It is imperative that each participant in the acquisition process understand the down-stream impacts that their decisions can have on the overall acquisition process.

Periodic evaluation of required reporting level & management structure

It is important to perform periodic management structure evaluation for which can be updated as per the project progress and addition of new experience from past project. Reporting levels need to be periodically modified to optimize the effort requirements and levels commensurate with program execution risk.

It was observed that there is insufficient motivation/direction/precedent for scaling back the EVM reporting requirements (CWBS Level(s), formats, managerial analysis, etc.) and the associated EVMS infrastructure. The current system need to make easy and acceptable for project managers in level of reporting over time.

Form the survey feedback it can be assessed that the current the ability to vary the reporting level over the contract lifecycle phases may enhance affordability following the recommendation.

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APPENDIX – A Distribution % Impact of Cost Segments & Cost Heads

Sl. No.	Cost Segments	Cost Heads	Low	Neutral	Moderate	Significant
1	Variance Application		**11 %**	**25 %**	**29%**	**34%**
1.1		Variance at too Low level of the WBS	12 %	26%	28%	34%
1.2		Identification of Meaningful Thresholds	0%	30%	32%	38%
1.3		Frequency of EVM Analysis Reporting	14 %	20%	36%	30%
1.4		Times of Approvals for Submission of the Variance	14 %	20%	28%	38%
1.5		Finding Corrective measures	2%	32%	28%	38%
1.6		Monitoring application of Corrective Measures	26 %	22%	24%	28%
2	Level of Control Account		**9%**	**26 %**	**25%**	**41%**
2.1		Stage/Milestone Plan	0%	28%	26%	46%
2.2		Analyse as per funding	12 %	26%	28%	34%
2.3		Variance calculation at too Low level of the WBS	20 %	22%	18%	40%
2.4		Volume of Corrective Actions	2%	28%	28%	42%
3	Maintaining EVM System		**20 %**	**19 %**	**26%**	**35%**
3.1		Compliance Forms	18 %	16%	30%	36%
3.2		Result Recording & Application Process	22 %	22%	22%	34%
4	Creating WBS		**11 %**	**33 %**	**23%**	**34%**
4.1		Breakdown of activity Level	6%	32%	28%	34%
4.2		Activities Repetition	6%	36%	26%	32%
4.3		Construction linked activities	22 %	28%	12%	38%
4.4		Non-Conformance with actual required	18 %	34%	18%	30%
4.5		Project specific requirement	2%	34%	30%	34%
5	Recording & Maintaining Data		**11 %**	**26 %**	**23%**	**39%**
5.1		Project physical progress	30 %	14%	26%	30%
5.2		Purchase/Procurement records	0%	46%	18%	36%
5.3		EAC/CEAC	2%	20%	22%	56%
5.4		Frequency of reporting	0%	30%	26%	44%
5.5		Level of details	16 %	22%	28%	34%
5.6		Accounting Reconciliation	16 %	20%	24%	40%
5.7		Overly Prescriptive	16 %	30%	18%	36%
6	Standard Code or Principal		**8%**	**27 %**	**25%**	**40%**
6.1		Lack of information in contract documents	24 %	24%	22%	30%
6.2		Subcontractor Invoice Integration	0%	30%	30%	40%
6.3		Lack of knowledge or experience of responsible	2%	34%	20%	44%
6.4		Buffer assumption in Scheduling	2%	20%	22%	56%
6.5		Differing opinion of Reviewers	20 %	26%	18%	36%
6.6		Ignorance of Significance of Issues	0%	28%	38%	34%
7	Application & Tools		**11 %**	**27 %**	**25%**	**36%**
7.1		Outdated Tools used for EVM	14 %	26%	24%	36%
7.2		Time & Cost Schedule Integration	18 %	24%	28%	30%
7.3		Subcontract Integration in tools	2%	32%	24%	42%
8	Contract Conditions		**8%**	**24 %**	**26%**	**43%**
8.1		Fixing the Baseline Change/Maintenance	8%	20%	20%	52%
8.2		Time allowed to fix the Baseline	0%	24%	36%	40%
8.3		Modification to stages of Contract Funding	20 %	14%	28%	38%
8.4		Funding Forecast-based Baseline in place of Budget req.	6%	24%	22%	48%
8.5		Variable Scope of work	10 %	24%	18%	48%
8.6		Level of Control Stages /Account	0%	24%	22%	54%
8.7		Delay in Contract finalisation	16 %	30%	20%	34%
8.8		Quantum of Change in scope	0%	30%	38%	32%
9	Reportin		**15**	**27**	**26%**	**33%**

	g System		**%**	**%**		
9.1		Modification to keep short	22 %	24%	26%	28%
9.2		Additional requirements Beyond scope	0%	24%	34%	42%
9.3		Preliminary project Reports	22 %	32%	18%	28%
10	Funding /Contracts		**16 %**	**25 %**	**26%**	**33%**
10.1		Modification to payment stages/funding	26 %	24%	20%	30%
10.2		Construction linked funding	22 %	18%	30%	30%
10.3		Force measure	0%	32%	28%	40%
Total =			**11.96%**	**25.82%**	**25.41%**	**36.81%**