



Kinapse White Paper

Earned Value Management, an approach for effectively managing pipeline value

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Kinapse Consulting, 2009

Simple numeric targets run counter to a value creation approach

A traditional planning and budgeting process has an annual cycle that involves the preparation, negotiation, approval, and monitoring of detailed plans and budgets by department, business unit, division, and group - all consolidated into the 'master plan and budget' for the year ahead. The targets that are agreed become commitments between different organizational levels and are treated as 'fixed performance contracts' against which managers' performance is evaluated and incentive bonuses often paid. Actual performance is controlled throughout the year with reports that analyse variances against plan. Pressured by fixed targets and performance incentives, managers focus on making the numbers instead of making a difference, meeting set goals instead of maximizing potential. In pharmaceutical R&D, managing performance by the numbers can be associated with phenomenon such as the "Year End Proof of Concept effect" i.e. in some companies, Research eager to achieve its fixed target of handed-over proof-of-concepts to Development may push a molecule through to the next stage gate in spite of lack of substantial pre-clinical efficacy data. When the "managing by the number" system is as pervasive in organisations as it is today, it influences the behaviour of managers and employees in a way that is counter productive to strategic management.

Companies need to demonstrate and track the value they generate

In many cases analysts place little value on the development pipeline and almost nothing on earlier

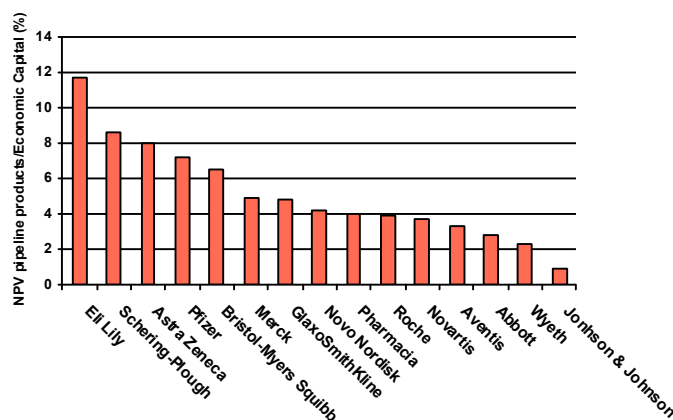


Figure 1: NPV Pipeline Products/Economic Capital (2002) (%)¹
Economic Capital is defined as total assets less non-operating assets, less non-interests bearing liabilities plus economic adjustments

projects; ca. 10% of a pharmaceutical company's value resides in its pipeline (although, this percentage would go up for Biotechnologies or other R&D heavy companies). Demonstrating the value of R&D has been lost in detail, in fragmented information and in surrogate measures. Today's organisations and processes hinder our ability to maximize value from our asset base. Pharmaceutical companies have done much to improve the planning and execution of development programmes, yet little in the way of value management has been incorporated at this level. Life Sciences R&D organisations need a unifying measure and objective that recognises the different businesses along their R&D pipeline.

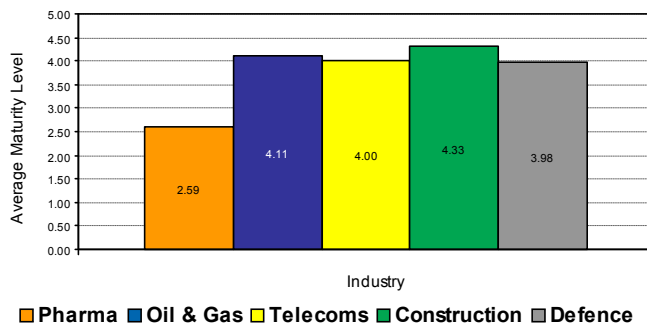
Value creation measures an organisation's ability to add value to a project. Put simply, value creation is the difference between the output price and input price of an activity less the incremental costs of that activity. Each activity in the R&D value chain should add expected value to an asset or else cause its termination. One of the objectives of project portfolio management is to maximise the portfolio value which includes identifying the value drivers of each project, focusing on key drivers, tracking progress of projects and the portfolio against value targets. By measuring project progress in an objective manner, Earned Value Management (EVM) provides an effective framework for tracking project and portfolio value over time.

Earned Value tracks progress against plan in a single indicator

Traditional cost analysis focuses on the actual cost of the work that was completed. Much progress has been made to collect the actual costs through the time charge and accounting systems that exist on practically all projects. What Earned Value brings is a measure of the amount of work that has been done in a unit of measure that is consistent and comparable with costs. In other words, it allows the comparison of “apples and apples” by using the same unit of measure for progress as for cost.

EVM began in High Tech industries (Defence, Aerospace & Engineering) in the 1970s and is now the accepted basis of project management in these industries. EVM is a project management technique used for measuring project progress in an objective manner. It combines measurements of technical performance (i.e. accomplishment of planned work), schedule performance (i.e. behind/ahead of schedule), and cost performance (i.e. under/over budget) within a single integrated methodology. When properly applied, EVM provides an early warning of performance problems and answers the question **“What did we get for the money we spent?”**

As shown in Figure 2, pharmaceutical R&D's Portfolio, Project and Resource Management (PPRM) capability lags behind that of other R&D intensive and technologically-advanced industries.



In spring 2008, Kinapse conducted a survey to help Life Sciences R&D organisations to evaluate and compare their PPRM maturity against that of their peers³. The survey indicates that performance management aspects of PPRM appear not to be managed as critical elements of Life Sciences R&D organisations' PPRM strategy. Little in the way of value management has been incorporated at this level.

Figure 2: The maturity of project management in different industries²

How is the US Government managing value?

Department of Defense (DoD) contractors are required to establish and maintain earned value management under the ANSI-EIA-748-98 Standard⁴.

In 1965, the U.S. Air Force acquisition managers defined 35 criteria which they felt would capture the essence of Earned Value Management (EVM), and also satisfy their need to oversee the work that was being performed for them by private industry. Two years later, the Department of Defense (DoD) adopted these same criteria as their Cost/Schedule Control Systems Criteria (C/SCSC). These 35 standards were then consistently applied to all cost type and incentive type contracts for the next three decades.

Then in 1996, after a rewrite of the 35 C/SCSC criteria by private industry, the DoD accepted the rewriting/rewording of these criteria under a new title called the Earned Value Management System (EVMS). The total number of criteria was reduced to 32. The 32 criteria of the Earned Value standard are based on the principles of sound enterprise management. These criteria cover the process categories, project organisation, planning, updating, evaluating, forecasting and baseline control required to effectively use earned value measures.

In June 1998, private industry in the form of the National Defense Industrial Association (NDIA) took the defined criteria concept one step further and obtained acceptance of the EVMS in the form of the American National Standards Institute, termed the ANSI/EIA-748 Standard, which was adopted the same year by DoD. Currently, DoD and NASA requires EVM on cost or incentive contracts, subcontracts, and other agreements greater than \$20 M.

EVM provides the insight Management needs to take effective project decisions

Companies manage shareholder expectation by providing guidance on future performance, and it is against shareholder expectation that company performance is measured. The objective of corporate strategy is to deliver value to shareholders by prioritizing projects against strategic objectives, and it is portfolio management that implements corporate strategy to meet shareholder expectations. However, portfolio management also helps to develop corporate strategy, and as such plays a pivotal role in providing guidance on future company performance.

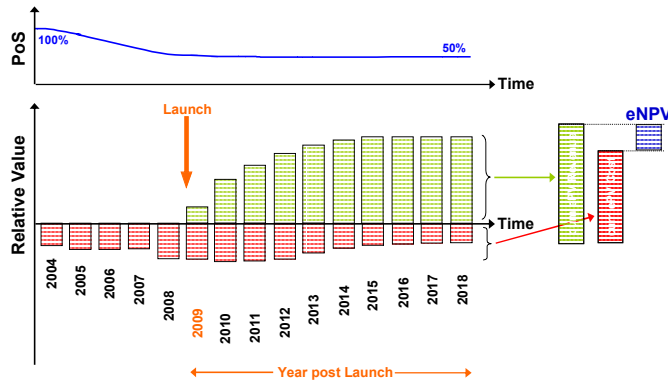


Figure 3: Project eNPV

PoS = Probability of Success ePV = Expected Present Values

Most companies use the traditional expected net present value (eNPV) metric in determining the financial value of their development compounds in light of the substantial technical and market-based uncertainty inherent in pharmaceutical R&D. Figure 3 indicates the principles of an eNPV calculation.

Project valuations as part of evaluations can be in some companies the responsibility of the portfolio management department and are traditionally part of an annual/semi-annual portfolio review process. As the development process and market/sales expectations are characterised by uncertainty, individual project eNPVs are inevitably subject to constant change.

Progress to market and incremental R&D expenses affect the value of individual projects, the portfolio and the company. Until now R&D Life Sciences' leadership has not been well supported in understanding project performance. Most organisations have access to lots of data:

- Projects and Studies have milestone-based plans
- "Templates" or "benchmarks" for expected cycle times exist for projects and studies
- Likely external spend (direct project costs) on projects and studies are estimated
- Resource allocation algorithms give a view of likely internal costs by function
- Costs can be related to effort and time taken to move between milestones
- Systems for gathering actual costs and relating them to projects and studies are in place

The challenge organisations face is finding a way to synthesize the above data into meaningful knowledge.

In a volatile environment, Life Sciences R&D Executives track and assess the risk incurred on the overall portfolio value by applying EVM. Project performance can be assessed by plotting an individual project's eNPV against their respective Cost Performance Index (CPI) and Schedule Performance Index (SPI). The SPI provides an objective measure of schedule progress by calculating the ratio of work physically performed versus work scheduled based on approved budget. The CPI provides an objective measure of cost progress by calculating the ratio of work physically performed versus the actual cost incurred in accomplishing the work based on approved budget.

This can help to visually track and identify those higher-value projects hindered by poor performance and/or cost efficiency factors and define the necessary corrective actions to mitigate the risk on the portfolio value.

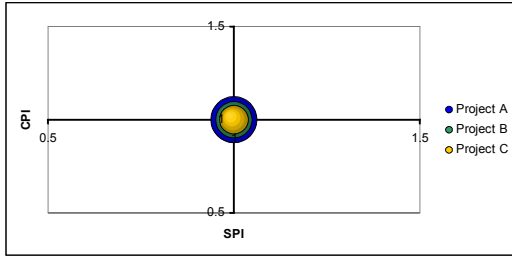


Figure 4: Project eNPV (size of the bubble) plotted against CPI and SPI at the time of portfolio review (Baseline)

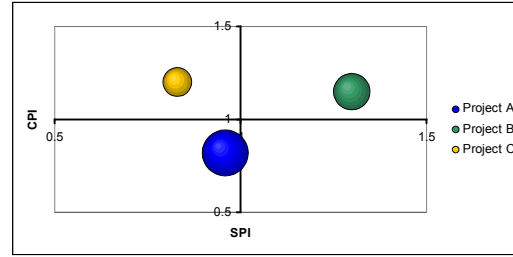


Figure 5: Project eNPV (size of the bubble) plotted against CPI and SPI at Baseline + n Month

Since EVM performance indices (CPI, SPI) measure deviation from plan, they can be used to indicate whether the risk process is being effective in addressing uncertainty and controlling its effects on project performance.

A. High SPI but low CPI. The project is overspent and ahead of schedule, requiring focused attention to cost risk, with the possibility of spending additional time to address this. In such instances, the Project Manager should be ready to answer key questions to help decision-makers/stakeholders to interpret the EVM indices adequately e.g. has the project consumed resources that were essential for other projects?

B. Both CPI and SPI are greater than 1. The project is under-spent and ahead of schedule, creating opportunities to be captured e.g. consider re-distributing resources across the portfolio, conduct project

lessons learned and identify best project practises, etc. In such instances, the Project Manager should expect questions like has the overall quality of the project been compromised to achieve early, under-budget delivery?

C. Both CPI and SPI are lower than 1. The project is overspent and behind schedule requiring aggressive action to address threats.

D. High CPI but low SPI. The project is under-spent and behind schedule, requiring attention to be paid to addressing schedule risk, and cost trade-offs to be considered. In such instances, the Project Manager should be ready to answer questions such as is the lack of resources responsible for the project delay?

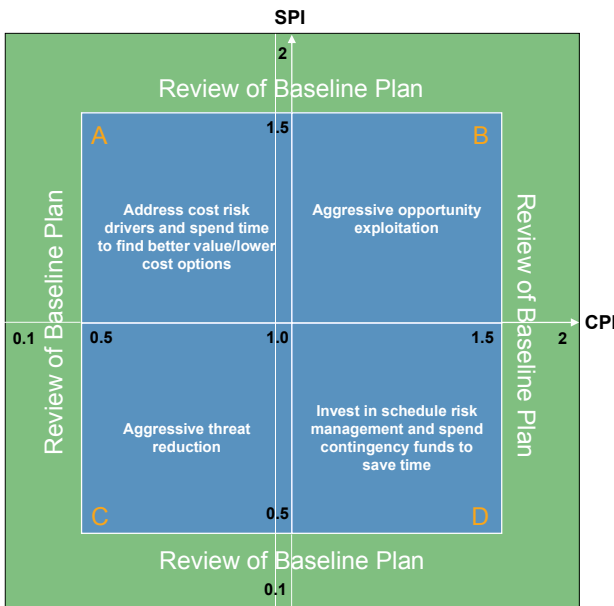


Figure 6: Relationship between the values of EVM indices and risk incurred⁵

may not simply be due to the existence of opportunities or unmanaged planning and resourcing issues. Typically, if actual performance is much greater or much lower than expected or planned, this could indicate poor planning or incorrect scoping when setting up the initial baseline plan. Baseline re-planning effort should be considered⁵. Plotting the trend of CPI and SPI over time against such thresholds can also give useful information to indicate whether the risk process applied is being effective in addressing uncertainty and managing project performance.

EVM may be pushed beyond project-level usage to support decision making at the portfolio level

The EVM technique has the potential to be pushed beyond the current state-of-the-art application at project level and be applied at the portfolio level. We advocate the use of the Portfolio Performance Index (PPI) to measure the performance of the portfolio in terms of value.

$$\text{PPI (Portfolio Performance Index)}_{\text{Month } n} = \Sigma (\text{CPI}_{\text{Month } n} * \text{SPI}_{\text{Month } n} * \text{eNPV}) / \Sigma \text{eNPV}$$

If PPI < 1, the actual portfolio performance is behind the planned performance. The portfolio is not on track to deliver its planned value.

If PPI > 1, the actual portfolio performance is ahead of planned performance. The portfolio is offering additional opportunities to deliver greater value than originally planned.

The PPI index answers the question “Will the portfolio deliver the expected value?”

While plotting the eNPV for each project against their CPI and SPI informs on variations in their respective project value, monitoring the PPI over time informs on variations in the overall portfolio value. Clearly some variation of the PPI is to be expected as projects unfold, but if a trend develops and crosses the threshold of “common acceptable variance”, action should be considered to mitigate the risk. Equally, if an upward or downward PPI trend can inform on the risk incurred in the overall portfolio value, a stable PPI trend does not necessarily imply that the portfolio is in the same shape as it was at the baseline point. The overall portfolio value may remain roughly the same over time while the individual project values vary but balance themselves out. Therefore, the PPI is a valuable indicator if used in combination with the eNPV for each project plotted against their CPI and SPI.

By defining appropriate CPI and SPI threshold values based on historical data, organisations can measure their portfolio value management effectiveness. For instance, if an organisation were to establish 0.95 as being the lowest CPI and SPI threshold values and 1.05 as the highest values, then the PPI performance lower bound would be set at 0.90 [PPI lower bound = CPI lower bound (0.95) *SPI lower bound (0.95)] and upper bound at 1.10 [PPI upper bound = CPI upper bound (1.05) *SPI upper bound (1.05)]. Figure 7 illustrates an example of time point interpretation of the PPI value and potential risk-mitigation actions undertaken.

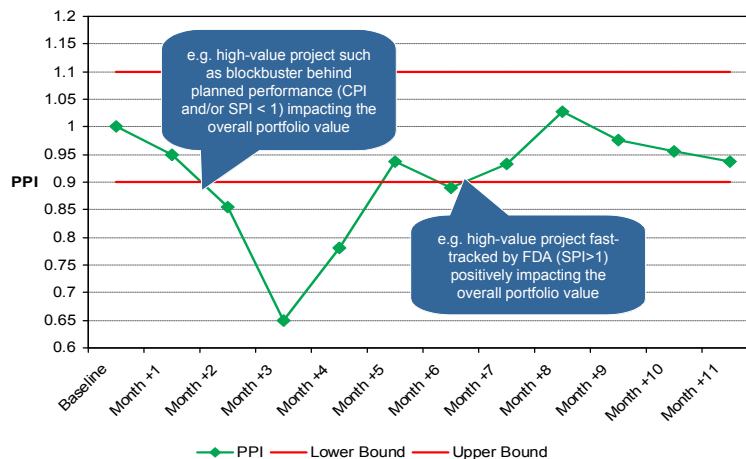


Figure 7: Portfolio Performance Index (PPI) over time

How to implement EVM?

Implementing EVM is well worth the effort. Although the EVM technique has the potential to be applied at the portfolio level, before such benefits can be experienced the foundation of the EVM technique needs to be solidly in place at project level. Project Managers and stakeholders must be first armed with the earned value information so that the current status of a project, the rates of variances, and once significantly into the project the end budget compared to the original estimate can be accurately predicted.

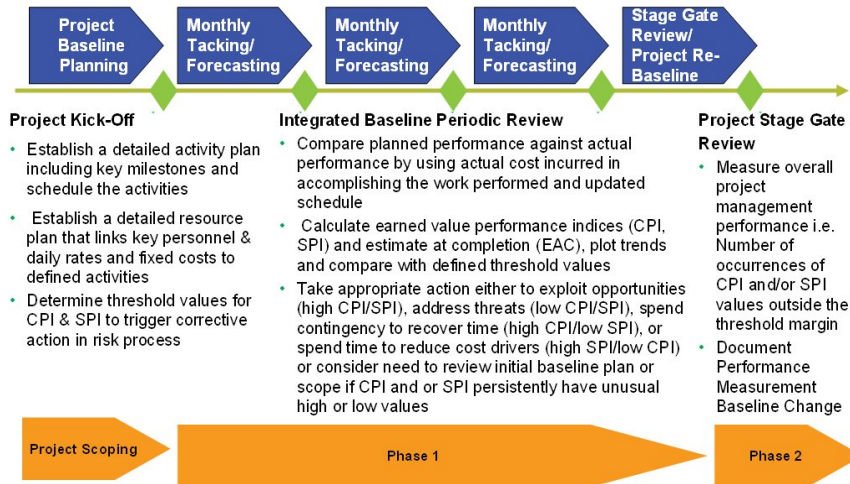
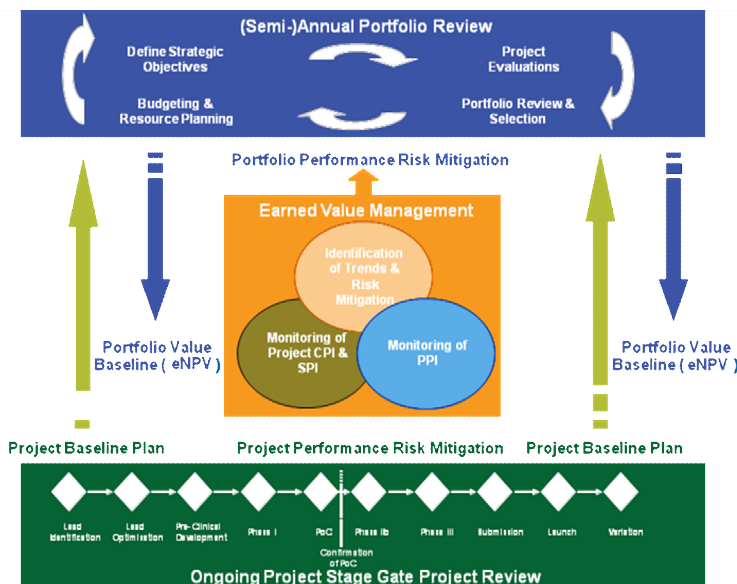


Figure 8: Project Earned Value Process

Further benefits can also be gained from implementing EVM by pushing the techniques beyond current project-level usage through further seamless integration with the operational portfolio review cycle. This enables holistic performance tracking of the portfolio, monitoring of portfolio value over time and identification of trends which can support effective risk-mitigation planning and implementation.

Comparing planned & against actual expenditures does not inform project performance but EVM truly does. However, tracking and reporting actual cost incurred in accomplishing the work performed at the activity/project level remains a challenging issue among Life Sciences R&D organisations, one place to start applying the EVM technique is co-development projects because they typically are more closely tracked and greater information is often available.

Figure 9: Integrated Earned Value Process



Conclusion

Although pharmaceutical companies understand value at the portfolio level, the processes that they have adopted hinder their ability to maximise value from the asset base. Pressured by fixed targets and performance incentives, managers focus on making the numbers and meeting set goals instead of maximising potential.

Life Sciences R&D organisations need a unifying measure and objectives that recognise the different businesses supporting their R&D pipeline. Yet the pharmaceutical industry has done little in the way in embedding it in their project management culture while in the Defense industry, the US Government manages for value by demanding of the Department of Defense (DoD) contractors that they maintain earned value management under the ANSI-EIA-748-98 Standard. Life Sciences R&D organisations should move away from informing project performance by comparing planned against actual expenditures and embrace EVM as the unifying measure that truly provides Project Managers and decision-makers with accurate and reliable feedback on cost and schedule performance throughout the lifecycle of their project.

As demonstrated in this Kinapse White Paper, the techniques of EVM can be pushed beyond current project-level usage and applied at the portfolio level. Portfolio management's common challenge is to track project performance across the entire portfolio in a timely and effective manner. This will help R&D executives to demonstrate that they will deliver the planned pipeline value to give stakeholders' confidence that today's business decisions will deliver growth and profitability goals, leading to higher yield R&D investments. However, since the portfolio review is traditionally a (semi-) annual exercise, the difficulty of tracking variation to the expected value of projects that are subject to constant project planning changes is used as an excuse not to do so. The EVM technique applied at portfolio level can enable holistic performance tracking of the portfolio, monitoring of portfolio value over time and identification of trends which can support effective risk-mitigation planning and implementation. Ultimately, this delivers to R&D executives the ability to credibly and responsively redirect the activities of their portfolio and easily communicate the value gained through doing so.

Appendix - Managing Projects Using Earned Value Measures

1. EVM consists of the following primary and derived data elements

Primary Measures

Planned Value (BCWS) is the cost of the work that is scheduled to be done in a certain time period if everything goes exactly to plan. For example, if you have a two-day task that is scheduled to cost \$50 per day, the Budgeted Cost of Work Scheduled (BCWS) for that task after the first day is \$50; after the second day, it is \$100. This measure tells you how much should have been spent up to a certain date according to your plan.

Actual Cost (ACWP) is the total costs actually incurred and recorded in accomplishing work performed during a given time period for a schedule activity.

Earned value (BCWP) is the budgeted cost of the work that has been done up to a certain point. This tells you how much the work you have actually done up to a certain date should have cost, if the costs went according to plan. If this number is less than BCWS, it means that work is being done slower than planned.

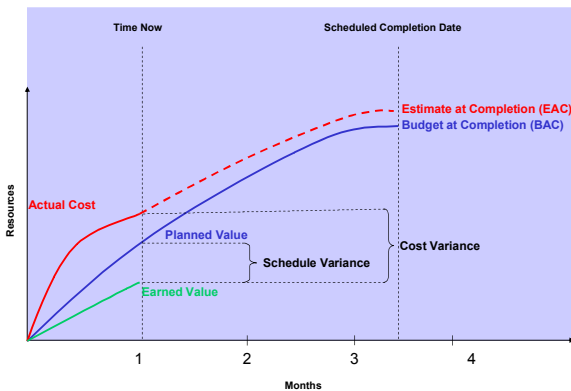


Figure 10: Earned Value Chart

Derived/Calculated Measures

From the three primary measures it is possible to derive measures that can be used to accurately assess the status of the project and predict its future state.

Cost Variance (CV). The numerical difference between the earned value (BCWP) and the actual cost (ACWP).

$$CV = BCWP - ACWP.$$

If CV value is positive, the project is currently under budget.

Schedule Variance (SV). An indicator of how much a program is ahead of or behind schedule.

$$SV = BCWP - BCWS.$$

If SV value is positive, the project is currently ahead of schedule.

Cost Performance Index (CPI). The cost efficiency factor representing the relationship between the actual cost expended and the earned value.

$$CPI = BCWP/ACWP.$$

A CPI ≥ 1 suggests a relatively efficient cost factor, while a CPI < 1 may be cause for concern.

Schedule Performance Index (SPI). The planned schedule efficiency factor representing the relationship between the earned value and the initial planned schedule.

$SPI = BCWP/BCWS$. A SPI ≥ 1 is good. SPI < 1 suggests actual work is falling behind the planned schedule

Budget at Completion (BAC). Sum total of the time-phased budgets.

$$BAC = \sum BCWS$$

Estimate to Complete (ETC). A calculated value, in dollars or hours that represents the cost of work required to complete remaining project tasks.

$$ETC = BAC - BCWP$$

Estimate at Completion (EAC). A calculated value, in dollars or hours that represents the projected total final costs of work when completed.

$$EAC = ACWP + ETC$$

Please, note that in Microsoft Project 2007, EAC is calculated as $EAC = ACWP + (BAC - BCWP) / CPI$

2. An EVM Case Study - EVM truly informs project performance

An example of project tracking that does not include earned value performance management is presented below. This project has been planned in detail, including a time-phased spend plan for all elements of work. The project is planned to start on 01 July 2008 and has a planned total budget of \$315 M (BAC) and a total estimated duration of 6.5 years to Submission. The planned estimated cost for each development phase is indicated to the right of the activity bar.

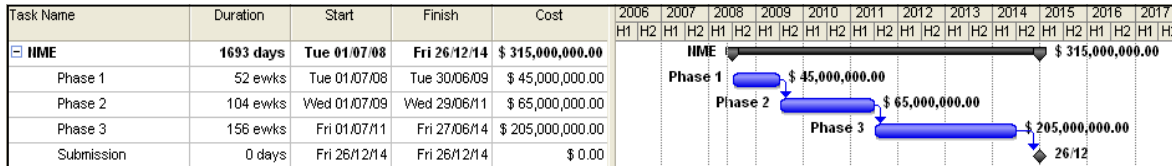


Figure 11: Time-phased spend plan before project start

Figure 12 shows the cumulative planned budget for this project as a function of time (the blue line, labelled BCWS).

It also shows the cumulative actual cost of the project (red line) through Q4 2009. It appears that this project was under budget from Q3 2008 to Q4 2009. How should management react to this information? What is missing from this chart is an understanding of how much work has been accomplished during the period compared to the planned performance.

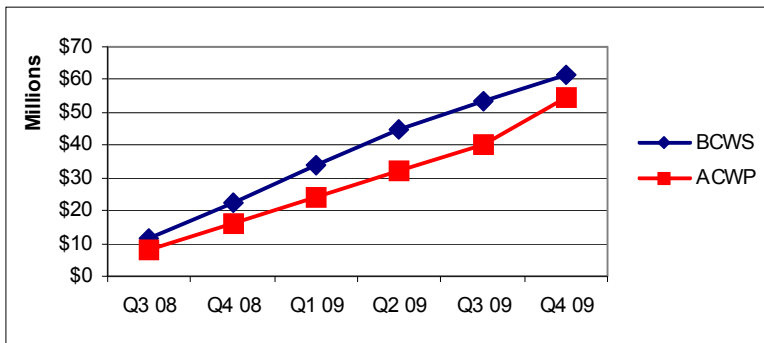


Figure 12: Cumulative planned budget against cumulative actual costs

How should management react to this information? A method is needed to measure technical performance objectively and quantitatively and inform on decision making. That is what EVM accomplishes.

As of the 31 December 2009, the Project Manager reports an actual total spent of \$54.5 M.

- Phase 1 was completed with a 3-month delay and for an actual total spent of \$40 M.
- As a consequence, the start of the Phase 2 has been delayed and as of the status date 12% of this activity has been completed. The actual spent to date is of \$14.5 M.

The actual cost for each development phase is indicated to the right of the activity bar.

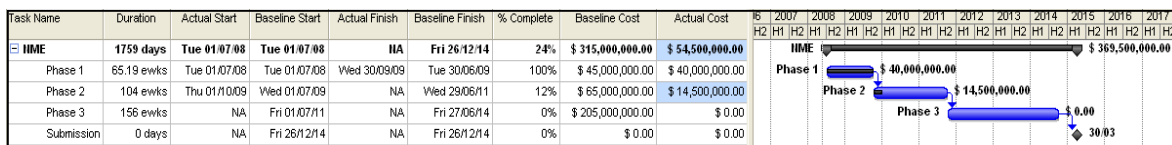


Figure 13: Time-phased spend plan against actual as of the 31 December 2009

Is this project on time and budget?

We have calculated for this project the primary and derived EVM measures. Although Figure 12 suggests that this project is under budget at the end of Q4 2009, the project has actually overspent \$1.7 M (CV) for the work that has been accomplished since the start of the project. This project is also behind schedule (SPI<1).

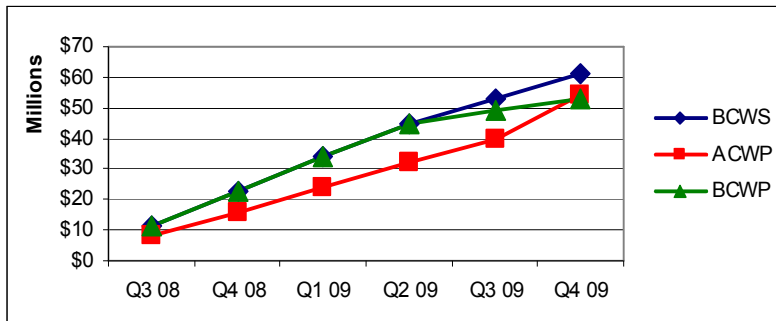


Figure 14: Cumulative planned budget against cumulative actual costs and earned value

3. Detailed calculation of Earned Value measures used in the case study

	Budget at Completion / BAC (\$M)	Earned Value / BCWP (\$M)		Planned Value / BCWS (\$M)		Actual Costs / ACWP (\$M)	Estimate at Completion / EAC (\$M)		Progress as of the 31/12/09
Phase 1	\$45.00		\$45.00		\$45.00	\$40.00		\$40.00	100%
Phase 2	\$65.00	= BAC * Progress	\$7.80		\$16.25	\$14.50	= ACWP + BAC - BCWP	\$71.7	12%
Phase 3	\$205.00		\$0.00		\$0.00	\$0.00		\$205.00	0%
NME	\$315.00	= SUM (BCWP)	\$52.80	= SUM(BCWS)	\$61.25	\$54.50	= SUM (EAC)	\$316.7	

As per the original plan, the activity should have been completed by the 30/06/09, therefore BCWS=BAC

As per the original plan, by the 31/12/09 26 weeks worth of work should have been completed. Since this activity was scheduled to be completed within 104 weeks, therefore BCWS=BAC*26/104

As per the original plan, the activity was not expected to be started by the 31/12/09, therefore BCWS=0\$

	Cost Variance (\$M)		Schedule Variance (\$M)		Cost Performance Index		Schedule Performance Index	
Phase 1		\$5.00		\$0.00		1.13		1.00
Phase 2	= BCWP - ACWP	-\$6.70	= BCWP - BCWS	-\$8.45	= BCWP / ACWP	0.54	= BCWP / BCWS	0.48
Phase 3		\$0.00		\$0.00				
NME	= SUM (BCWP) - SUM (ACWP)	-\$1.70	= SUM (BCWP) - SUM(BCWS)	\$ -8.45	= SUM (BCWP) / SUM (ACWP)	0.97	= SUM (BCWP) / SUM (BCWS)	0.86

Legend:

- **Data Input: Data known by the Project Manager**
- **Data Output: Calculated Earned Value Measures**

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About Kinapse

Kinapse works with its Life Sciences R&D clients to provide value creation through information processing, business transformation consulting and asset value consulting. We provide synergistic capability to enhance value in these three areas separately or in combination. Our business model blends experienced consultants with a high calibre analytic and delivery team based in India with industry veteran Consulting Partners who bring deep experience and expertise of R&D processes and functions.

We help companies to understand the real value of their assets and develop strategies for exploiting their portfolio that best support these companies' objectives, capabilities and resource constraints. Our experience in organisation and process design and implementation, and transactions makes us well placed to support in the implementation of actions resulting from decisions on portfolio strategy. In conjunction with one of our industry partners we can offer a complete suite of services and solutions around portfolio strategy, valuation, tactics and implementation.

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