



Schedule Adherence a useful measure for project management

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### • • • Abstract

- Project accomplishment not in accordance with the planned schedule frequently has adverse repercussions; cost increases and duration is elongated.
- <u>Schedule Adherence</u> provides additional early warning information to project managers, thereby enabling improved decision making and enhancing the probability of project success.





### Overview

- Introduction
- Schedule Efficiency vs Adherence
- Measuring Schedule Adherence
- Example Application
- Real Data Results
- o Summary
- Final Remarks





### Introduction

- Development of a project plan is difficult
- Much effort is invested
- Experts are employed
- History, heuristics, algorithms to establish best & worst case outcomes
- Constraints identified
- Resource availability considered
- Task sequencing & interdependencies





## Introduction

- Mechanism for consolidating the information <u>The Schedule</u>
  - Provides an operational description for the project team and senior managers
  - Possibly the most important document for a project
- The schedule represents the most efficient process for executing the project ...deviation leads to inefficiency ...and other related problems





## Introduction

- Thus... because the <u>Schedule</u> is so vital to success ...there is a compelling case for project managers to do their utmost to ensure execution conforms to it
- A method for measuring conformance to the schedule is proposed for enhancing EVM and early warning management information...





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## Schedule Efficiency vs Adherence



- What is Schedule Adherence?
  - Milestones, objectives, interim products achieved on time?
  - SPI & SPI(t) are more resolute examples of efficiency indicators
- The measurements identified do not provide information about how the achievement was made



## Schedule Efficiency vs Adherence



- Example suppose at status period 3 we are to have completed 2 milestones: 1 & 2
- At period 3 we have completed 2 milestones: 1 & 3

#### Is Anything wrong?

- Should the manager be concerned with the performance sequence?
- Does the out of sequence performance make any difference?







- Recall the initiatives to improve project performance and quality over the last 20 years: SPC, TQM, SEI CMM®, and ISO 9001
- What was their message?

Undisciplined project execution leads to inefficient performance and defective products.

• Then ... doesn't it make sense to measure how well the plan (process) is being followed?



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Did the accomplishment match exactly the expectation from the planned schedule?

- Earned Schedule provides a means to measure Schedule Adherence
  - Derived from two EVM measures PV & EV
  - ES is the duration associated with the PMB where the EV accrued should have occurred







- The connection between ES and the PMB is remarkable ... regardless of the project's position in time, we can know what <u>should</u> have been accomplished
- For a claimed amount of EV at a status point AT, the portion of the PMB which should be accomplished is identified by ES







- It is more likely performance is not synchronous with the schedule ... EV is not being accrued in accordance with the plan
- The next chart is an example ...the EV accrued is the same amount as shown on the previous chart, but has a different distribution









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- <u>Tasks behind</u> indicates the possibility of impediments or constraints
- <u>Tasks ahead</u> indicates the likelihood of future rework
- Both, lagging & ahead cause poor performance efficiency ...ahead performance is most likely caused by the lagging tasks

Concentrating management efforts on alleviating impediments & constraints will have the greatest positive impact on project performance



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- Ahead tasks are frequently performed without complete information
- Performers must anticipate the inputs from the incomplete preceding tasks
- When anticipation is incorrect a significant amount of rework is created
- Complicating the problem the rework created for a specific task will not be recognized for a time ....until all of the inputs are known or the output is incompatible for a dependent task





- By measuring the portion of the EV accrued that is congruent with the planned schedule we can have an indicator for controlling the process
- <u>Schedule Adherence</u> is defined as:

 $\mathsf{P} = \Sigma \mathsf{E} \mathsf{V}_{\mathsf{j}} / \Sigma \mathsf{P} \mathsf{V}_{\mathsf{j}}$ 

where the subscript j denotes the identity of the tasks comprising the planned accomplishment

- The value of  $\Sigma PV_j$  is equal to the EV accrued at AT
- $\Sigma EV_j$  is the amount of EV for the j tasks, limited by the value of the corresponding PV<sub>i</sub>





• Recall the question ...

Did the accomplishment match exactly the expectation from the planned schedule?

• The P-Factor is the indicator for answering the question

• Characteristics of the P-Factor

- Its value must be between 0.0 and 1.0
- P = 1.0 at project completion
- P = 0.0 indicates accomplishment out of sequence
- P = 1.0 indicates perfect conformance to schedule





- When the value of P is much less than 1.0 the PM has a strong indication of an impediment, overload of a constraint, or poor process discipline
- When P has a value very close to 1.0, the PM can feel confident the schedule is being followed ....and that milestones and interim products are occurring in the proper sequence

The PM now has an indicator which enhances the description of project performance portrayed by EVM & ES





- Notional data has been created to illustrate the application of <u>Schedule Adherence</u>
- The task numbers in the table are associated with the numbering shown on the chart of the network schedule
- By calculating the difference between PV@ES and EV@AT, impediments/constraints (I/C) and rework (R) can be identified to specific tasks







Task	PV	PV@ES	EV@AT	EV - PV	I/C or R
1	10	10	10	0	
2	12	9	5	-4	I/C
3	10	10	10	0	
4	5	5	3	-2	I/C
5	5	2	5	+3	R
6	8	4	3	-1	I/C
7	7	0	1	+1	R
8	5	0	3	+3	R
Total	62	40	40	0	



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- Three tasks identified as lagging: 2, 4, and 6
- PM should investigate these tasks for removal of impediments or alleviation of constraints
- Should no impeding problem be found, the PM has reason to suspect poor process discipline from one or more members of the project team
  - It may be discovered that an employee is insufficiently skilled or trained
  - The employee to obtain a satisfactory performance review performed a down stream task because he knew how to do it

![](_page_22_Picture_7.jpeg)

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• In this instance ..... Who caused the problem?

![](_page_23_Picture_0.jpeg)

- Tasks identified for potentially creating rework are: 5, 7, and 8.
- Clearly tasks 7 & 8 are at risk of rework because some or all of the required inputs are absent
- The potential for rework is not so obvious for task 5. ...it is not synchronous with the schedule, but the needed inputs are complete
  - By working ahead the worker presumes that his work is unaffected by other facets of the project
  - Subtle changes to task requirements often occur as more detail becomes known as the project progresses Thus ...<u>It is risky to be out in front</u>

![](_page_23_Picture_7.jpeg)

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![](_page_24_Picture_0.jpeg)

• What is the value of the P-Factor for this example?

Task	PV	PV@ES	EV@AT	EV - PV	I/C or R
1	10	10	10	0	
2	12	9	5	-4	٧C
3	10	10	10	0	
4	5	5	3	-2	٧C
5	5	2	5	+3	R
6	8	4	3	-1	٧C
7	7	0	1	+1	R
8	5	0	3	+3	R
Total	62	40	40	0	

 It is seen that PV@ES = EV@AT ... PV@ES identifies the tasks which should be in-work/complete: 1 through 6

![](_page_24_Picture_5.jpeg)

![](_page_25_Picture_0.jpeg)

Task	PV	PV@ES	EV@AT	EV - PV	I/C or R
1	10	10	10	0	
2	12	9	5	-4	٧C
3	10	10	10	0	
4	5	5	3	-2	I/C
5	5	2	5	+3	R
6	8	4	3	-1	٧C
7	7	0	1	+1	R
8	5	0	3	+3	R
Total	62	40	40	0	

- Sum of EV@AT for 1 thru 6 is equal to 36 ...but the amount of EV for task 5 is +3 with respect to its corresponding task PV ...and thus,  $\Sigma EV_i = 36 3 = 33$
- The P-Factor can now be calculated:

#### $\mathsf{P} = \Sigma \mathsf{EV}_j \, / \, \Sigma \mathsf{PV}_j = 33 \, / \, 40 = 0.825$

![](_page_25_Picture_6.jpeg)

![](_page_26_Picture_0.jpeg)

- From the value of P ...~80 percent of the execution is in conformance with the schedule
- Presuming all of the claimed accomplishment not in agreement with the schedule requires rework, i.e. 7 units ....then:
  - ~<u>18 percent</u> of claimed EV requires rework
  - Without a large amount of MR, successful completion is unlikely
  - The PM has much to do to save this project ...however, without the P-Factor indicator and the analysis ES facilitates, it is unclear as to what he/she should investigate and take action to correct

![](_page_26_Picture_7.jpeg)

![](_page_27_Picture_0.jpeg)

#### Real Data Results

- The next chart is a graph of CPI, SPI(t) and the P-Factor versus Percent Complete using actual project data
- Observe the following:
  - Values of P from 20% through 40% complete
  - Values of CPI & SPI(t) throughout
  - Overall behavior of the P-Factor

#### What can be said about this project?

![](_page_27_Picture_8.jpeg)

![](_page_28_Figure_0.jpeg)

![](_page_29_Figure_0.jpeg)

![](_page_30_Picture_0.jpeg)

#### Real Data Results

- The outcome forecast is the project will complete under budget and slightly past the planned date ... *a successful project*
- A logical conjecture is ...when the planned schedule is closely followed output performance is maximized ...the project has the greatest opportunity for success
- Also ...when the indicators are all good, especially early in the project, we can deduce the project planning was excellent, as well as management and employee performance

![](_page_30_Picture_5.jpeg)

![](_page_31_Picture_0.jpeg)

#### • • Summary

- Earned Schedule, an extension to EVM for schedule performance analysis, is extended further ...creating a useful tool for PMs
- EV and ES with the PMB are used to develop the concept of <u>Schedule Adherence</u>
  - Measure for Schedule Adherence:  $P = \Sigma EV_i / \Sigma PV_i$
  - Identification of Impediments/Constraints & Rework
- High value of P leads to ...
  - Maximum performance for Cost & Schedule
  - Greater understanding of excellent project planning

![](_page_31_Picture_9.jpeg)

![](_page_32_Picture_0.jpeg)

#### • • Final Remarks

- Some EVM experts & practitioners believe that schedule analysis is possible only through detailed examination of the network schedule
- ES is shown to offer methods which greatly simplify schedule forecasting and analysis
- <u>Schedule Adherence</u> is a PM tool for process control not available from traditional analysis of the network schedule
- Further research of the P-Factor measure is encouraged ...a calculator is available from the ES website

![](_page_32_Picture_6.jpeg)

![](_page_33_Picture_0.jpeg)

## References

- "Schedule is Different," <u>The Measurable News</u>, Summer 2003: 31-34
- "Connecting Earned Value to the Schedule," <u>CrossTalk</u>, June 2005: on-line
- "Schedule Adherence: a useful measure for project management," <u>CrossTalk</u>, April 2008: 14-18
- o Earned Schedule Website: <u>www.earnedschedule.com</u>

![](_page_33_Picture_6.jpeg)