Applied Research on Software Progress Measurement: Taking B2B Project of A Company as an Example

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Abstract: Because of the limitations of Earned Value Management (EVM), there are great defects in managing software progress. Although Earned Schedule (ES) improves EVM, it is not reliable to utilize cost data to measure software progress. In 2014, Earned Duration Management (EDM), which is a new measurement method, was introduced. In this paper, via a practical case, the EDM method is used to measure the software progress.

Keywords: Software Progress; Earned Value Management; Earned Duration Management; Schedule Performance Index (SPI); Duration Performance Index (DPI)

1. Introduction

As a method of performance measurement for project management, EVM has achieved great success in cost management, but it always fails in schedule management, because they always fail in the later stage of the project, which makes EVM unable to be used in schedule management. Therefore, EVM is almost only used for managing cost. In 2003, ES changed the calculation method of progress indicators to eliminate their shortcomings[1]. ES method is better than traditional EVM method. The new indicators do perform better. However, to utilize cost data in calculations, which may not provide reliable information. Homayoun Khamooshi and Hamed Golafshani published a paper in 2014 describing a new approach to schedule performance for project management[2]. Earned Duration is a management technique that eliminates the inconvenient of using cost data in planning.

2. Research question

This paper proposes one research question pertaining to software progress: how to measure the progress of software with the method of EDM in actual project?

The study objective of this paper is to test the accuracy of earned duration, and use the measurement method to forecast the end time of the project.

3. Methodology

According to the data given by the actual project, this paper first compares EDM with EVM, which is more accurate for evaluating the project progress. The performance of EVM's SPI index and EDM's DPI index for project monitoring was compared. The second step is to select a stage in the software schedule to predict the completion time of the project.

4. Test the accuracy of earned duration

Several values are given by the study case: PV, AC, EV, PD and AD.

PV: Planned Value, is the budget for each task. AC: Actual Cost, is the actual cost of each activity at the time of completion or reporting time. EV: Earned Value, is the budgeted cost of completed work. PD: Planned Duration, is the duration assigned to plan to complete a task. AD: Actual Duration, is the duration of an activity from the actual beginning to the actual end.

The following values need to be calculated before reviewing.

SPI: Schedule Performance Index, A measure of schedule efficiency expressed as the ratio of earned value to planned value. The formula is: SPI = EV/PV[3], SPI > 1.0 means that the progress is ahead of schedule; SPI=1.0, means that the progress is on schedule SPI < 1.0, means that the progress is behind schedule[4].

TPD: Total Planned Duration, is the total duration of project plan completion.

TED: Total Earned Duration, is the sum of ED that tasks have been done.

ED: Earned Duration, for the project, at any point in time, is the duration corresponding to Total Earned Duration on Total Planned Duration S-curve, which mathematically could be expressed as: ED = PD/AD×PD[5],

DPI: Duration Performance Index, for project, at any point in time, represents the overall schedule progress performance toward the completion of the project. It is defined as: DPI = ED/AD[2], the indicative expression of the values obtained is similar to that of SPI, DPI > 1.0 means that the progress is ahead of schedule; DPI = 1.0, means that the progress is on schedule DPI < 1.0, means that the progress is behind schedule.

TAD: Total Actual Duration, is the sum of AD that activities is completed.

According to the known PV, AC, EV, PD and AD, the values in the follow table are calculated.

	PV	AC	EV	SPI	PD	AD	ED	TPD	TAD	DPI
M1	148874	125953	128197	0.86	31	36	26.7	31	36	0.74
M2	816358	777209	819102	1.00	59	57	61.1	90	93	1.07
M3	2122918	2082103	1940771	0.91	91	106	78.1	181	199	0.74
M4	4056426	4000068	3737566	0.92	92	99	85.5	273	298	0.86
M5	5809035	5702749	5613165	0.97	61	57	65.3	334	355	1.15
M6	6886024	6699288	6469233	0.94	62	78	49.3	396	433	0.63
M7	8212950	8019224	7858604	0.96	89	85	93.2	485	518	1.10
M8	10149668	9936398	9795321	0.97	92	92	92.0	577	610	1.00
M9	12762437	12415857	12040095	0.94	61	71	52.4	638	681	0.74
M10	14064546	13881661	13250136	0.94	92	99	85.5	730	780	0.86
M11	15825100	15627801	15286855	0.97	59	51	68.3	789	831	1.34

Table 1. EVM and EDM metrics for B2B project.

According to **Table 1**, to draw the performance test curves of SPI and DPI, as shown in **Figure 1.** It shows the status of the progress of each phase of the software process. SPI shows that except for M1, the progress performance of other stages is within the controllable range. However, DPI shows that M1, M3, M6 and M9 are behind schedule, and have reached the Red Alert range, which is consistent with the actual progress and planned progress values shown in **Table 1**. Therefore, DPI is a more effective progress measurement index than SPI, which indicates that EDM is more effective than EVM in measuring progress performance.
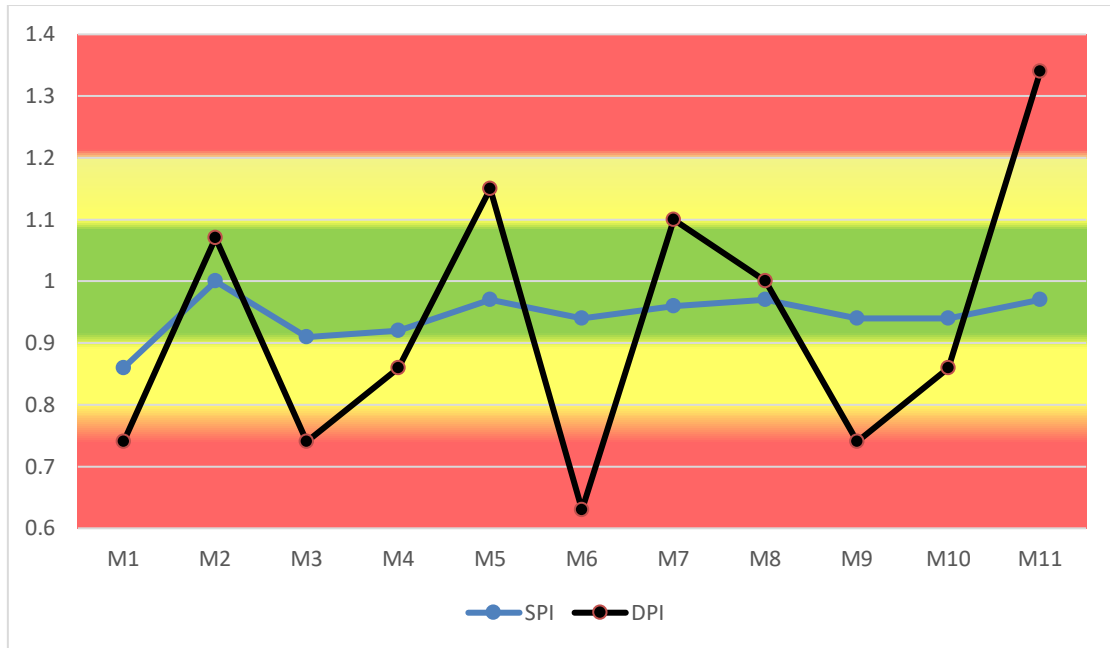
Figure 1. Project execution performance statistic.

5. Forecast project completion time

In EDM, EDAC is used to forecast the completion period of a project. BPD: Baseline Planned Duration, is the planned duration for the completion of the project. EDAC: Estimated Duration at Completion, as: EDAC = BPD/DPI[2].

Select the predicted project completion time at the end of M4, and bring the values in **Table 1** into the formula. $EDAC_{M4} = 789 \div 86.36\% \approx 913.62$.
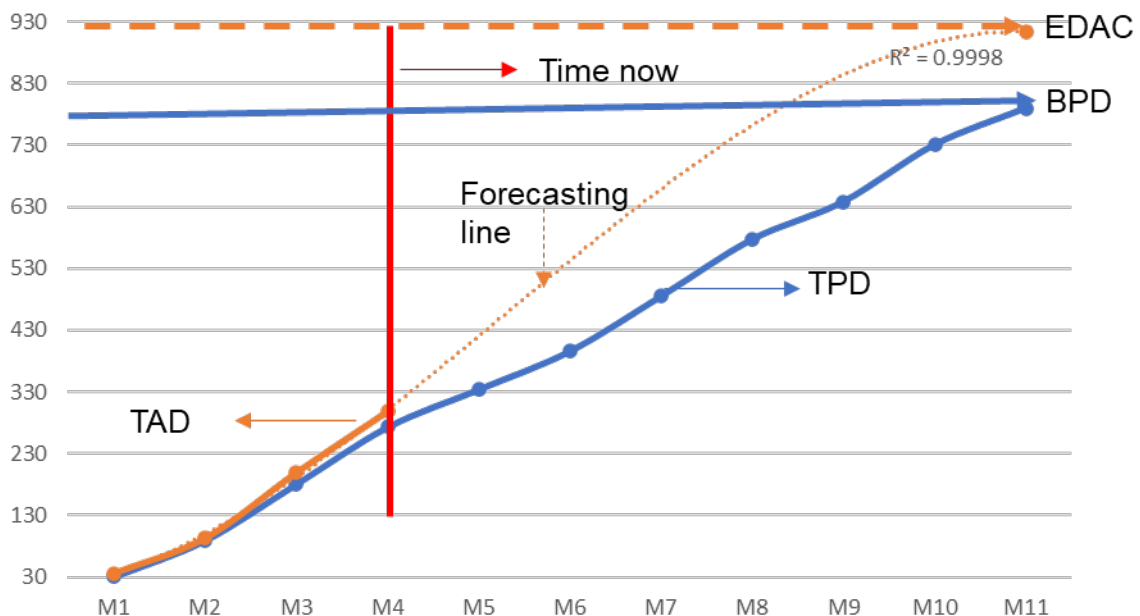

Figure 2. Forecast project completion time.

When the software is in the M4, the completion duration of the project is about 913 days. The original plan was 789 days. It indicates that the project progress has been delayed, and immediate response and corrective measures should be taken. It is very convenient to forecast the progress of the project with EDM system.

6. Conclusion

This paper compares the accuracy of EVM and EDM in progress measurement, and concludes that EDM is more effective than EVM. It is very convenient to use EDM to forecast the completion period of a project, which is not as complex as EVM calculation. It can effectively monitor the process performance of the project in real time. This paper is only a preliminary study of the application of EDM in measurement for software progress, which provides a reference for project managers to better understand EDM.

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