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(1 PDU for $9.95)

The Reduced Scope Index (RScI)

How to Estimate Your Adjusted Scope As You Finish Your Project (or Agile Iteration) on Time and on Budget

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Introduction

Frequently, part way through a project, the team will discover that things have not been going exactly according to plan. Unexpected technical difficulties have occurred, the deliverables have not all been completed on schedule, a major milestone may have slipped, the people working on the project are not the ones envisioned in the plan, and extra work has already been done to keep the project from falling further behind.

While the solutions can be as varied as the project's problems, one solution employed (especially in Agile projects) is to hold to the original cost and schedule and *reduce the estimate of the scope* to be completed by the originally scheduled date (within the iteration's time-box). The original staff continues to work at its planned pace while the original plan's scope is adjusted to match the possibilities offered by the remaining schedule.

The broadest assumption one can make about the remaining scope is that if the completed work on the project to date is less than planned, the amount of the project's result (the project's scope) will be correspondingly diminished.

[Note: this discussion will focus on *reduced* scope, but good news early in a project could lead to an estimate of an *increased* scope. The Reduced Scope Index might more generally be called the *Altered* Scope Index. Good news on projects is rare enough that this discussion will persist with the pesimistic term, Reduced Scope Index.]

In the following example, the shape of the staffing profile defines the shape of the project activity. In most departments the project staffers are in high demand and are simultaneously scheduled on multiple projects. Preserving the *shape* of the staffing profile minimizes disruptions to both the immediate project and to the other active projects surrounding it.

So the question arises, "How do you estimate the reduced scope that results from preserving the shape of the orginial staffing plan (and with it, the original cost and schedule)?"

A simple example
To answer this common question, we will use New Leaf's handy new ratio, the Reduced Scope Index (RScI). To understand the details of how the RScI works, consider the following simple example.

Here's a project plan for a seven-month project that will involve 18 staff-months of effort. The scope goal, measured in staff-months, is 18. Entered data is indicated in **bold** type. (For an Agile project, think of the months as weeks and the staff-months as staff-weeks in an iteration that is 7 weeks long.)

Month	Staff	
1	**1.0**	
2	**2.0**	
3	**3.0**	
4	**4.0**	
5	**4.0**	
6	**2.0**	
7	**2.0**	
7		Total months, the schedule in months
18		Total staff-months, the budget, the total planned value, the full project scope

While the actual plan probably breaks the work down in staff-hour units, the effort in the table has been summarized in staff-month units to keep our example easy to understand. Notice how the plan's activity grows from 1 staff-month the first month to 4 staff-months for the fourth and fifth months, and finally tapers off to 2 staff-months for the sixth and seventh months.

Simplifying assumptions
At this point we will collect our assumptions for our simple example. After we finish exploring the example, we will revisit the assumptions and see how to revise our results when some of our assumptions do not hold in the real world. Our assumptions are:

1. Project scope is defined as the "value" in "planned value" and "earned value."
2. Scope can be measured in staff-month units.
3. When we measure our progress, all activities that have been begun have been completed—there are no partially completed activities in our mid-project figures
4. People can schedule their time in hours, so that fractional staff-months of scope are possible answers to our questions.
5. Team members will work according to the orginal plan.
6. Traditional earned value assumptions apply:

- The unfinished part of the project will be similar to the finished part.
- The CPI will persist to the end of the project.
- The SPI will converge to 1.0 on the later date when the project's earned value equals its planned value.

7. Either the CPI or the SPI can be a good indicator of the scope productivity of the project

Continuing with our simple example, we next look at the project measurements part way through. Again the question is, "What is the possible scope that we can finish on schedule, with the staff working its planned hours?"

Measurements in mid-project
At the end of the fourth month the details on the project look like this:

To Date:	
4	**Project is now at end of this month**
10.0	Planed Value to Date (planned scope)
11.0	**Actual Cost to Date**
9.0	**Earned Value to Date (achieved scope)**
0.82	Cost Perf. Index (CPI) (Scope Earning Efficiency of Staff)
0.90	Schedule Perf. Index (SPI) (Scope Timing Efficiency of Staff)
0.82	Reduced Scope Index (RScI) (= Minimum (CPI, SPI))
22.0	Est. Cost at Complete (Original Budget / CPI)
7.8	Est. Schedule at Complete (Original Schedule / SPI)
14.73	Est. Scope at Orginial Schedule (Orginal Budget x RScI)

We now see that the project at the end of four months is not going according to plan. The scope that was planned to have been completed at this point was 10 staff-months of work. The earned value of the completed work (the achieved scope) is only 9 staff months. The amount of work that has actually occurred is 11 staff-months. (In this example, all tasks have been fully completed at the date of the measurement [see assumptions above].)

We can make a familiar earned-value prediction and say that if the remaining work is similar to the completed work, the project will cost 22 staff-months (not the planned 18) and be finished in 7.8 months (not the planned 7).

Two new lines in the details answer our question of "What is the estimated scope that we can finish with the staff working its planned hours on the orginial schedule?" We multiply the Orginial Budget, 18, by the Reduced Scope Index, .82, to get an estimated scope of 14.73 staff-months. Project scope is identified as the "value" in "planned value" and "earned value" and is measured in units of staff-months [see assumptions above].

We also would like to know how much scope we can achieve in the next month.

Three attempts at next month's scope
Here is a first attempt at an answer:

INCOMPLETE METHOD (Omitting CPI and SPI)	
7.0	Remaining possible scope (Budget - Actual Cost to Date)
3.0	/ Remaining months
2.33	= Scope possible next month (Assumes a level scoping to the end of the project)

Our first attempt started with 7 planned staff-months of remaining budget, divided it by the remaining 3 months, and arrived at possible scope of 2.3 staff-months for each of the next three months.

However, the estimated 7.0 staff-months of remaining scope did not include any consideration of the Cost Performance Index's fall from 1.0 to .82 or the Schedule Performance Index's decline from 1.0 to .90. The lower CPI tells us that we should remember that we are *not being as efficient* as we originally planned to be, while the lower SPI tells us we are *not being as fast* as we orginially planned to be. So 2.33 staff-months of scope for next month is too high.

A second attempt at a solution:

RScI TOTAL METHOD (Considering both the CPI and SPI)	
7.00	Remaining possible scope (Budget - Actual Cost to Date)
0.82	x Reduced Scope Index (RScI = Minimum (CPI,SPI))
0.82	CPI (Scope Earning Efficiency of Staff)
0.90	SPI (Scope Earning Lateness of Staff)
5.73	= Reduced remaining possible project scope
3	/ Remaining months
1.91	= Reduced scope possible next month (Assumes a level scoping to the end of the project)

The second attempt includes both our inefficiency (as measured by the CPI) and our lateness (as measured by the SPI). Both characterize performance that is less than 1.0, or 100%.Whichever of the two is worst (lowest) determines the most scope we can achieve. We will call this minimum index the Reduced Scope Index (RScI). With a CPI of .82 and an SPI of .90,

RScI = Minimum (.82, .90) or
RScI = .82.

With the RScI, we estimate the reduced remaining possible project scope of 5.73 staff-months and next month's scope at 1.91 staff-months. However, we still have not matched the 4-2-2 planned monthly staffing pattern for the last 3 months of the project.

RScI PATTERNED METHOD (Considering CPI and SPI and preserving the original shape of the scoping)	
7.00	Remaining possible scope (Budget - Actual Cost to Date)
0.82	x Reduced Scope Index (RScI =Minimum (CPI,SPI))
5.73	= Reduced remaining possible project scope
	The 4-2-2 pattern
5.73	Reduced remaining possible project scope
4.00	Next month's plan
8.00	/ Remaining months' total plan (Budget - Planned Value to Date)
2.86	= Reduced scope possible next month with a 4-2-2 pattern
	(= 4/8 x <Reduced remaining possible project scope>)

The third attempt shows how we can refine the second attempt and apply the 4-2-2 pattern of the remaining plan to find the 2.86 for next month (and the 2.86 - 1.43 - 1.43 pattern for the remaining 3 months).

The new index

New Leaf's new index is defined as:

- Reduced Scope Index (RScI) = Minimum (CPI, SPI)

This new index obviously works like the two possible earned-value indexes it comes from. Specifically, for the RScI:

- An index of 1.0 means all is well (or at least, all is going according to plan).
- An index *less than1.0* means things are behind plan.
- An index *greater than 1.0* means things are ahead of plan.

Final check

In order to be sure that the RScI calculation really works, let's compare our three attempts to adjust our staffing:

Original planned work, scope

Month	Scope
1	1.0
2	2.0
3	3.0
4	4.0

Current measures

10.0	Planed Value to Date
11.0	Actual Cost to Date
9.0	Earned Value to Date

Forecasted scoping		Adjusted Scope		
	Originial	Incomplete	RScI	RScI
Month	Plan	Method	Total Method	Patterned Method
5	4.0	2.33	1.91	2.86
6	2.0	2.33	1.91	1.43
7	2.0	2.33	1.91	1.43
Remaining possible scope	8.00	7.00	5.73	5.73
Total scope	18.00	16.00	14.73	14.73
Total cost	18.00	18.00	18.00	18.00

The “Incomplete Method” over-estimates the possible remaining scope by forgetting the staff's inefficiencies. The "RScI Total Method" and the "RScI Patterned Method" correctly estimate the 5.73 staff-months of reduced remaining possible scope. However the "RScI Total Method" fails to preserve the 4-2-2 planned shape of the original plan's last three months. The "RScI Patterned Method" correctly estimates the possible remaining scope by *proportionately adjusting the remaining scope* to preserve the shape of the original plan, 2.86 – 1.43 – 1.43.

Assumptions revisited

Our assumptions were:

1. Project scope is defined as the "value" in "planned value" and "earned value."
2. Scope can be measured in staff-month units.
3. When we measure our progress, all activities that have been begun have been completed—there are no partially completed activities in our mid-project figures.
4. People can schedule their time in hours, so that fractional staff-months of scope are possible answers to our questions.
5. Team members will work according to the orginal plan.
6. Traditional earned value assumptions apply:

- The unfinished part of the project will be similar to the finished part.
- The CPI will persist to the end of the project.

- The SPI will converge to 1.0 on the later date when the project's earned value equals its planned value.

7. Either the CPI or the SPI can be a good indicator of the scope productivity of project

The first assumption simply asserts that there should be a rough equivalence between the project's planned activity and the project's progress towards a completed product. As the project progresses the percent of cumulative project activity and the percent of cumulative product scope should be roughly the same. They both end at 100% at the project's conclusion. If these two metrics diverge for a while during the project, a careful review can correct the scope estimate.

Scope could be measured in many units including dollars, deliverables, or precentage of the completed product. The second assumption notes that, given "scope" can be measured as "planned value" or "earned value," it's convenient to use staff-months. We measure scope in the same units of work that cost can be measured in. If other units were needed in the real world, the totals for the completed plan would provide suitable conversion factors.

The third assumption, that there were no partially completed activities, allowed us to be sure that our calculations were precise. Small amounts of incomplete work do not adversely affect earned-value calculations in real projects. If a large amount of incomplete work exists, assigning “partial credit” can usually correct the problem.

The fourth assumption, that people can schedule their time in hours, is true of most white-collar projects.

The fifth assumption that team members will work according to plan means that they will meet the orginial schedule and cost. It also means that if they fall behind in productivity or speed, they must expect a reduction in the scope of the project in order to meet their original schedule and cost. In a real project, the team might work some overtime hours in order to preserve crticial portions of the project's scope. A team might also get special help for special problems. In either case the scope estimate may be adjusted.

The sixth assumption, that traditional earned-value assumptions apply, has several parts. The projected Estimate at Complete (EAC) and many other statistics of familiar earned-value calculations all rest on the assumption that the unfinished part of the project will similar to the finished part. Minor adjustments can be made when this assumption is a little inaccurate.

Experience shows that for most white-collar projects the CPI quickly arrives at a stable value that persists throughout the project. The SPI is usually slower to establish a stable value and will eventually converge to 1.0 when the full scope is delivered. Depending on when the orginal date halts the project, either index may act as the "minimum" for the Reduced Scope Index (RScI). When the project halts

on the original date, the lower value gives the more conservative estimate of the total scope delivered.

The last assumption, that either the CPI or the SPI will be a good indicator of scope productivity, needs some further qualification. The CPI is a true scope indicator by definition. When the project is halted on schedule, CPI = earned value (the earned scope)/full project cost. The SPI requires an assumption that the project scope is accumulating at a sufficiently steady rate over time to allow one to assume that a project that completes only a percentage of its work on schedule has achieved only a similar percentage of its project scope. This assumption may be a little inaccurate and require that the actual pattern of the planned accumulation of the project scope (of the earned value) be carefully reviewed.

None of the prior assumptions provide a strong reason to distrust the lessons of our simple example. Minor allowances can be made for any assumption that fails to strongly hold.

Conclusion

We have seen how to combine the CPI and SPI from traditional earned-value analysis to create a conservative Reduced Scope Index (RScI). As with the two familiar indexes, an RScI value of 1.0 means all is well (or at least, all is going according to plan). An index *less than 1.0* means things are behind plan; an index *greater than 1.0* means things are ahead of plan.

The RScI gives the busy project manager a quick estimate of the total remaining possible scope, and when matched to the shape of the original plan's staffing profile, an estimate of the next month's scope. The preserved staffing profile means that the project activity will go forward as planned, with no disturbances to the working staff.

The RScI calculations, modified by a realistic assessment of our initial assumptions, allow us to estimate the reduced scope that can be achieved while preserving the orginal cost and schedule.

About the author

John M. (Jack) Nevison, PMP, is the author of six books and numerous articles on computing and management. During the course of his business career, Nevison has built and sold two businesses, managed projects, managed project managers, and served as both an internal and external consultant to Fortune 100 companies. He is a past president of the Mass Bay Chapter of the Project Management Institute (PMI®), a past president of the Greater Boston Chapter of the Association for Computing Machinery (ACM), a certified Project Management Professional (PMP), and a Phi Beta Kappa graduate of Dartmouth.

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