Bullseye chart or CPI/SPI Quadrant
How to use scatter plot to measure the performance of your project by using only two indices
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Bullseye chart or CPI/PCI Quadrant

How to use scatter plot to measure the performance of your project by using only two indices

Cost Performance Index (CPI) and Schedule Performance Index (SPI) are key performance indicators that help to measure and analyze the efficiency of a project. The (SPI) focuses on measuring the schedule efficiency, while (CPI) measures the cost efficiency. Using both indicators will help the project manager to know how far ahead or behind the project is at the point of analysis.

Formulas

\[
SPI = \frac{EV}{PV}
\]

- \( EV \) = Earned Value
- \( PV \) = Planned Value

\( SPI < 1 \) behind schedule
\( SPI = 1 \) on schedule
\( SPI > 1 \) ahead of schedule

CPI and SPI indices
Schedule Performance Index (How efficiently are we using time)
Cost Performance Index (How efficiently are we using our resources)

An earned value approach allows an early warning system that should result in schedule and/or cost savings.

**Combining SPI with CPI**

A CPI > 1 (CPI greater than 1) indicates that the project is over budget. So, when this is combined with the situation when SPI < 1 (SPI less than 1), which indicates that the project is behind schedule, conclusions could be drawn that the project is under budget but behind schedule. In other words, the tasks performed were efficient, but more of them should have been performed by now (the time of analysis). This also means that no enough resources have been allocated to the control account and less complex work is being performed, the skill mix being used is different from plan, or that the actual rates applied are less than plan.

A condition where CPI is less than one and SPI is greater than one could indicate that the project is over budget but ahead of schedule. There may have been overstaffing relative to the approved plan, more costly personnel were used, or the planned costs have been underestimated. Often, of course, there is a combination of these factors.

<table>
<thead>
<tr>
<th>SPI</th>
<th>CPI</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;1</td>
<td>&gt;1</td>
<td>understaffing and/or less expensive (experienced) resources</td>
</tr>
<tr>
<td>&gt;1</td>
<td>&lt;1</td>
<td>Oversstaffing, more overtime work hours and/or Underestimated</td>
</tr>
</tbody>
</table>

**Reporting**

SPI & CPI measurement is a tool to focus on problem areas in order to implement earlier corrective measures. The calculations also help in identifying the risk factors, these factors can become unfavorable and direct drivers to cost and schedule.

Primavera offers an excellent capability to show, among others, these two indices.

The following example will show an analysis was made with P6 using The CPI and SPI two identical projects been executed by two different teams.

**Example 1**

Two identical houses A and B need to be renovated, the budget and planning for both houses are exactly the same. The renovation work at both houses were started at the same time, but there were two different teams working, each team has its own working method, capacity and experience.

After 2 months the owner wanted an analysis to the performance using the Schedule that include two extra columns, CPI and SPI, so he asked for project update at week 9. He received the following:
The owner compares only the two performances from Primavera P6. The indices have the following readings:

<table>
<thead>
<tr>
<th></th>
<th>CPI</th>
<th>SPI</th>
</tr>
</thead>
<tbody>
<tr>
<td>House A</td>
<td>0.85</td>
<td>0.87</td>
</tr>
<tr>
<td>House B</td>
<td>0.94</td>
<td>1.09</td>
</tr>
</tbody>
</table>

To put this in an X-Y scatter graph:
The owner concludes the following:

House A has a bad cost indication but also not efficient planning rates or skill quality of workers? House B has a better CPI index (lower cost than house A) but it’s resources are exhausted. The two teams should learn lessons from each other. Team A should investigate where the bleeding comes from, team B should investigate the above norm workers efficiency. Maybe he should lend some labor to team A.

The owner sees also that house A is behind schedule, at the contrary house B is ahead of schedule.

As good way to monitor and control the shift of CPI and SPI through the age of a project, you need to build these two indices in your schedule and have mechanisms to track it, it’s not complicated but the insight it can give on reporting is very powerful.

In the next example, I will put the two indices per time interval in one graph and monitor them.

**Example 2:**
An unknown project, its data shows the following in the first 7 weeks:

<table>
<thead>
<tr>
<th></th>
<th>SPI</th>
<th>CPI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1</td>
<td>0.50</td>
<td>0.78</td>
</tr>
<tr>
<td>Week 2</td>
<td>0.62</td>
<td>0.89</td>
</tr>
<tr>
<td>Week 3</td>
<td>0.86</td>
<td>0.81</td>
</tr>
<tr>
<td>Week 4</td>
<td>1.01</td>
<td>0.89</td>
</tr>
<tr>
<td>Week 5</td>
<td>1.02</td>
<td>0.95</td>
</tr>
<tr>
<td>Week 6</td>
<td>1.10</td>
<td>1.00</td>
</tr>
<tr>
<td>Week 7</td>
<td>0.95</td>
<td>1.04</td>
</tr>
</tbody>
</table>

Visualizing these numbers in a graph we will have:

You can see that the start is not encouraging, but through the time things get better and the indices is heading towards the value of 1. Note that SPI always tends to get close to 1.0 as we reach end of the project, can you guess why?

A better way of visualization the history of CPI and SPI values is to show these two indices per period through an X-Y scatter graph:
Scatter graph explained:

the vertical (y-axis) is CPI, the horizontal (x-axis) is SPI. A CPI (BCWP/ACWP) below 1.0 is bad if it was 0.8 then for every €100 you spend of actual cost you only achieve €80 of the budgeted work. Similarly, an SPI (BCWP/BCWS) below 1.0 is bad again if was 0.8 then you are only performing work at 80% the rate you scheduled it at. So, the bottom left is “double bad”, behind schedule and over budgeted cost. The top right is “double good”, ahead of schedule and under cost. A point at (1,1) is where you want to end up. Each reporting period will give you a point on the x-y scatter graph.

Analysis of the first 7 weeks of the project depending only on the data of CPI and SPI:

From this example we can see that work starts with low budgeting and low rate. In the next three weeks, there will be some efforts going on and attempts made to increase the efficiency. At week 6 there will be a boost in rate caused maybe by replacement of team by a better, more experienced and lower cost/unit one. At week 7 there is a correction in situation which leads two indices to head toward the (1,1) point, the Bullseye!

We don’t know about the whole project duration or cost, all we know is these two indices for the first 7 weeks and yet we can make some judgements on the efficiency of the project. Conclusion is that the project starts low spending and bad control on efficiency, later things get better and maybe too good to be true! at the end it shows that there is some correction and the project is on the track. Most likely the project will end up above budget as a result of the performance of the first 4 weeks.

Bullseye Chart
Another example, from petroleum engineering:
Often for Drilling Engineers evaluating historical drilling operations and contractors where the actual performance was not in accordance with plan, can be a challenging, especially if you have a large volume of historical wells and very little time to filter through them.

The Bullseye Chart is an effective method to construct and easily communicate about the efficiency of a project.

About Azad Pasha
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Planning for me is not only a time tool - it's also costs, benefit, funding, risks and Cash flow. It's the base of any Business unit/plan. Connect with me on LinkedIn