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Leading Indicators in Technology Development Project Management

Introduction

A requirement of good project management is a control system, a way of measuring progress and assessing health. “A project monitoring system involves determining what data to collect; how, when and who will collect the data; analysis of the data; and reporting current progress.”¹ The most common controls in project management focus on the cost and schedule aspects of the cost-schedule-quality equilibrium (the three key variables in project management), generating project indicators that focus on these two areas.²

What are these indicators actually measuring for the project manager? Is the project manager looking backwards at what happened, looking at current status, or looking forward to the future? In developing new technology, all three equilibrium areas need to be monitored equally. Many new products have under-delivered or failed because of a perception of poor quality when they were initially launched to the public (e.g., Apple’s *Newton*, Microsoft’s *Bob*, *New Coke*, etc.). What indicators were used to track quality, to assess how well these products were performing, before they were shipped to the public?

Indicator Types

Verzuh describes two traditional metrics: schedule variance (SV) and schedule performance index (SPI) metrics.³ These are lagging indicators of performance, with significant delays due to administrative overhead (e.g., data gathering, compilation, and analysis lead times). On larger projects, the performance snapshots given by SV and SPI can be weeks out of date and allow any problems to become worse before corrective action is taken.⁴

As with SV and SPI, most traditional project management indicators are lagging (e.g. days lost due to injuries). They inform the project manager of where the project has been or how the project was doing in the past. Other indicators are current indicators, highlighting where the project is (e.g. costs incurred to date).

Lagging and current indicators inform the project manager (PM) of what has happened but not what is or what will be occurring. Most common project indicators focus on actual-to-planned dates or schedule-to-cost comparison metrics. While knowing the rate at which money has been spent is useful, it does not indicate whether the work is being done correctly.⁵

¹ Clifford F. Gray and Erik W. Larson, *Project Management: The Managerial Process* (Irwin/McGraw-Hill; 3rd Ed., 2005), 411

² Eric Verzuh, *The Fast Forward MBA in Project Management* (John Wiley & Sons, 2nd Ed., 2005), 305

³ Verzuh, 315

⁴ Project Management Institute: College of Scheduling, “Leading and Lagging Indicators of Project Schedule Problems,” <<http://www.pmic.org/topics/dec2006tom.pdf>> (December 2006)

⁵ Verzuh, 311

These two types of indicators, while useful, do not help the PM predict the future, to know what areas are likely to become troublesome or when a project will be complete. Traditional indicators are not generally indicators of quality but instead focus on the cost and schedule aspects of a project, ignoring quality as hard to measure and less relevant. Leading indicators are needed for a PM to assess all three project aspects properly, including leading indicators of quality.

Leading Indicator Usages

Leading indicators are forward looking and when well crafted, can help the project manager know where to apply attention to a project. Leading indicators are commonly used in economics, to determine how national/global economies will be performing in the future. In the USA, a composite indicator (i.e., a collection of individual indicators) called the Index of Leading Economic Indicators is a compilation of 11 indicators found to be the best predictors of future behavior.⁶ By aggregating these individual indicators, economists have created a reliable metric that can be utilized to predict the likelihood of the national economy expanding, slowing, or contracting.

Other examples of leading indicators are in safety and medical applications. A common use in occupational safety is accident prediction, where it matters more how accidents can be prevented in the future than knowing how many accidents have happened in the past.⁷ Another usage is in epidemiology, where leading indicators can predict how diseases will spread and how to stop them.⁸ In both these examples, leading indicators are used to get to a desired future goal by using past data without focusing on the past.

For project management, just as leading indicators can predict the direction of the largest economies, they can also predict if a work breakdown package will be in jeopardy or if a project will finish on time. Leading indicators can provide a forward-looking assessment of quality as well as schedule prediction. This allows the PM to know how well the product functions, how well it is meeting customer requirements, and when to adjust resources as necessary so that an on-schedule, on-cost, and on-quality project will be delivered.

Leading Indicator Challenges

A challenge with leading indicators is that they need to be developed for specific types of projects. In order to assess their accuracy, they have to be tested so the project manager will have confidence in their predications and will be willing to take those predications back to stakeholders and the sponsor with confidence. The Hawthorne effect⁹ also needs to be considered, to ensure that what is being measured does not affect the results.

⁶ Investors Guide, Leading Indicators Explained, <<http://www.investorguide.com/igu-article-288-economic-trends-leading-economic-indicators-explained.html>> (N.d.)

⁷ Great Safety Performance, National Library of Medicine, National Institutes of Health, <http://www.ncbi.nlm.nih.gov/sites/entrez?cmd=Retrieve&db=PubMed&list_uids=15635932&dopt=Abstract> (December 2004)

⁸ Finding Leading Indicators for Disease Outbreaks, Journal of the American Medical Informatics Association, <<http://www.jamia.org/cgi/content/abstract/14/1/76>> (October 26, 2006)

⁹ Wikipedia, s.v. "Hawthorne Effect," <<http://en.wikipedia.org/wiki>> (March 2006)

Using a software development project as an example, traditional indicators have been:

- reviewing how many lines of code have been written
- how many hours have been spent on developing a discrete module,
- how many functions have been developed of the total planned

These traditional indicators are lagging and do not inform the project manager of how well the remainder of the project will run. These indicators also do not reinforce good programming or people management practices and do not concentrate focus on the integrated final product—discipline that a good PM wishes to reinforce. They are easy indicators to obtain from engineers who do not like reporting status but know what they are doing. These indicators provide an easy solution for engineers to report technical information with little actual data content—“technical expertise will rarely compensate for lack of communication skills.”¹⁰

Even if agile programming methods are not used, agile project management metrics¹¹ can provide the leading indicators needed for good project management. Instead of measuring lines of code developed, the project manager can measure features completed vs. features remaining. To avoid the Hawthorne effect, measure customer satisfaction for features and not engineering status of features. This provides an additional benefit of not reporting a feature complete until the customer is satisfied that it is complete.

Leading Indicator Values

How much planning and control is enough? That depends on the three aspects of projects from Frame: Project Complexity, Project Size, and the Level of Uncertainty.¹² Frame suggests that small projects should become concerned about over-planning and excessive controls when administrative costs exceed a 15-25% range. Even small projects require some planning to avoid falling behind and finishing late.

The total of a project’s costs includes not only its production costs but also its administration costs. Metrics are administration costs so project managers should chose the right set of metrics to provide a good picture of project health. A mix of lagging, current, and leading indicators will provide a complete picture of a project’s past, present, and future health.

Good PMs should review all of the available indicators and select the right mixture for their projects. To achieve the right mixture of project status, leading indicators should not be added to the lagging and current indicators but instead should replace some existing indicators. The project dashboard that results from a wise selection should not increase the administration costs but will increase the data accuracy.

Summary

MST 512 has emphasized the need for proper upfront planning and definition of a project. While much emphasis has been placed on understanding the work breakdown packages and

¹⁰ James A. Bent, “Project Controls: An Introduction,” in *Project Management Handbook*, ed. David I. Cleland and William R. King (John Wiley & Sons; 2nd Ed., 1988), 572

¹¹ Leading Answers, “Most Software Development Metrics are Misleading and Counterproductive,” <http://leadinganswers.typepad.com/leading_answers/2006/09/most_software_d.html> (September 11, 2006)

¹² J. Davidson Frame, *Managing Projects in Organizations* (Jossey-Bass; Rev Sub Ed., 1995), 168-169

schedule, cost-schedule-quality equilibrium must be maintained. By spending time and using a disciplined approach to indicator selection, a project's dashboard can be well constructed.

A key component of this dashboard is leading indicators. By choosing indicators that have been accurate in past or similar projects, the PM can predict probable problems earlier, before they come serious. This should decrease the delay between issue discovery and corrective action, increasing project efficiency. The cost-schedule-quality equilibrium can then be more tightly maintained and better project deliverables will result by using leading quality indicators.