

Improving Measurement Plans from multiple dimensions: Exercising with Balancing Multiple Dimensions - BMP

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Abstract

“Tracking & Control” activities in software projects are most often based, in industry, on just two dimensions of analysis: time and cost. Most often, ‘tracking & control’ excludes other dimensions (such as quality, risks & impact on society, stakeholders’ viewpoint in a broader sense) taken into account in Performance Management models such as EFQM or the Malcolm Baldrige model. How can balancing those multiple concurrent control mechanisms across several dimensions of analysis be done? Balancing Multiple Perspective (BMPs) is a procedure designed to help project managers choose a set of project indicators from several concurrent viewpoints. This paper also presents the related questionnaire with a list of 14 candidate measures helping to compare the “as-is” situation and to figure out what will be the desired one, including cost figures to be possibly considered in the budget for next projects. .

Key words – BMP, Multi-perspective, Balanced Scorecard, QEST/LIME, Project Management

1. Introduction

There has been considerable interest over the past years in how projects should be tracked and controlled, including a greater demand for Project Management Professionals (PMP) certifications. There has been as well a greater attention to the way a project could be more productive and less defect prone, but often not as much attention to the project budget allocated for those tracking & control activities. What is the project budget percentage dedicated to those activities: 1% or 10%? And “how much” does it cost to track & control a software project?

Only a few authors have reported in the ‘90s about this issue including Capers Jones who reported the costs of measurement in projects (one of the few studies proposing some figures about this) to be approximately between 3% and 6% for internal ones and between 2.5% and 4.5% for external ones [JONE96]. Tom Demarco, whose well-known motto about measurement has been from years “*You can’t control what you can’t measure*”, said in 1995 that “*Metrics cost a ton of money. It costs a lot to collect them badly and a lot more to collect them well [...] At its best [...] metrics can inform and guide developers and help organizations to improve. At its worst, it can do actual harm. And there is an entire range between the two extremes*” [DEMA95]. Two out of ten problems leading to failures in the implementation of software measurement programs have been reported by Howard Rubin to be the intensive usage of a single measure or (on the opposite side) the usage of too many ones [RUBI96]. What are then the options about measurement costs: to reduce and cancel a part of a measurement program in order to meet budgeted targets from an economic/financial viewpoint or could it be an issue of balancing how that budget for the tracking & control process should be spent across several dimensions of analysis (for instance: quality, risk, ethics, user satisfaction and so on)? Management tools such as the Balanced Scorecard (BSC) are based on multiple concurrent perspectives. In this paper, a procedure called “Balancing Multiple Perspectives” (BMP) is proposed to tackle this measurement issue, which procedure could be used as a tool to reinforce the choice of measures and indicators to support the design of *strategic maps*.

The paper is organized as follows: Section 2 presents the BMP, its objective and the related procedure. Section 3 discusses the initial results and the assumptions under which a test has been conducted, while in Section 4 results are analyzed and commented. Finally, Section 5 reports some conclusions and suggestions for future work.

2. BMP: Balancing Multiple Perspectives

There is generally an underestimation of the average percentage of project budget dedicated to the “tracking & control” process. The ultimate corporate objective being (obviously) profitability – as also stated in the Balanced Scorecard approach –, when fiscal quarterly results are strained, a business reaction is often a costs reduction on projects and cost-based activities, including what pertains to the “control” (and therefore measurement) function.

2.1. Objectives

A key concept in the BMP approach (Balancing Multiple Perspectives) [BUGL05a] is that the choice of actions for increasing performance does not need to be limited to *reducing cost*; increasing performance can also be achieved by *optimizing through balancing* the actual strengths and energies within a project. While *time* and *cost* are the main perspectives of interest for managers, other concurrent perspectives of analysis could be profitably taken into account as well. Of course, adding to current controls would increase the budget percentage allocated to tracking and control (“T&C”) activities. Therefore, for maintaining both constraints (increasing the perspectives of analysis under the same project budget percentage for “T&C” activities) an interesting solution is in balancing the number of measurement controls across “more-than-two” perspectives. A basic mechanism behind BMP is to make more explicit the trade-off across several dimensions of analysis. For instance, if the priority is to pay more attention to time-to-market aspects, than quality could suffer (in terms of product defects rate). Similarly, if the priority is to produce defect-free software products, a more adequate testing phase might be required, increasing project costs while, on one hand, reducing the prospective project mark-up but, and on the other hand, reducing the potential rework after the release with a lower defect rate. And so on.

2.2. The Procedure

The BMP procedure for controlling multiple concurrent dimensions consists of four steps (which could be performed jointly by a project manager and his quality assurance assistant):

- 1) Determine the dimensions of interest in the project: at least three dimensions (four or five, as in EFQM, Baldrige, BSC);
- 2) Determine the list of the most representative measures associated with each dimension;
- 3) For each of the measures selected, identify which other control variables might be impacted negatively (e.g. counter-productive impacts: for instance, higher quality will often mean a greater initial cost or longer project duration; the same applies to cost and risk;
- 4) Figure out the best combination of indicators and the causal relations between them in order to build a measurement plan for the project.

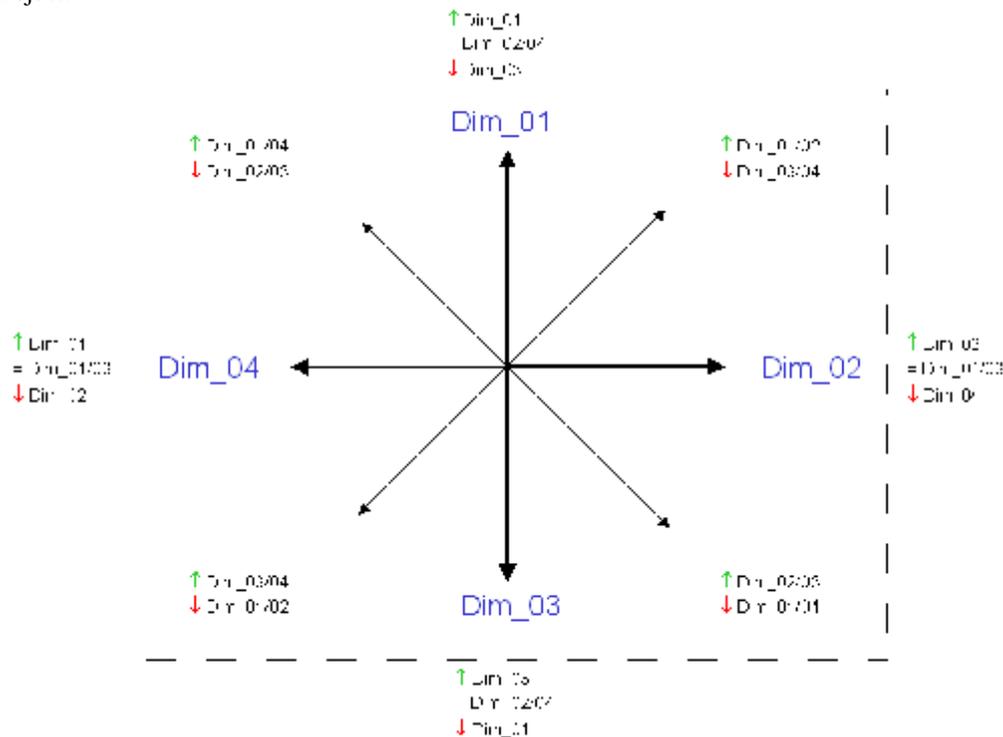


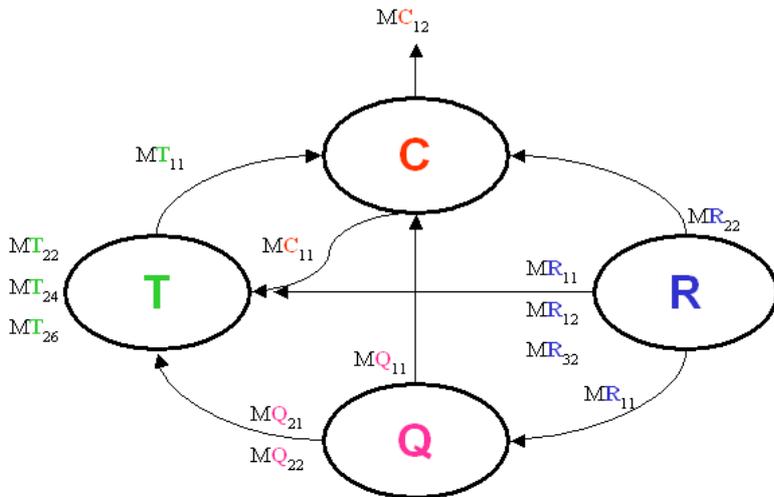
Figure 1 - A generic four-dimensional BMP

2.3. Causal Relationships

It is not sufficient to perform steps #1 and #2 for designing a measurement plan within an organization: in such a context, this produces only a list of measures (often, project goal-based derived and classified by dimension of analysis - e.g. time, cost, quality, risk, ethics, user satisfaction). The added value from this list can be leveraged out if relationships among those goals (measured and tracked against their targets over time) are established in the planning phase of this measurement plan, defining what Kaplan & Norton called the *strategic map* [KAPL04].

Hoffman recently asserted “One problem comes from a lack of relationship between the metrics and what we want to measure [...]. And a second problem is the overpowering side effects from the measurement programs” [HOFF00]. An

example of linkages is presented next in the context of a BMP analysis with four perspectives (Time, Cost, Quality, Risk), using a set of core measures from the PSM Guide [DOD03].



Time	<ul style="list-style-type: none"> • MT₁₁ – Milestone Dates • MT₂₂ – Problem Report Status • MT₂₄ – Change Request Status • MT₂₆ – Test Status
Cost	<ul style="list-style-type: none"> • MC₁₁ – Earned Value • MC₁₂ – Cost
Quality	<ul style="list-style-type: none"> • MQ₁₁ – Defects • MQ₂₁ – Defect Containment • MQ₂₂ – Rework
Risk	<ul style="list-style-type: none"> • MR₁₁ – Staff Experience • MR₁₂ – Staff Turnover • MR₂₂ – Functional Change Workload • MR₃₂ – Resource Utilization

Figure 2 - Indicators by perspective and causal impacts

3. How to Apply BMP

3.1. BMP-Questionnaire

In order to apply BMP and derive some comparable data over time, a questionnaire - available also from the SEMQ website¹ was built. It is structured with four main sections:

1. Respondents profile & viewpoints – how many years of experience and perspectives do respondents represent? The first objective of BMP is to balance measures across multiple perspectives and enlarge the scope of (project) measurement without limiting it to the time and costs perspectives.
2. Measures – an organization can decide to apply its own measures. However, for comparability sake, we decided here to choose a set of measures 67 measures/indicators suggested by the PSM (Practical Software & Systems Measurement) Guide version 4.0b [DOD03]. This set of measures covers at least four of viewpoints suggested in the Introduction section (time, cost, quality and risk).
3. Causal relationships – this is getting greater visibility in ISO 9001:2000 organizations and in organizations having implement software process improvement (SPI) programs (i.e. using CMMI or SPICE models). ISO 9001 indeed introduces in Clause 8 (*Measurement, analysis and improvement*) the need for a continuous improvement through a measurement process. As in the Plan-Do-Check-Act approach, data analysis for corrective or preventive actions requires to test some hypotheses about the relationships among the processes of the quality management system (QMS).
4. Cost for the “Tracking & Control” process – there is often a misconception about the way measurement has to be classified from an economic viewpoint. Is it an individual visible cost item or should it be included in the “control” process? And, how much does it cost on average to measure a project? Because one of the main failure causes for measurement programs is the management perception that measuring is too costly, it is fundamental to better understand measurement to ensure that the right things are being measured,

3.2. List of possible indicators

A detailed list of measures selected for the Balancing Multiple Perspectives (BMP)-Questionnaire is presented in Table 1 for obtaining useful information about the current and desired measurement program both from a technical and an economic viewpoints.

4. BMP application: first results & feedbacks

Some experimentations and public presentations were conducted over the past months, proposing BMP as a way for rethinking about measurement programs both from a teaching viewpoint (at ETS in a university environment) as well as from an industrial one (at the Italian Software Metrics Association) [BUGL05b]. Some of the insights gained are:

- From a teaching viewpoint: it seems to simplify the way for explaining the ISO/IEC 15939:2002 Information Model and introducing the cause-effect linkage among development processes, as a useful foundation for ICT Balanced Scorecards (BSC). Again, it is a way to point out to practitioners and students that there are plenty of well-proven and established measures within the Software Engineering domain, but also that each Measurement Program must be built

¹ http://www.geocities.com/lbu_measure/qestlime/bmp.htm

having in mind that unique situation and that every measure should be designed and verified to be effectively *goal-driven*.

- From an *industrial* viewpoint: a key result has been to increase awareness about cost-benefit analysis in implementing (or not) a certain measure/indicator within their current QMSs. In particular, the questions about how much does it cost the “T & C” phase has stimulated industry people to learn more and more about the effort/cost of splitting of their projects by SDLC phase, because in many cases the answers have been: don’t know. Our recommendation for decision making about the costs for measurement in a project is the application of the *Test Selection Algorithm* [ABUT05] within the context of a Measurement Program (each measure has its own cost from its definition till the project closure, within a budget constraint): the point stressed is again in terms of balancing the current available amount of budget and not to simply cut controls. And from that perspective, the issue is: what are the drawbacks of deleting or adding some controls? Finally, it was also recommended to re-label such measures and indicators as project “controls” to provide a better match with managers’ responsibilities.

1a	1	Respondents profile by project role (# and %)
	2	Experience profiles for current project role (# and %)
1b	3	# analysis viewpoints (OLD)
1c	4	# analysis viewpoints (NEW)
2	1	# selected measures (OLD)
	2	# selected measures (NEW)
	3	# affected viewpoints (NEW)
	4	Avg of measures by viewpoint (# and %)
	5	Ranking of selected measures by: abs value, respondent project role, analysis viewpoint
3a	1	List of causal relationships among measures
	2	Ranking of relationships by: abs value, respondent project role, analysis viewpoint
4a	1	% respondents knowing amount of costs for m&c (<i>monitoring & control</i>) activities
4b	1	Max, Min, Avg and Med for the returned values (%) – OLD
4c	1	Max, Min, Avg and Med for the returned values (%) – NEW

Table 1 - *A first list of indicators from the BMP-questionnaire*

5. Conclusions & Prospects

One of the issues raised when discussing about “tracking & control” in software projects is the amount of budget to allocate in absolute terms, with little room for evaluating whether there is a proper balancing in terms of perspectives addressed by these controls. Usually there are two perspectives almost always addressed (time and cost), while other ones (such as quality, risk, ethics and so on) are only occasionally taken into account, eventually assigning them the responsibility for any additional costs for new controls to be implemented on projects. The key for optimising “tracking & control” activities while making projects more productive is not necessarily in eliminating controls, but could also be in balancing them to cover and balance to tackle a greater number of viewpoints. This paper has presented an overview of a proper usage of BMP (Balancing Multiple Perspectives), introducing a set of possible measures for data gathering and analysis based on the BMP-questionnaire. Future work will include data gathering using the BMP questionnaire and, with a proper amount of data, analyzing how it can facilitate the definition of the BSC strategy map, including choosing indicators for each perspective and mapping them to the possible dimensions of analysis (e.g. Time, Cost, Quality, Risk, ...) and looking for a double-check balancing.

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