

A Software Process Tailoring System Focusing to Quantitative Management Plans

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Abstract. This paper presents a survey about use of quantitative management indicators in a Japanese software development organization. This survey is conducted in order to investigate possible criteria for selecting and customizing organizational standard indicators according to the context of each project. Based on results of the survey, we propose a process tailoring support system that is mainly focusing to quantitative management planning. The system EPDG+ (Electronic Process Data Guidebook Plus) helps project planners select / customize indicators to be employed in process control. Derived software project plans including measurement and analysis activities can be browsed in detail with this system.

1 Introduction

Quantitative management, i.e. the quantitative control in both of quality and schedule management is a key factor of the software processes. The quantitative management requires *indicators* based on quantitative data. Generally, we need to select indicators according to the context of each project, and then we also need to plan the activities for both of measurement and analysis of quantitative data that is required to derive the indicators. Organizations in a certain level of capabilities (e.g. CMMI-staged[1] level 3) usually define their own set of the project management indicators. Thus project planners must understand the purpose of each indicator, select/reject it according to the context of each project, so that activities for measurement and analysis are planned properly. This work is often very difficult for novice planners without sufficient knowledge of quantitative management.

In this paper, we report the survey about the use of indicators in a Japanese software development company (though we are not allowed to disclose the detail of the company, including its name, in this paper). This survey was conducted in questionnaire form in order to design the features of the process tailoring support system EPDG+ (Electronic Process Data Guidebook Plus) that is being developed by us. EPDG+ mainly focuses to the quantitative management, having features to expose appropriate indicators according to the context of each project based on the master list of organizationally standardized indicators. EPDG+ also supports to integrate the measurement and analysis activities required for selected indicators into an engineering process at project planning.

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2. Related Work

Many studies and standards related to quantitative management have been done since it has direct influence to the improvement of productivity and quality. ISO/IEC15939[2] shows the framework for software measurement, analysis, and construal to achieve various information needs, such as project management and quality assurance. Information structure handled in the measurement and analysis process is specified as a reference model as shown in Fig.1.

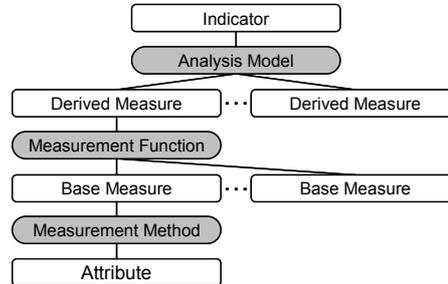


Fig.1 Measurement information model in ISO/IEC15939

This model shows the way which eases objective decision-making based on quantitative information by associating well measurable attributes characteristic to process or product in a project, such as development scale, effort, and number of defects, with the indicator for decision making[3]. Thus, the primary data called *base measure* is collected by quantifying various attributes which exist in a project according to the defined measurement method. Then, the secondary data called *derived measure* is derived by assigning some base measures to measurement function. Finally, the indicator is obtained by analyzing these measures according to the defined analysis model. A project manager makes decision according to the finally derived information product with decision criteria. At the following discussions, we use this concept and the terms based on ISO measurement information model.

Meanwhile, several EPG (Electronic software Process Guidebook) systems are proposed in the past (e.g. [4]). Most of them mainly focus to support to understanding of the prescribed software process. Our approach is also capable of this field. though our current focus is how to utilize the information models, such as definition and flow of quantitative data, required by quantitative management. The ISO information models are useful and very important for the process tailoring.

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3. Survey of the Current Status of Used Indicator

3.1 Background

In this study, we consider software development organizations, which perform following two practices, as targets of our approach to support quantitative management planning.

- Every project is planned and performed based on the development process which is defined as organizational standard, typically, in the form of WBS (Work Breakdown Structure).

- The indicator set for quantitative process management is prepared as an organization standard.

When quantitative management is to be planned, selecting appropriate indicators and integrating associated measurement and analysis activities into the project plans are to be performed. However, the definitions of standard indicators are shortly described in the natural language and almost none of formal explanation about an analysis model, function definition (i.e. calculation method), or a measurement method is provided in many organizations. Moreover, explicit tailoring guidelines are not provided. Inexperienced managers have great difficulty in selecting appropriate indicators for their project.

In order to develop the assistance system for novice managers to select and to customize standard indicators to fit their projects, we have conducted a survey to 17 projects in a Japanese software development company to see actual status of indicators selection and customization in industries at first.

3.2 Survey Outline

The survey was conducted by using the questionnaire for project managers who applied quantitative management in a software development (enterprise software system development section) with hundreds of employee. We sent the questionnaire to project managers in the company mainly asking about actual use of their organizational standard 45 management indicators. They are used for progress management, review tracking, testing, process quality assurance (PQA), requirement management, support process.

The first part of the questionnaire is questions about the profile of the project, such as project size, business area, and the profile of manager, e.g. months of experience as project manager and the number of project s/he ever managed.

The second part (main part) of the questionnaire is a list of indicators; for each indicator, questionee is requested to specify the extent of use. The extent of use is at first categorized into two answers, "Used" or "Unused". Then each answer is divided in to more detailed ones. "Used" is divided in 5 answers, and "Unused" is divided in 5 answers. The concrete reason why they used/unused the indicator is optionally provided.

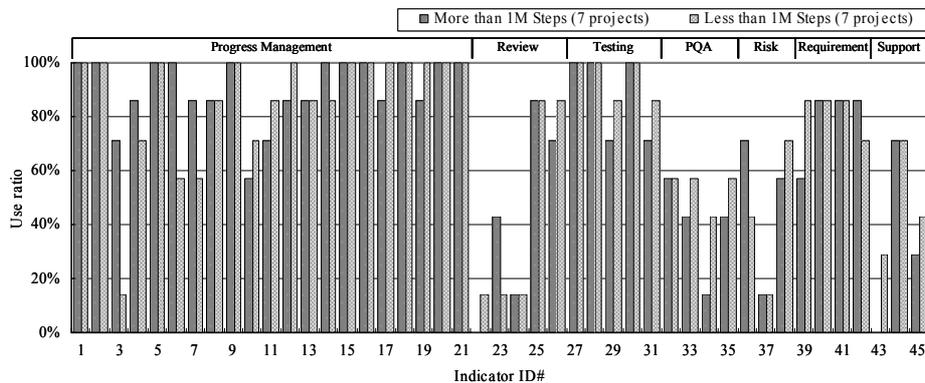


Fig.2 Summary of the use ratio (used vs total) for each indicator

3.3 Results and Analysis

At first, we summarized usage data simply in two categories, “Used” or “Unused”, to get rough trends of the answers according to product size (either less or more than 1 million steps) as shown in Fig.2. Then we proceed to detailed analysis regarding manager’s experience (either less or more than 4 years) and also detailed level of indicator use. Since we had to exclude 4 samples without product scale information in program steps, 13 project samples are used in following analysis. This analysis is done because we assume novice managers of small projects would need systematic assist to selection and adaptation of standard indicators to fit the project size, meanwhile most indicators would be employed in large projects regardless of the experience of the managers.

As analysis results, we currently have following observations:

- Indicators for progress management, testing, and requirement management are used in most projects, except one indicator (#3 for tracking the delay of progress report meetings). Indicator #3 is employed in the large project group, but not employed in the small project group. We got a comment from a small project manager that there is little possibility of delay of meeting in small projects.
- Indicators for review tracking, for PQA, for risk management, and for support process showed low rate of use (reasons for these tendencies is not clear at this point).
- In the small project group, we found that experienced managers use many modified or alternative indicators, while novice managers seldom do such adaptation. We got a comment that experienced manager often use alternative information that is available with less cost, and omit some indicators according to their practical situations.
- In both of the small and large project groups, indicators #22~24 for tracking the effect of review are not employed by any projects. Furthermore, a few of experienced managers answered that they don’t sufficiently understand the definition and usage of those indicators.

These observations just show trends of the indicator use in one organization “as-is”, and we need to be careful to generalize it. However, we found those observations are actually valuable in considering systematic supports for selection and adaptation of indicators. We actually had following insights in designing the features of EPDG+:

1. As we observed, contexts of the project influence the use pattern of the indicators. By extracting influenced factors according to various project contexts, we will be able to provide indicator candidates to be employed. In order to accomplish this, further survey to more projects and more organizations are needed.
2. Alternation and modification made to standard indicators by experienced managers may be exposed to inexperienced managers as supplemental information of management planning. In order to accomplish this feature, functions to customize the standard indicators, to store them for future reuse, and to expose inherited indicator variations are needed.

Furthermore, by accumulating the such customization records, EPDG+ system itself will make this kind of survey quite easily and inexpensive.

4. Designing and Prototyping EPDG+

The EPDG+ system is an extended version of EPDG (Electronic Process Data Guidebook) system[5] which scopes to help to understand the process data definitions for analysis and measurement. EPDG+ extends its scope to project planning. It supports a tailoring in planning measurement and analysis activity depending on the characteristics of the project based on quantitative management.

Tailoring support is typically provided according to the following scenario. In this scenario, the work flow is assumed that the planner inputs a process description without management plan, integrates management plan based on quantitative management, and then outputs a process description with management plan.

1. A user inputs a process description, and specifies characteristics of the project to the system.
2. A user refers to the indicators that the system has exposed, and selects indicators.
3. A user browses the plan provided by the system in a graphical way (see Fig.3), and confirms excess and deficiency in the measurement and analysis activity.
4. If necessary, planner will return to step 2, and modifies indicator selections.
5. Once all indicators to be used were decided, project process with quantitative management plan is generated.

There are two major features of EPDG+ as follows:

- **Indicator recommendation:** Organizational standard indicators are listed with rating information based on various criteria. Rating based on records of indicator employment in the past projects with similar profile may be one useful criteria.
- **Browser of process with measurement and analysis activities integrated:** In order to confirm measurement and analysis activities in the process while planning, this feature enables to browse planned processes with integrated measurement and analysis activities.

Fig. 2 shows a screenshot of the prototype system. The system window consists of three panes for process structure overview, zoomed detail of the process indicating measurement and analysis activities, and indicator explanations and examples.

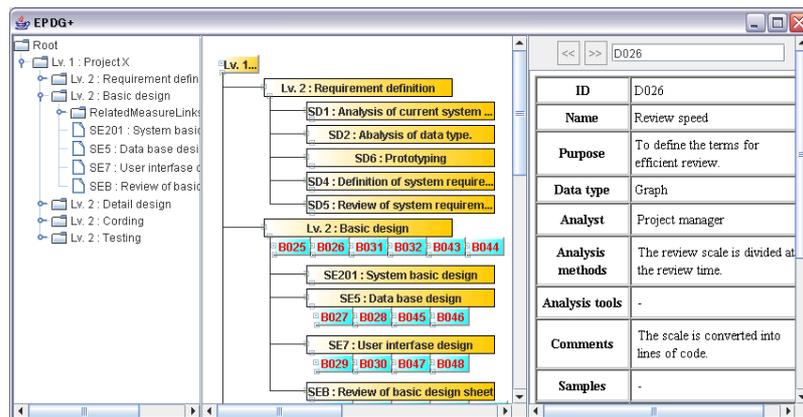


Fig.3 A Screenshot of the EPDG+ prototype for WBS-style process descriptions.

5. Conclusion

This paper mainly presented a survey of organizational indicator use for the systematic support to process quantitative management. From the observations we confirmed that quantitative management indicators are actually selected and tuned in hand to fit to the characteristics of each project, and therefore systematic support to indicator selection and modification will be great help to efficient project management. Our EPDG+ is currently under development and it is planned to be integrated to the guideline system for a software company's managers.

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