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A Study on Tool for supporting the Software Process Improvement based on ISO /IEC 15504

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Abstract

In the current marketplace, there are maturity models, standards methodologies and guideline that can help an organization improve the way it does business. Software process assessment models, ISO/IEC 15504 and CMMI provide a tool to assess your organization's software development capability. Experienced assessors make these assessments. However these models don't supply systematic metrics for software process assessment. Therefore the assessors have used their subjective estimations for quantitative measurement in their software process assessment. This paper defines the basic metrics and presents the standard metrics in categories of process defined by ISO/IEC 15504 to assess software process quantitatively and objectively. In addition, presents an essential guideline to identify your organization's condition by suggesting a process maturity assessment metrics to apply the standard metrics to your organizations.

1. Introduction

The quality of a product depends on quality of a process is a known fact. Many industrial software organizations have put effort to improve their software process, which based on ISO/IEC 15504, CMMI. To improve the quality of software and their organization's software development capability and productivity, various approaches have been tried. Process assessment enables to identify the process capability, and based on the resulted assessment you can expect an enhancement of the process by identifying your process strengths, weaknesses and risks and preventing them. This paper intends to present the methods of how to design standard metrics and apply them, on which you can assess the main process defined by an assessment model in order to measure an achievement of the process goal in their performing organization and an achievement of their activities quantitatively.

2. Basic Study

2.1. ISO/IEC 15504

Alike CMMI, ISO/IEC 15504 also assesses process maturity by identifying present process condition to support organization's process enhancement activities. It defines a Process Assessment Model (PAM) that supports the performance of an assessment by providing indicators for guidance on the process purpose. For the capability dimension, the process capability levels and process attributes are identical to those defined in ISO/IEC 15504-2. Evolving process Capability is expressed in the Process Assessment

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Model in terms of process attributes grouped into capability levels. The attributes and capability levels are identical to those defined in ISO/IEC 15504-2. Process attributes are features of a process that can be evaluated on a scale of achievement, providing a measure of the capability of the process. They are applicable to all processes. Each process attribute describes a facet of the overall capability of managing and improving the effectiveness of a process in achieving its purpose and contributing to the business goals of the organization. A capability level is a set of process attribute(s) that work together to provide a major enhancement in the capability to perform a process. Each level provides a major enhancement of capability in the performance of a process. The levels constitute a rational way of progressing through improvement of the capability of any process and are defined in ISO/IEC 15504-2. There are six capability levels in the reference model, incorporating nine process attributes.

Table 1. ISO/IEC 15504 Capability Level

Level	View of Measurement
Level 1 Performed	The implemented process achieves its process purpose.
Level 2 Managed	The previously described Performed process is now implemented in a managed fashion (planned, monitored and Adjusted) and its work products are appropriately established, controlled and maintained.
Level 3 Established	The previously described Managed process is now implemented using a defined process is capable of achieving its process outcomes
Level 4 Predictable	The previously described Established process now operates within defined limits to achieve its process outcomes.
Level 5 Optimizing	The previously described Predictable process is continuously improved to meet relevant current and projected business goals.

There are two types of process assessment indicators: process attributes indicators, which apply to capability levels 1 to 5 and process performance indicators, which apply exclusively to capability level 1. The PAI and PPI indicators in this model give examples of evidence that an assessor might obtain, or observe, in the course of an assessment. The evidence obtained in the assessment, through observation of the implemented process, can be mapped onto the set of indicators to enable correlation between the implemented process and the processes defined in this assessment model. These indicators provide guidance for assessors in accumulating the necessary objective evidence to support their judgments of capability. They are not intended to be regarded as a mandatory set of checklists to be followed, but as guidance for an assessor to support the judgment of process capability.

2.2. GQM (Goal-Question-Metrics) Approach

GQM approach involves three steps. First is conceptual step. It consists of elements such as object, purpose, viewpoint and focus. In this step, major foal are set. Second is operational step. In this step, questions are derived from the foals that must be answered in order to determine if the goals have been achieved. It asks questions about how the specific goals have been assessed or achieved. Third is quantitative step in which proper answers are given to the questions. Through the steps, a metrics system is made. These metrics can be used as a measurement tool which metrics a set of data is associated with every question in order to answer it in a quantitative way.

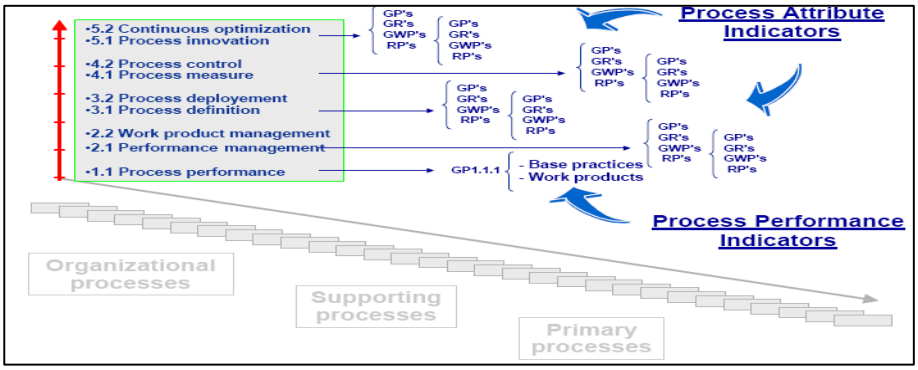

Figure 1. The relationship between assessment indicators and process capability

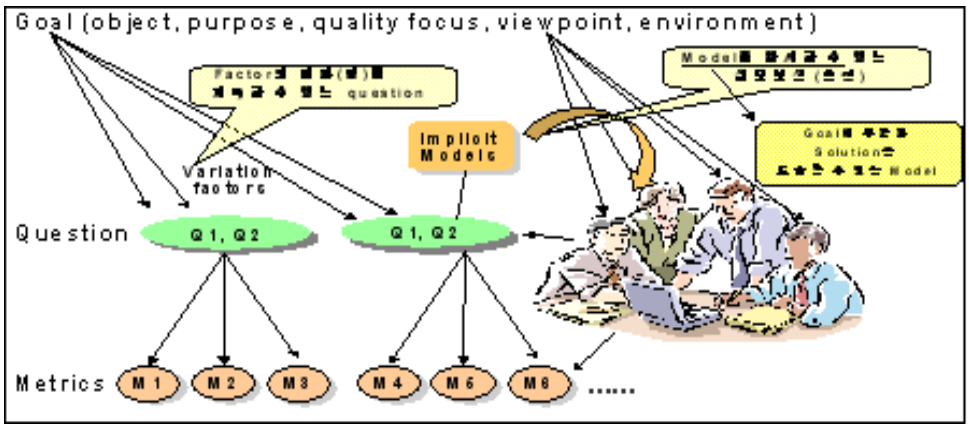

Figure 2. Composition of GQM method

3. Process Assessment Metrics of ISO/IEC 15504

To maximize the effect of organization management a metrics is required which measuring the process performance of the software project quantitatively. For an organization, to be qualified by ISO/IEC 15504 or assessed Level 4 or above by CMMI quantitative process management must be followed and all process performance (basic performance, management performance) has to be measurable. The measures in quality process management consist of the size of product, deadline, man month, cost, resource, modification, risk and defect, which are basic elements for the metrics.

For capability assessment, PA, GPI, GRI, GWPI and so forth are defined in its level and assessors fill each item with assessment point by gathering each process performance achievement. GPI item is a mandatory item to be filled. Others can be optional by assessor consultation. Making a PCMT table, you can gather relevant PCM result when you consider the following conditions: Assessment has to cover one step higher target then your objective target GPI item is a mandatory item to be filled. Others can be optional by assessor consultation. An average assessment point by many assessors can make assessment for same item. The defined PCM for process capability is $PCM = 6 \times \left(\sum_{i=1}^{n} \frac{Q_i}{100} \right) \times \frac{1}{n}$

PA2.1	Q4. Allocate and use resources to perform the process according to plan?					
	Q5. Manage the interfaces between involved parties?					
	Question of GRI					
	Goal: Performance Management					
	Q1. Organization with identified responsibilities and authorities?					
	Q2. Project planning, management and control tools, including time and cost reporting?					
	Q3. Work-flow mangagement system?					
	Q4. Email and /or other communication mechanisms?					
	Q5. Information and/or experience repository?					
	Question of GWPI					
	Goal:Performance Management					
	Q1. Monitors process performance against defined Evaluation report?					
	Q2. Report of planing?					
	Q3. Provides evidence of communication, meeting, reviews and corrective actions?					
	Q4. Contains status information about corrective actions?					
	Q5. Monitors identified risks?					
	Question of GPI					
	Goal: Workproduct Management					
	Q1. Define the requirements for the work products?					
	Q2. Define the requirements for documentation and control of the work products?					
	Q3. Identify, document and control the work products?					
	Q4. Review and adjust work products to meet the defined requirements?					
	Question of GRI					
	Goal: Workproduct Management					

Figure 3. Process Capability Metric Table (PCMT)

4. The design and implementation support tools PCM

The SPICE-based organization is trying to promote continuous improvement process accumulate experience and promote systematic analysis it is important to use either. First, can decide whether must achieve some improvement activity for formation's purpose achievement first. Secondly, can forecast effect of improvement activity Third, through experience, efficiency can establish process that is maximized. Fourth, can correspond on formation's restriction item and change of structure that do that is by improvement activity. Collect Metric measurement experiences of several companies which propelled SPICE by reason such as upside and propose an automation tool.

4.1. Requirement analysis of PCM system

Purpose of PCM system is thing to be easy and offer fast process measurement experience to organization which target improvement. Figure 4 it Use Case diagram of system be.

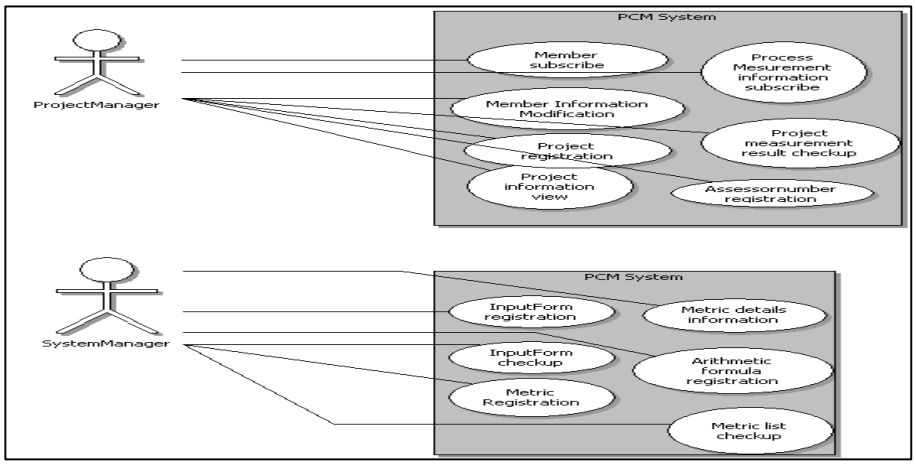

Figure 4. PCM System Use Case Diagram

Can confirm whether system must achieve some activity by offering Metric and judging items accordingly with Root Word about strength of each process.

4. 2. UI of PCM System

Divide by plan and results and input project period and dimension after input project name and feature to basis information. Take advantage of this input data and create necessary last result data in SPICE judging.

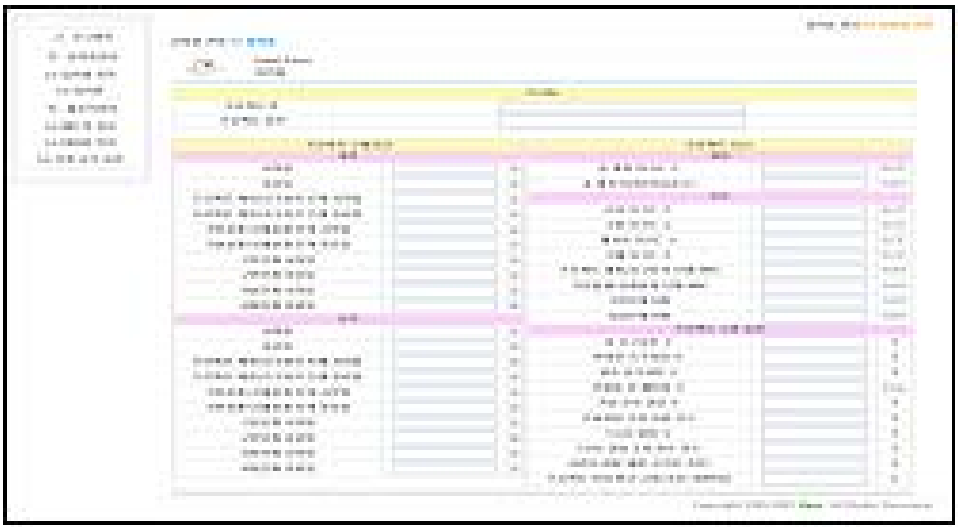

Figure 5. Project Data Registration Screen

Figure 5 relationship data to base automatically through data combination of process measurement Metric measurement result of relevant Metric show.

Figure 6. Process Measurement Metric Result Screen

ENG measurement Metric is 23, CFG measurement Metric 4, QUA measurement Metric 4 be, MAN measurement Metric defined by 8. Procure Metric measurement result and process ability level to database and keep Metric measurement experience

and SPICE judging experience collecting SPICE judging data continuously through system that propose.

4.3. Analysis and Comparison

Comparison viewpoint of method that propose in this treatise with old software process quality measurement model as well as process assessment, it is functionality and practical use gender as a measurement tool for process improvement in software development establishment oneself. Method that old model in assessment support extent proposes in this treatise whereas support function related with judging grade decision can ease continuous data collection and storing accumulation and confirm improvement effect by fixed quantity. Result of assessment is objective comparatively, and measure present state by fixed quantity and does active software process improvement direction to be predictable because is confirmed by numerical value which is quantification. Is same with table 3 if compare feature between PCM support method that propose with software process quality measurement model of old SPI method.

Table 3. Comparison

Category	existent SPI method	Proposal method
Process management's easy	qualitative	quantities
Efficiency of assessment	Passive method concurrent with a assessment tool	Automatic assessment
Accuracy of grade decision	By N, P, L, F confirmation	By percent confirmation
Continuous data collection and storing accumulation	Do not offer	quantities questionnaire

4. 4. Reliability Estimation

Measure that some method is effective and executed theoretical authoritativeness estimation of proposal method. Enforced sensitivity analysis is effective and decide precedence of SPI achievement that is quantities taking advantage of AHP(Analytic Hierarchical Process) reasoning techniques. As AHP reasoning techniques 1 step, use AHP application software Expert Choice by hierarchic structure (Hierarchical Structures) and marked weight analyzing relation between decision-making factors. Give 9 in case is good extremely. Figure 7 displays results that perform through Pairwise Comparisons EXPERT Choice tool of decision factors.

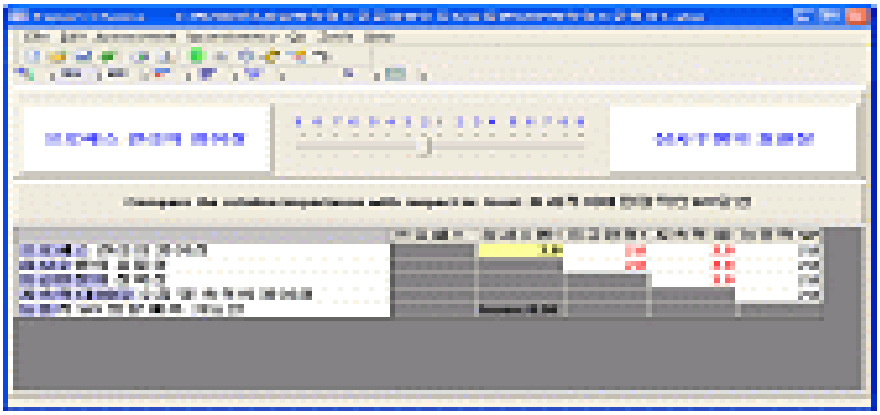

Figure 7. Pairwise Comparison

5. Conclusion

In this paper we suggest the metrics in each processes enables organizations to predict a direction for active process enhancement and to quantize present process condition specifically and to identify if the goal of process can achieve. This objective process metrics based on ISO/IEC 15504, which has not been introduced in previous process assessment models, can be expected to measure process capability and to identify the risk, problems, and condition of process performance by using these metrics. From the results of this paper, following advantage can be obtained. Can raise formation's project management process maturity, and progress situation of project can confirm easily. Quantitative project performance of an organization can be measured using PCM before it works to improve process in earnest.

Acknowledgment

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