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Refining an Assessing Model for Simplified TMM

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Abstract—Certification models, e.g. CMMI and TMMi, are hard to use most small software development organizations in Korea. Moreover, some companies do not have their own teams in charge of testing. To solve this issue, we propose the assessment method of a simplified test maturity model for small SW development organizations in local environment and. For the proposed assessment method, we consider the environment surrounding the local software industry and development teams, and then determine how to establish the assessment method. We show the proposed assessment method to apply local SMEs for their conditions, and reduces cost and labor as well as shortens the time spent on assessment in contrast to the previous models.

Keywords—Assessment Model; Simplified TMM; Test Maturity Model; CMMI; TMMi;

I. INTRODUCTION

The importance of software (SW) has been increasing in many fields along with the recent growth of convergence SW development. Figure 1 shows over 50% of software development cost across industries. With IT being widely adopted across the board, software is considered ever more crucial.

As SW takes up significant parts, the quality of software is perceived as a crucial factor in many fields, specially, in automobile and aviation industries. Yet, incidents from the insensibility of SW quality have been on the rise, e.g. the Toyota incident in 2008. Convergence software is directly associated with human, property, and data damages in our society, which is the reason why software quality should be enhanced. Thus, to secure the competitive edge of SW industry, high quality software needs to be developed.

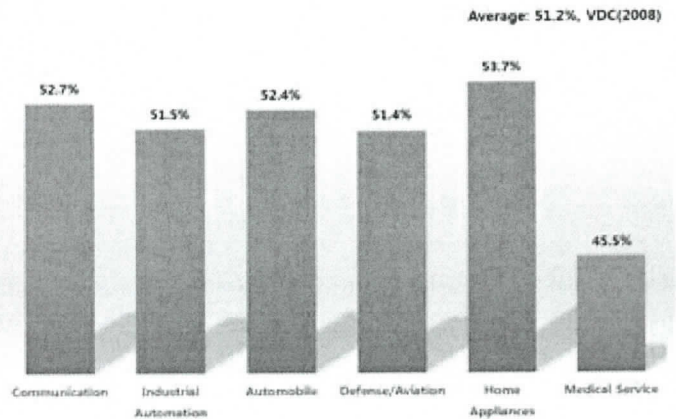


Fig. 1. Importance of SW Across Industry

To develop high quality software, quality control and roles of test teams are very important. Table 1 shows the project performance with the presence or absence of test teams. This analysis of Korean software companies indicates that companies with test teams perform projects better [2].

TABLE I. PROJECT PERFORMANCE DEPENDING ON QUALITY ASSURANCE AND PRESENCE OF TEST TEAMS

Items	Presence/absence of test team	
	Present	Absent
SW engineering	68.6	45.3
Development productivity	25.9	22.7
Late delivery	1.64%	8.30%

Items	Presence/absence of test team	
	<i>Present</i>	<i>Absent</i>
rate		
Excess cost rate	0.87%	7.32%
Operational fault density	0.131	0.268

Whilst software quality and testing are increasingly important, but problems also exist as below.

- Low quality of SW in Korea
- Corporate structure of local SW developers (SMEs account for larger parts than large enterprises)
- Indiscreet preference for foreign SW
- Lack of investment in quality due to lack of affordability
- Difficulties in securing test experts

To develop high quality software, it is necessary to organize a team in charge of software test and quality, and to continue the quality control.

To improve the quality of software, it is important to develop software in compliance with systematic procedures, and to test software developed. Currently, many local companies adopt software quality assessment models widely used across the world, e.g. CMMi or TMMi. However, not many companies employ such models due to cost burdens or lack of skilled human resources. The certification of an assessment model requires lots of time, and expenses related to assessment and consulting. These issues hinder local SMEs from adopting assessment models. Thus, it is indispensable to develop a Korean test maturity model suitable for the environment surrounding the local SW industry and developers.

This paper concerns the development of an assessment method for the Simplified TMM(Korean Test Maturity Model). This method helps establish an assessment procedure, and present an assessment method. Also, this paper analyzes the simplified TMM in comparison to the previous models. This paper comprises the following chapters. Chapter 2 covers related works and analyzes the software quality certification models, i.e. CMMi and TMMi. Chapter 3 describes an assessment model for the Simplified TMM. Finally, chapter 4 presents the conclusion and suggestion for further studies.

II. RELATED WORKS

As a method of SW quality enhancement and improvement, certification is highly important. Currently, diverse models are available for software quality certification. Also, these models vary in terms of required levels and objectives. Table 2 shows certification models and objectives.

TABLE II. OBJECTIVES OF CERTIFICATION MODELS

Goal	Model
Improving test teams	<ul style="list-style-type: none"> • TMM(Test Maturity Model) • TMMi(Test Maturity Model Integration)
Improving test processes	<ul style="list-style-type: none"> • TPI(Test Process Improvement) • TPI Next(Test Process Improvement Next)
Assessing development teams' competencies	<ul style="list-style-type: none"> • CMM(Capability Maturity Model) • CMMI(Capability Maturity Model Integration)
Measuring development processes	<ul style="list-style-type: none"> • SP(Software Process)

The present paper focuses on CMMI and TMMi among other certification models.

A. CMMI(Capability Maturity Model Integration)

CMMI is designed to efficiently support the process improvement activities for organizations. The SEI(Software Engineering Institute) at Carnegie Mellon University integrated multiple CMM models into CMMI. CMMI is applicable to process assessment and/or process improvement in view of organizational differences.

The structure of CMMI can be described with staged and continuous representation methods. This paper deals with the staged representation method only. The staged representation method has the following model structure.

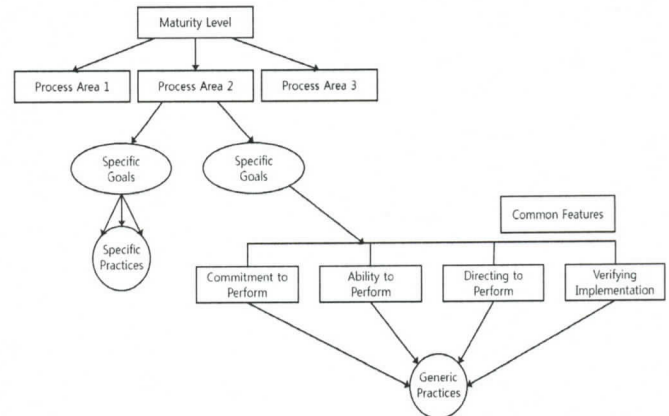


Fig. 2. Model Components in Staged Representation Method

The model components include maturity levels, process areas, generic goals, specific goals, common performance items, generic practice and specific practice. Maturity levels represent the work performance indicators in organizations. CMMI describes an organization with 5 maturity levels. Process areas refer to activities that should be performed for a given process. Each process area has goals to achieve. Goals comprise of specific goals(SG) and generic goals(GG). These goals serve as the criteria for determining if a process area is performed in an organization. Practices refer to specific activities to meet the goals defined in the process areas.

CMMI consists of 5 maturity levels, i.e. Level 1: Initial, Level 2: Managed, Level 3: Defined, Level 4: Quantitatively Managed and Level 5: Optimizing. Lower maturity levels underlie upper maturity levels. Thus, all the lower maturity levels should be met in order to reach the top maturity level.

As the assessment method of CMMI, SEI's SCAMPI(Standard CMMI Appraisal Method for Process Improvement) is used. SCAMPI-based assessment should be performed by senior SCAMPI assessors. Also, assessors use SCAMPI data provided by SEI for assessment. SCAMPI assessment data comprise an SCAMPI guide, a questionnaire and assessment templates. SCAMPI-based assessment results are applied to improve corporate processes.

B. TMMi(Test Maturity Model Integration)

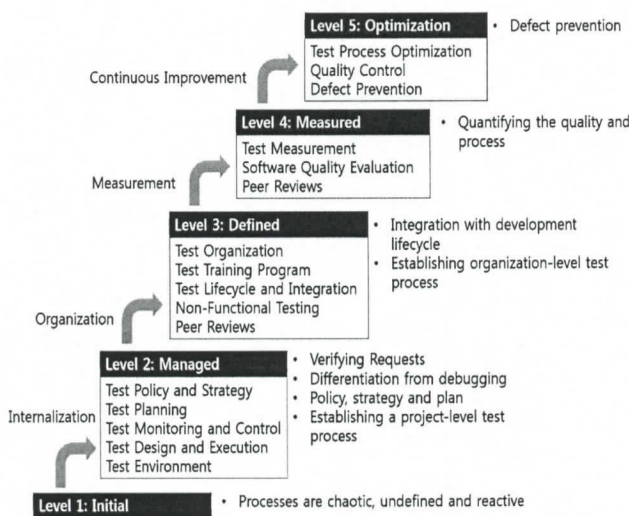


Fig. 3. TMMi Level

TMMi is a diagnosis and improvement guide model for organizational software processes released by TMMi Foundation. TMMi is a model for assessing the maturity of software test teams and for improving their processes. This model provides assessment models, procedures, assessment tools, inquiries and criteria for assessor training programs. TMMi was developed to rectify the vulnerabilities of the CMMI-based test process. Also, TMMi deals with the tests and quality process areas that are not available in CMMI and comprises 5 maturity levels.

TMMi has 5 maturity levels as in Figure 3. Each level consists of initial, management, definition, measurement and optimization. Level 1 does not have any process as TMMi is not applied. Levels 2~5 have 3~5 processes. For example, Level 5 involves such processes as defect prevention, quality control and test process optimization. Each process has several goals. If a company meets all goals, it is regarded to have the level-5 test maturity.

TMMi has 5 maturity levels, and each maturity level involves several process areas. Each process area involves several specific/generic goals. Generic/specific goals involve several generic/specific practices.

TMMi assessment method is implemented as follows. 1) TMMi Foundation approves the assessment method. 2) The assessment entity arranges assessment targets, and performs assessment based on TMMi Release. 3) Upon completion of assessment, the assessment entity prepares an assessment report. The official assessment procedure may vary with the targets and scopes of assessment. In general, the assessment is conducted in the following order: diagnosis planning -> interview and output review -> on-site analysis and deriving improvement tasks -> sharing diagnosis results -> improvement activities. The maturity level is defined based on the lowest score among the scored process areas. The score of each process area is defined with the lowest score of the goal items. Each goal is defined based on the mean score of the practice items.

III. THE ASSESSING MODEL FOR SIMPLIFIED TMM

This chapter describes an assessment model for the Simplified TMM. This Korean test maturity model targets local SMEs. Due to the small scale of local SW industry and development organizations, most companies have difficulties in applying the existing certification models in terms of time, cost and labor. Also, as quite a few companies do not have in-house test teams, the Korean test maturity model should be easy to apply. Considering the conditions of local SMEs, the Korean test maturity model simplifies the assessment procedure and outputs.

A. Assessment procedure

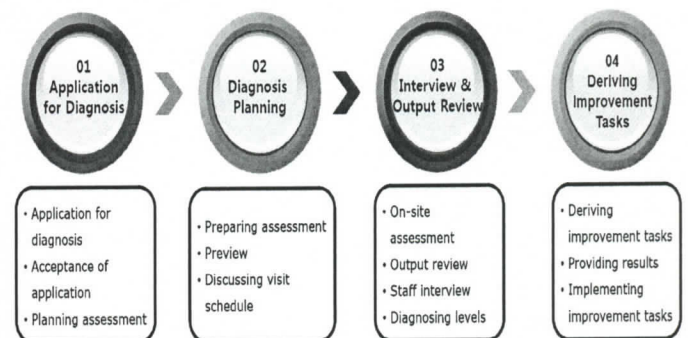


Fig. 4. Assessment Procedure of Korean Test Maturity Model

Figure 4 shows the assessment procedure of the Korean test maturity model. The procedure comprises application for diagnosis, diagnosis planning, interview and output review, and deriving improvement tasks. Once a company applies for a test maturity assessment, the diagnosis entity accepts the application and plans the assessment. In planning the assessment, the entity prepares to diagnose the applicant's test maturity and discusses the visit schedule with the company. The diagnosis entity can ask the company for data relevant to diagnosis. The company should submit the requested data to the entity. The diagnosis entity organizes an assessment team to preview the received data from the company before assessing its test maturity model. In the interview and output review, assessors diagnose the company's test maturity via on-site assessment. Assessors analyze the data submitted by the

company, identify any missing data, and interview the company's staff to diagnose its test maturity level. Upon completion of assessment, assessors derive improvement tasks and submit the assessment results to the diagnosis entity, which in turn prepares a final report based on the data received and sends the report to the company. The company implements the improvement tasks proposed by the diagnosis entity based on the final results. Table 3 shows the stepwise activities and outputs performed by the assessment entity.

TABLE III. STEPWISE ACTIVITIES AND OUTPUTS OF AN ASSESSMENT ENTITY

Step	Activities	Outputs
Application for diagnosis	<ul style="list-style-type: none"> • Acceptance of application • Diagnosis planning • Target project selection 	<ul style="list-style-type: none"> • Application form • Diagnosis plan
Diagnosis planning	<ul style="list-style-type: none"> • Requesting relevant organizational chart • Requesting selection of staff in charge • Discussing interview schedule • Preliminary questionnaire survey • Selecting assessment level • Discussing visit schedule • Organizing an assessment team 	<ul style="list-style-type: none"> • Data for assessment • Organizational chart • Staff in charge • Preliminary survey • Assessment level • Diagnosis plan
Interview & output review	<ul style="list-style-type: none"> • Reviewing preliminary survey • Interviewing staff in charge • Reviewing related documents • Preparing assessment results 	<ul style="list-style-type: none"> • Preliminary survey • Interview form • Output per level • Summary of assessment results
Deriving improvement tasks	<ul style="list-style-type: none"> • Analyzing interview and questionnaire survey • Analyzing document review results • Reporting diagnosis results 	<ul style="list-style-type: none"> • Deriving improvement results • Assessment result report

B. Assessment Method

To assess the Korean test maturity model, the method, major activities and outputs are needed in each step. To apply for the diagnosis, the company fills the application form provided by the diagnosis entity. The entity plans the diagnosis based on the submitted application form. To plan the diagnosis, both parties can discuss the diagnosis plan through phone calls, emails or visits. The entity reviews the company's organizational chart and selects the assessment levels. Also, the diagnosis entity selects the target projects and staff in charge to discuss the interview schedule. Finally, the entity conducts the preliminary questionnaire survey. The diagnosis plan is needed in this step. In reviewing the interview and outputs, assessors visit the company to interview the staff in charge and review the related documents. Also, they review the preliminary questionnaire survey results to diagnose the level of the company. The entity prepares the summary of assessment

results as the output of this step. In deriving the improvement tasks, assessors review the data analysed by the company and derive improvement tasks. In this step, the assessors analyse the staff interview and questionnaire survey results as well as the document review results. As the outputs, assessors submit the report on improvement tasks derived and assessment results to the diagnosis entity. Then, the diagnosis entity prepares the final report based on the data submitted by the assessors.

C. Method of Determining Maturity Levels

The existing model assessment involves scoring each item and performing activities to make up for any missing parts. Yet, software should be developed within a short time frame in Korea. In addition, most local companies are small and lack in supports in terms of time, labor and cost. Therefore, the Korean test maturity model determines the maturity of essential practices with either Pass or Fail. Unlike the existing models, the Korean test maturity model does not score each item. Instead, the model checks each item and states Pass or Fail, which is to shorten the time for diagnosis compared with the existing models.

D. Comparison With Existing Models

Table 4 compares software maturity assessment models, i.e. CMMI, TMMi and the Simplified Korean test maturity model. The Korean test maturity model is developed for local SMEs, and simplifies the assessment items. Also, the proposed model focuses on software testing.

TABLE IV. COMPARISON OF CMMI, TMMi & KOREAN TEST MATURITY MODEL

Model	CMMI	TMMi	Korean model
Year of development	1991	2008	Under development
Developer	SEI	TMMi Foundation	TTA/Hongik University
Model type	System Engineering, SW development and maintenance process	SW Test	SW Test
Maturity level	Assessment of organization-level maturity & respective process area	Organization-level maturity assessment	Organization-level maturity assessment
Process Area	5	5	5
Method	25	16	7(developed up to level 2~3)
Procedure	SCAMPI-based assessment	Questionnaire, interview and official/unofficial assessment	Questionnaire, interview and on-site assessment
Characteristics	SCAMPI-based assessment of corporate competency	Assessment of test maturity via official/unofficial assessment	Assessment of test maturity in compliance with assessment procedure
Certification target	SW Process	SW Test Process	SW Test Process

IV. CONCLUSION

This paper proposes an assessment method of a Korean test maturity model suitable for local software development environment. The environment of local software industry is unfavorable, and the development organizations are mostly small. Thus, it is difficult to apply the existing certification models. Also, quite a few companies do not have in-house test teams. The proposed assessment method was developed to address this issue. To develop the assessment method, this paper discusses the conditions of local software industry and development organizations. Then, the method of implementing the assessment method is established. Based on the implementation method, the assessment procedure and method for the Korean test maturity model is developed. The proposed assessment method is applicable to local SMEs as it allows for their conditions, and expected to reduce cost and labor as well as to shorten the time spent on the assessment compared with the existing models. Further studies on assessment methods should deal with the details of assessors. Furthermore, the developed model need be applied to real companies so as to rectify any defects.

ACKNOWLEDGMENT

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