

Test Process Improvement using TMM(i)

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Introduction

More and more organisation are trying to improve their software development processes. The reference improvement model that is most often used is the Capability Maturity Model Integration (CMMI). In this model process areas related to testing, verification and validation, are described. but the level of detail is limited, especially from the viewpoint of the test professional. To fill in this gap the Test Maturity Model (TMM) has been developed, which has recently been succeeded by the Test Maturity Model Integration (TMMi) [www.tmmifoundation.org]. These test models provide a structured approach for improvement of the test process. Within Europe more and more companies are becoming maturing using the TMM. Consultants of Improve Quality Services have been involved in various improvement projects and share their experiences with the TMM(i) in this paper. Practical recommendations are given for the execution of test improvement projects according TMM(i).

The TMMi framework has been developed by the TMMi Foundation as a guideline for test process improvement and is positioned as a complementary model to the CMMI addressing those issues important to test managers, test engineers, test specialists, and software quality professionals. Testing as defined in the TMMi is applied in its broadest sense to encompass all software quality-related activities.

<p>Testing: The process consisting of all life cycle activities, both static and dynamic, concerned with planning, preparation and evaluation of software products and related work products to determine that they satisfy specified requirements, to demonstrate that they are fit for purpose and to detect defects. [ISTQB Glossary]</p>

Just like the CMMI staged representation, the TMMi also uses the concept of maturity levels for process evaluation and improvement. Furthermore process areas, goals and key practices are identified. Applying the TMMi maturity criteria will improve the testing process and have a positive impact on product quality, test engineering productivity, and cycle-time effort. The TMMi has been developed to support software organizations at evaluating and improving their test process. Within the TMMi, testing evolves from a chaotic, ill-defined process with a lack of resources, tools and well-educated testers to a mature and controlled process that has defect prevention as its main objective.

Practical experiences are positive and show that TMMi supports the process of establishing a more effective and efficient test process. Testing becomes a profession and a fully integrated part of the software development process. As stated the focus of testing changes from defect detection to defect prevention.

Overview of the TMMi maturity levels

TMMi has a staged architecture for process improvement. It contains stages or levels through which an organization passes as its testing process evolves from one that is ad-hoc and unmanaged, to one that is managed, defined, measured, and optimized. Achieving each stage ensures that an adequate improvement has been laid as a foundation for the next stage. The internal structure of the TMMi is rich in testing practices that can be learned and applied in a systematic way to support a quality testing process that improves in incremental steps. There are five levels in the TMMi that prescribe a maturity hierarchy and an evolutionary path to test process improvement. Experience has

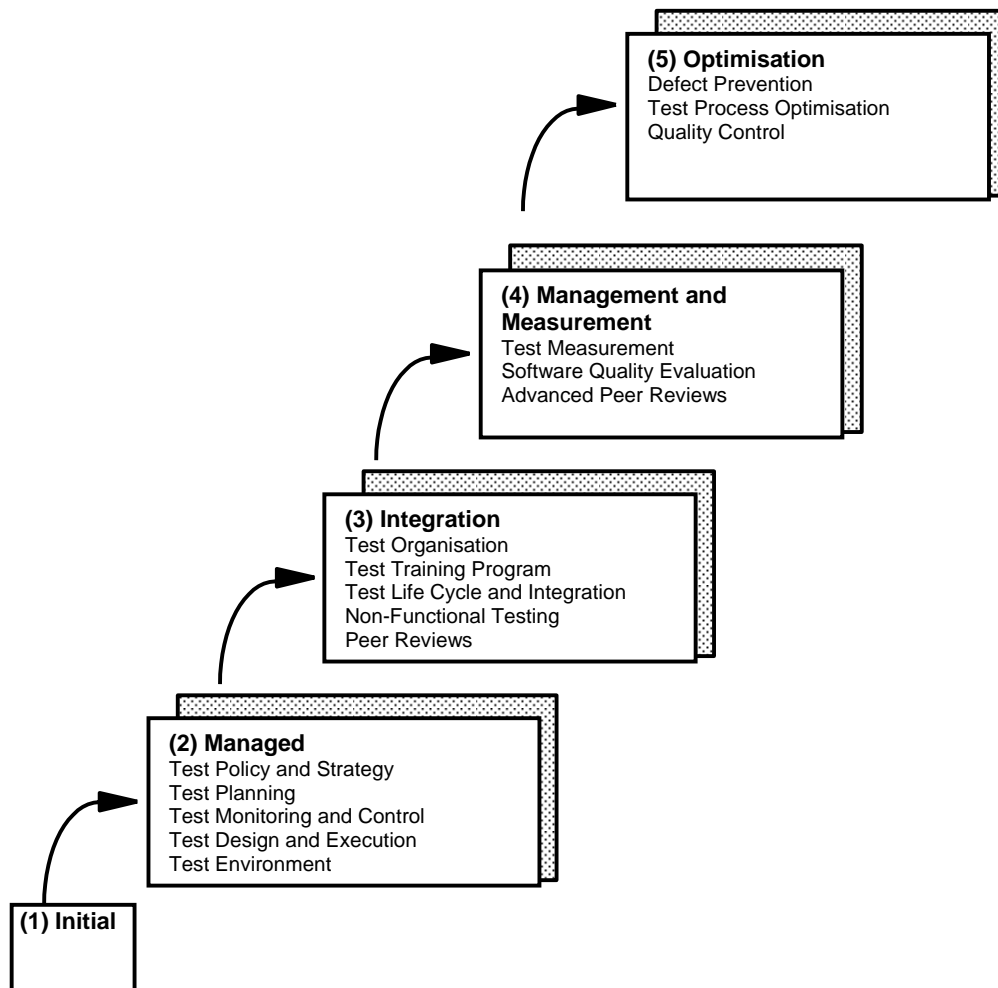


Figure 1: TMMi maturity levels and process areas

shown that organizations do their best when they focus their test improvement process efforts on a manageable number of process areas at a time, and that those areas require increasing sophistication as the organization improves. Because each maturity level forms a necessary foundation for the next level, trying to skip a maturity level is usually counterproductive. At the same time, you must recognize that test process improvement efforts should focus on the needs of the organization in the context of its business environment and the process areas at higher maturity levels may address the current needs of an organization or project. For example, organizations seeking to move from maturity level 1 to maturity level 2 are frequently encouraged to establish a test group, which is addressed by the Test Organization process area that resides at maturity level 3. Although the test group is not a necessary characteristic of a TMMi level 2 organization, it can be a useful part of the organization's approach to achieve TMMi maturity level 2. The process areas for each maturity level of the TMMi are shown in figure 1.

Note that the TMMi does not have a specific process area dedicated to test tools and test automation. Within TMMi test tools are treated as a supporting resource (practices) and are therefore part of the process area where they provide support, e.g. applying a test design tool is a supporting test practice within the process area Test Design and Execution at TMMi level 2 and applying a performance testing tool is a supporting test practice within the process area Non-Functional Testing at TMMi level 3.

Recommendations

In using the TMM(i) model during practical test process improvement, it has shown to have great value. It is not just a theoretical model, but a well-founded set of process areas and goals. We have also found that although the model is quite easy to understand, implementing it in an organisation and thereby improving the test process is not always a straightforward task. On average it takes approximately two years to achieve TMM(i) level 2. To support organisations doing test process improvement, based on our practical experiences, a number of recommendations are provided. Not so much on the model itself, but more focused towards the test process improvement project. Some may seem obvious but we have seen quite a few test improvement projects fail due to these reasons. We strongly suggest one takes these recommendations seriously, since we have seen them being a major contributor towards success in a test process improvement project. For convenience the recommendations are split into four categories:

- Organisation of the improvement project
- Documentation structure
- Metrics and measurements
- Miscellaneous

Organization of the improvement project

Determine the goal

It is desirable to clearly define the goals of the improvement project. Within the TMMi the process area 'Test policy and strategy' requires that an organization defines a test policy, which states the organization's view on testing. It answers questions like 'Why do we test?'; 'How important is quality?'; 'Are we time-driven or quality-driven?'. The

answers to these questions provide an understanding of management's view on testing and their commitment with respect to quality and testing.

Determine the current status and best practices

Before starting an improvement project it is necessary to know which maturity level the test processes have. Therefore the current situation has to be assessed. It then becomes clear which information and procedures are already available, but especially what needs to be improved. In addition to the status with respect to the TMMi process areas it is useful to collect best practices. Some projects act better on specific areas than other projects. In this way projects can learn from each other.

Communication

At the start of an improvement project a communication plan should be written, in which it is indicated who should be addressed, what information should be sent out and which communication mechanism will be used. Show what you are doing! The test policy is a good means to communicate about the improvement project on a management level. Other examples are company newsletters or presentations in a departmental meeting. A useful tool for setting up a communication plan is a mind-map. This graphical presentation provides a clear overview of the cohesion between the various messages and their target audience.

Budget

To enable people to contribute to the improvement project they should have a budget. Only then project can free resources. To have progress it is recommended that people have at least a day per week to spend on the improvements. If less time is reserved it will result in most time being spend on meetings to keep up-to-date. Freeing sufficient time enables making progress and gives focus. Therefore it is more likely that results are delivered in time.

Process ownership

External consultants can provide a very positive contribution to an improvement project because of their knowledge and practical experiences (with TMMi). Furthermore they are often dedicated to the improvement project and have no involvement in operational projects. They can therefore be the stimulator to process improvement with respect to progress. The improvements should also be embedded in the organization. It should be prevented that improvements collapse as soon as the external consultant leaves the organization. It's therefore highly recommended to make internal staffing the owner of the test process improvements project and test processes instead of external consultants. Besides embedding improvements this approach will also increase their involvement.

Create stakeholders involvement

Test projects in which the changed processes will be experimented and/or deployed should be involved in the planning process of the improvement project and have to provide input to the improvement plan. Besides the involved test projects other stakeholders should be planned for, especially for TMMi process areas that involve other disciplines or departments, like 'Test environment' (at TMMi level 2), 'Technical training programme' and 'Test life cycle and integration' (both at TMMi level 3). During

the discussions on new procedures and templates they have to be involved, as well as during the reviews. Also management should be explicitly involved by providing management commitment and assigning a management sponsor, as otherwise the improvement project is doomed to fail.

The maturity of the development processes

It is important to not only look at test processes, but also involve the processes from which testing is highly dependent. Without a mature environment improving the test process is very difficult or sometimes even impossible. Especially one should be looking at processes such as project planning, configuration management and requirements management. Without a decent project planning it is difficult to set up a thorough test planning, due to the many dependencies that exist. For applying test design techniques it is essential to have a set of unambiguous requirements. Also changes in the requirements should be well managed and the test team should be notified. Finally not having a configuration management system often results in defects not being reproducible and defects reoccurring that were supposed to be solved. These types of problems can't be solved within the test process itself, but are often to be solved in the 'surrounding' processes.

Documentation structure

Transparent document structure

In an early phase of the improvement project a document overview should be established. All members and stakeholders of the improvement project must easily understand the document structure. A simple format is creating a table with the required processes, descriptions or procedures per process area supported by a high level graphical presentation. Make use of documents, templates, etc. that are already available to fill in the structure as soon as possible. The remaining pieces will follow during the improvement project.

Availability of process artifacts

Documents, both procedures and templates, should be easily accessible for all test staff and other stakeholders. For that purpose an intranet page could be used, with, as a starting point, the complete document structure of the test process. From that structure all latest versions of procedures and templates can be accessed and downloaded.

Metrics and measurements

Within TMM level 2 a start is made on measuring the test process. At the TMMi collecting improvement data has, in line with CMMI, been moved up to level 3. (At the TMM is was situated at level 2). However, measurement on goal related performance indicators is still at level 2.

Small number of key metrics only

Often a (too) large number of metrics is defined when measuring on the test process. Within that set sometimes no cohesion can be found and (project) management 'drowns'

in the data provided. A very useful method to define a measurement programme, and therefore metrics, is the Goal-Question-Metric (GQM) method. Important is to define the goal of the measurement, what exactly is going to be measured, and how the data will be collected and analysed. Within TMMi it is required to have a limited number of metrics per process area that either addresses the efficiency, effectiveness or degree of deployment of the process. Keep metrics as simple as possible!

Provide feedback

Collecting metrics should be made as easy as possible for both persons providing measurement as for persons analysing and using the data. Where possible tools should be used. When people that collect the data are not informed on how the data is used they tend to lose their interest, as they don't see the advantages. It's therefore a must to organize feedback sessions, on a regular basis, for people that collect and use the measurement data. Also other stakeholders may be interested. People then see that the data is actually being used and can provide constructive input for further analysis.

Miscellaneous

Existing procedures

Within a test organization attempts to structure the test process often haven't been made before. Writing a procedure is often easy, but deployment of a procedure to the various test groups is much more difficult. It is useful to investigate why the current set of procedures are not being followed before starting to focus on the deployment again. Solving the root cause of the previous failures enlarges the chance on success for the new deployment. Of course change should not be a goal on its own. One shall make use of the existing processes as much as possible. Only when it's clear why current processes are not being followed it is necessary to change them where needed. Furthermore it is needed to check the procedures on their compliance to the TMMi requirements in detail and early in the improvement project to prevent surprises at a later stage.

Other improvement initiatives

Beware of the 'yet, another initiative' syndrome. Within organizations other improvement initiatives can be on-going, e.g. software process improvement based on the CMMI. To prevent that duplicate activities are executed it is recommended to make a mapping on how the test improvement activities contribute to other improvement activities and vice versa. More improvement models often impose more requirements on project managers on how to organize their projects. By showing how the models, complementary, contribute to a more effective or efficient way of working the benefits can be shown making people are more likely to contribute and adhere to them.

The Authors

Erik van Veenendaal has implemented structured testing and carried out test process improvements activities, e.g. based on TMM and/or TPI, in a large number of organisations in different industries. He is the author of numerous papers and a number of books on software quality and testing, including the best-sellers 'The Testing Practitioner' and 'Testing according to TMap'. He is a regular speaker both at national and international testing conferences and a leading international trainer in the field of

software testing. At EuroStar'99 and EuroStar'02 he received the best tutorial award for a tutorial on "Usability testing" respectively "Test strategies and planning". At this years' EuroSTAR Erik will run a tutorial on TMM(i). Erik van Veenendaal is the founder and director of Improve Quality Services ltd., a company that provides consultancy and training services in the area of quality management and testing, vice-president of the International Software Testing Qualification Board (ISTQB) and vice-chair of the TMMi Foundation. Both *Richard Grooff* and *Rob Hendriks* are working as senior consultants at Improve Quality Services BV and have been involved in a number of test process improvement projects based on the TMM. The experiences they share come from various domains, such as medical, automotive and finance.