Motivations for and benefits of adopting the Test Maturity Model integration (TMMi): An international survey

Vahid Garousi  
Bahar Software Engineering Consulting,  
Queen's University Belfast

Erik van Veenendaal  
TMMi Foundation  
Improve IT Services BV

Michael Felderer  
University of Innsbruck,  
Blekinge Institute of Technology

Abstract:
Test Maturity Model integration (TMMi) is a popular model for maturity assessment and capability improvement of software testing practices in industry. Originally inspired by the Capability Maturity Model Integration (CMMI), and managed by the TMMi Foundation, the TMMi specification provides guidelines for assessing and improving testing capabilities of teams and organizations. TMMi Foundation recently designed and conducted an international user survey, which received data from 74 companies that have received TMMi assessments and certifications. We report some of the survey results, focusing on motivations for and benefits of adopting the TMMi. The survey’s findings aim at increasing worldwide awareness about TMMi and encourage other practitioners to consider applying TMMi in their contexts.

Keywords:  
Test Maturity Model integration, TMMi, empirical study, survey

1 INTRODUCTION

In response to the growing demand for software quality and productivity, various initiatives, models, and approaches have been presented in the software industry since the 1980’s. Examples include the Capability Maturity Model Integration (CMMI) model [cmmiinstitute.com] and the ISO/IEC 15504 standard, also known as the Software Process Improvement and Capability Determination (SPICE) model.

Over the past three decades, CMMI adoption has gradually increased, mostly for organizations working in governmental and defense projects. According to the CMMI Institute [cmminstitute.com/learning/appraisals/results], as of this writing (January 2021), 9,566 companies have received CMMI appraisals (certifications).

While studies have reported that models such as CMMI and SPICE are useful, their primary focus is process improvements on the “overall” software development process lifecycle (SDLC). Despite the fact that software testing often accounts for a non-trivial portion of a typical software project in terms of time, budget and costs, such process improvement models do not provide specific improvement recommendations for software testing. For this reason, various models have been developed for dedicated improvements of software testing practices. A 2018 survey paper in IEEE Software [1] reported a catalog of 58 models for test maturity and capability improvements, e.g., the Test Maturity Model integration (TMMi) [tmmi.org], which, according to the paper [1], was the most widely used model.

Originally inspired by the CMMI, and managed by the TMMi Foundation, the TMMi model provides guidelines for assessing and improving testing capabilities.

According to the internal assessments database of the TMMi Foundation, in total, 215 companies/teams were assessed in 25 countries by the end of 2020.

Since its inception in 2010, the TMMi Foundation has been proactive in promoting the usage of the TMMi and also in surveying its members and certified companies to track the state of the test maturity worldwide. One recent such activity was an international user survey of companies who have received the TMMi certifications. 74 companies participated in the survey by providing data. We report some of the results from that survey, focusing on motivations for and benefits of adopting the TMMi.

We start by presenting a brief overview of TMMi, the survey design, and execution, as well as the respondents’ demographics. Then, we present motivations for and benefits of adopting the TMMi, based on the data provided by the survey respondents.

2  A BRIEF OVERVIEW OF TMMI

The roots of TMMi reach back to Gelperin and Hetzel’s evolutionary testing model [2], published in 1988, and an early test improvement model named Test Maturity Model (TMM) [3]. By seeing the need for a more established test improvement model, several test and quality experts (volunteers) came together (mainly based in Europe) and founded the TMMi Foundation in 2010. The first stable version of the TMMi specification (version 1.0) was published by the Foundation in 2012 [4]. The latest version of the specification, as of this writing, is 1.2 [5], published in 2018. The TMMi Foundation is
supported by the so-called TMMi Local Chapters that publicize and organize TMMi-related services and activities locally in their country or region. At the time of this writing, 22 TMMi Local Chapters, together covering 49 countries, are in existence, e.g., in China, the USA, Spain, Brazil, and France.

TMMi uses the concept of maturity levels for process evaluation and improvement. Furthermore, for each maturity level, a set of process areas, goals, and practices are identified.

TMMi is aligned with international testing standards, syllabi, and terminology of the International Software Testing Qualifications Board (ISTQB), which has certified over 720,000 test professionals as of this writing (April 2021). With TMMi, organizations can have their test processes objectively evaluated by accredited assessors and improve their test processes.

TMMi has a “staged” scheme for test process assessment and improvement. It contains stages or levels through which an organization passes as its testing process evolves from one that is ad-hoc, also called “initial or unmanaged” (level=1) to one that is managed (level=2), defined (level=3), measured (level=4), and optimized (level=5). Figure 1 shows the five maturity levels of TMMi, their Process Areas (PA), and the structure of TMMi as a meta-model. Achieving each level ensures that the requirements (all process areas) of that level have been achieved. Each PA has several specific goals (SG) and specific practices (SP). Across the five levels, there are in total 16 PAs, 50 specific goals (SG), and 173 specific practices (SP). Details of those elements can be found in the TMMi framework [5].

For instance, under maturity level 2 (“managed”), there are five process areas, e.g., PA 2.1 (Test policy and strategy). This PA has three SGs: SG 1 (Establish a test policy), SG 2 (Establish a test strategy), and SG 3 (Establish test performance indicators). The above SG 1, in turn, has three SPs: SP 1.1 (Define test goals), SP 1.2 (Define test policy), and SP 1.3 (Distribute the test policy to stakeholders).

A main underlying principle of the TMMi is that it is a “generic” model applicable to various lifecycle models and environments. Several experience reports and case studies from the industrial application of TMMi have been published, e.g., [1, 6-8].

In a recent IEEE Software paper [9], we presented a status report about TMMi, the trends of worldwide test maturity and certifications, and how companies have been ranked in each of its process areas (PA’s). Our analysis showed that, since starting the TMMi assessments in 2011, the number of annual assessments has been between 15-30 companies each year. In 2019 (20 formal assessments) and 2020 (28 formal assessments), there has already been a considerable growth in the uptake of the TMMi. We also found that for TMMi levels 2 and 3, PA2.5 (Test environment) and PA3.4 (Non-functional testing) have relatively more “not achieved” scores compared to other PAs. It seems that most companies have challenges in satisfying these two PAs.

The important aspects of what the motivations for and benefits of adopting the TMMi are had not been systematically investigated so far, and that is the goal of our recent 2020 user survey, from which the current paper has been written.

3 SURVEY DESIGN AND EXECUTION

This survey’s goal was to get a detailed understanding of the benefits of the TMMi, the reasons/motivations for adopting TMMi but also the challenges when applying the TMMi.

To cover the above goal, we used the survey design guidelines in software engineering [10] and designed the survey with 21 questions. The full survey instrument can be found in doi.org/10.5281/zenodo.4434119. Six questions were about the demographic information of the participants, e.g., size of the organization. One question (#10) was about motivations for adopting TMMi, two questions (#11 and #12) were about benefits, and three
questions (#18–#20) were about challenges when applying the TMMi.

To ensure the quality of the survey, we asked several (test) engineers in our network to do peer reviews of its draft and provide their feedbacks.

In this paper, we present the analysis of three important aspects:

- Q1-What were the main reasons (motivations) for adopting TMMi?
- Q2-What benefits have you experienced of adopting TMMi?
- Q3-Please quantify one or more of the benefits listed in the above question?

We executed the survey in Summer 2020 by sending email invitations to all the 114 companies/teams that had by then been formally assessed through the TMMi Foundation. The survey was online (hosted on Google forms). 74 companies/teams responded to the survey, thus yielding a survey response rate of 64.9%. The response rate and population size imply a confidence level of 85%. The sample size calculations can be found in bit.ly/3uCYk1M.

We present a summary of respondents’ demographics next, followed by the results of the above questions.

4 RESPONDENTS’ DEMOGRAPHICS

According to the data, half of the respondents were from Asia (37 of 74), a third from Europe (25 of 74), and the remaining from the rest of the world (see Figure 2).

In terms of industry sectors, about 31% (23/74) were from the IT/software delivery industry. 28% were from financial services (such as banking and insurance). The remaining were from other industries (see Figure 2). There were respondents from different organization sizes (about 40% SMEs up to 500 employees and about 60% from large enterprises with more than 500 employees). Thus, we could consider the dataset quite “representative”.

5 REASONS (MOTIVATIONS) FOR ADOPTING TMMi

For motivations of adopting TMMi, a set of 12 pre-defined response items were provided. Respondents could also provide any “other” motivation via a text box. Figure 3 shows the respondents’ opinions. Enhancing software quality, increasing testing productivity, and reducing product risk were mentioned as the top three reasons, which essentially form the project management’s “golden triangle”. This indicates better management of testing is an important motivation to adopt TMMi.

Furthermore, achieving TMMi certification is a key motivation for adopting TMMi, which indicates the importance of certification among TMMi certified organizations and their business operations.

Good engineering practices like standardized compliance, delivery predictability and improved test engineering discipline are of moderate importance for motivating the adoption of TMMi. Meeting customer requirements, improving team morale, accelerating software delivery, and improving business alignment provide only a low motivation for adoption. Finally, reducing project costs provides the lowest motivation to adopt TMMi.

Figure 3- Motivations for adopting TMMi

6 BENEFITS OF ADOPTING TMMi

For asking about the benefits of adopting TMMi, the survey had the same set of 12 pre-defined response items, as shown in Figure 4. Enhancing software quality, increasing testing productivity, and reducing product risk are not only high motivations but actually also observed benefits of adopting TMMi, by the responding organizations. Achieving TMMi certification is also reported to be a benefit. An interesting finding is that the internal factors of improved test engineering discipline and improved team morale are reported to be major benefits but were only moderate motivations to introduce TMMi. They can almost be considered “free” bonus when implementing TMMi.

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Reduced project costs are not only the least motivation but also the least experienced benefit of adopting TMMi. This might indicate that TMMi is not suitable for organizations where reducing project cost is significantly more important than enhancing product quality, engineering discipline, or compliance. It may also indicate that since there is little motivation, the opportunities that are offered within TMMi to reduce projects costs are not in focus and/or not given priority.

The list of motivations/benefits from the survey was designed such that they can be categorized under six headings: product quality, test efficiency, compliance, people, test predictability, and business alignment. For example, reduced product risks and reduced number of defects both contribute to product quality, increased testing productivity contributes to test efficiency, and an improved test engineering discipline and improved team morale contribute to the people aspect. Changing the view from the individual benefits to the categorized one provided the outcome shown in Figure 5.

Figure 4- Expectation versus reality (Expected versus actual benefits when adopting TMMi)

The high 88% of the TMMi users are observing benefits for product quality (e.g., reduced product risks and/or reduced number of defects). Benefits are also commonly observed in terms of test efficiency (77%), compliance (84%), and regarding the people aspect (77%).

Test predictability and business alignment both have a lower score. One should understand that test predictability is not fully achieved with practices such as test estimation and test project tracking at TMMi levels 2 and 3. Practices at higher TMMi levels, e.g., measurement (in level 4) and quality control (in level 5), are often needed to achieve test predictability. Hence, only when companies achieve TMMi level 4 or 5, test predictability benefits are observed and experienced. Also, when business alignment is low in the motivation list, the opportunities that are offered within TMMi to provide business alignment are probably not enough in focus. It is also an indicator that more specific practices on achieving business alignment (and value) should perhaps be present in the next release of the TMMi.

Another survey question asked participants to quantify one or more of the benefits. 38 of the 74 respondents provided input for that question. Those tangible metrics provided by participants also provide a justification for the reported benefits.

Some examples included:

- “A Defect Detection Percentage (DDP) increase from 60% to 70% during system testing”
- “Reduced test management tools from 4 to 2. Consolidated test automation tools from 6 to 4”
- “Defect leakage to production has reduced from 10% to 5%”
- “Seen more than 7% improvement in Time to Market”
- “Increase testing productivity: Regression test execution cycle is compressed from 4 hours to 30 minutes”
- “Project acquisition through TMMi certification”
“Our testing team has adopted practices that improve the testing job and make quality assurance and control more efficiently “

“A lot of people in my organization are happy/proud of this [TMMi] certification; the motivation has increased”

7 CONCLUSIONS

In the context of TMMi, a logical question to explore is about the motivations of companies to assess and improve their processes using TMMi.

Results of the 2020 survey, as reported in this paper, show that the main reasons for adopting TMMi are to: enhance product quality, reduce product risk, increase testing productivity (efficiency), benchmark against an internationally-used model, and increasing the prestige of testing teams. Most survey respondents reported observing those benefits after adopting TMMi. Thus most organizations have achieved the objectives they set when starting to do a TMMi based test process improvement project. This is confirmed by the high satisfaction ratio from the user survey. In answering the survey question, “In general, have the TMMi-based test process improvement efforts been successful?” 87% of respondents stated that TMMi fully meets or exceeds their expectations; they are either satisfied, very satisfied, or extremely satisfied with benefits achieved or exceeded.

REFERENCES


AUTHOR BIOGRAPHIES

Vahid Garousi is Executive Manager of Bahar Software Engineering Consulting Limited and an Associate Professor in Queen’s University Belfast. His areas of research and practice include: software testing, and empirical software engineering. He received his PhD in Software Engineering from Carleton University. For more information, visit: vgarousi.com. Contact him at v.garousi@qub.ac.uk

Erik van Veenendaal is the CEO of the TMMi Foundation, and a former senior lecturer at the Eindhoven University of Technology. His research interests include software testing, test improvement, quality and requirements engineering. He received his master’s degree in Business Economics at Tilburg University. Contact him at erik@erikvanveenendaal.nl

Michael Felderer is an Associate Professor at the University of Innsbruck, Austria and a Guest Professor at the Blekinge Institute of Technology, Sweden. His areas of research and practice include software quality and testing, empirical software engineering, as well as AI and software engineering. For more information, visit: mfelderer.at. Contact him at michael.felderer@uibk.ac.at