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

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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. In this invited paper, we discuss motivations for and benefits of adopting the TMMi. The discussion is based on an international user survey, which received data from 74 companies that have received TMMi assessments and certifications.

Keywords: Test Maturity Model integration, TMMi, test process improvement, software quality, software testing.

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 (cmminstitute.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), more than 10,000 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, 261 companies/teams were assessed in 28 countries by the end of 2021.

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 and discuss some of the results from that survey, focusing on motivations for and benefits of adopting the TMMi.

This invited paper is organized as follows. Section 2 provides a brief overview of TMMi. Section 3 discusses motivations for adopting TMMi. Section 4 discusses benefits of adopting TMMi. Finally, Section 5 concludes the paper.

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, 26 TMMi Local Chapters, together covering 54 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 770,000 test professionals (October 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). TMMi has five maturity levels. Each of them has several Process Areas (PA). 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], and [7].

In a recent IEEE Software paper [8], 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), 2020 (28 formal assessments) and 2021 (39 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 Reasons (Motivations) for Adopting TMMi

Figure 1 shows the respondents’ opinions on reasons for adopting TMMi. 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.

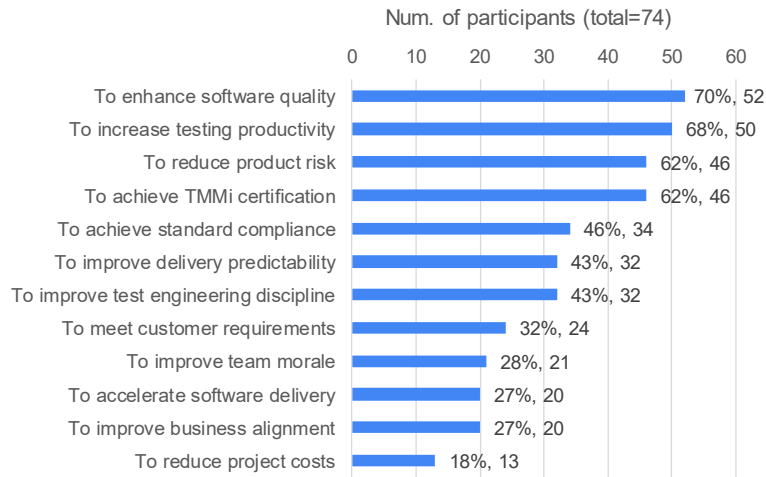


Fig. 1. Motivations for adopting TMMi.

4 Benefits of Adopting TMMi

Figure 3 and Figure 4 show the results on benefits of adopting TMMi. 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.

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.

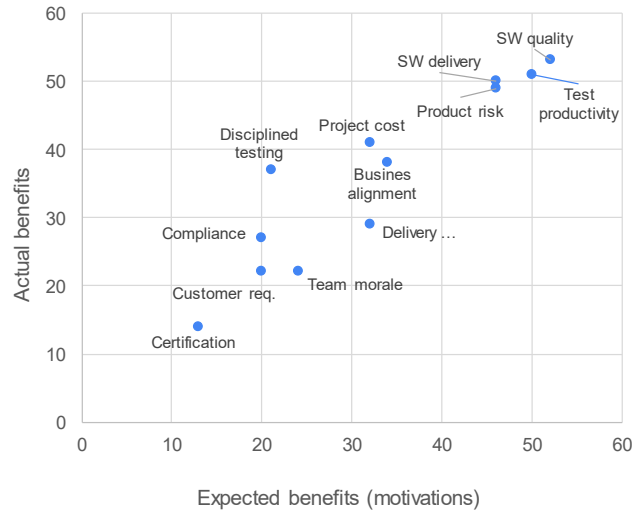


Fig 2. Expected versus actual benefits when adopting TMMi.

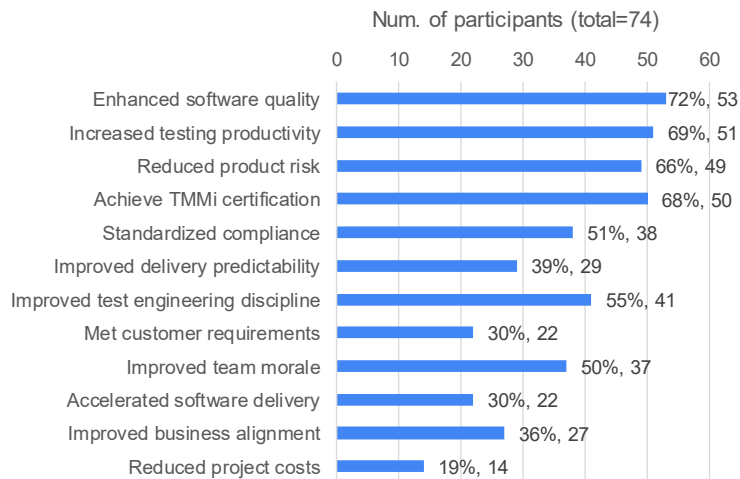


Fig 3. Benefits of adopting TMMi.

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 Fig. 4.

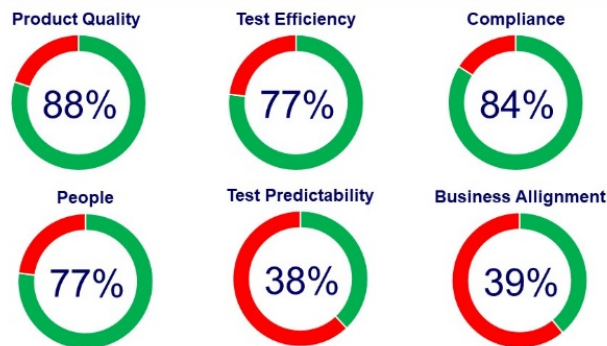


Fig 4. Ration of respondents which reported different benefits of adopting TMMi.

A 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.

5 Conclusion

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

1. Garousi V., Felderer, M., Hacaloğlu, T.: What we know about software test maturity and test process improvement, *IEEE Software*, 35(1) (2018)
2. Gelperin, D., Hetzel, B.: The growth of software testing, *Communications of the ACM*, 31(6) (1988)
3. Burnstein, I., Homyen, A., Grom, R., Carlson, C.R.: A Model to Assess Testing Process Maturity, *Crosstalk: The Journal of Defense Software Engineering*, 11 (1998)
4. TMMi Foundation: TMMi specification (reference model), release 1.0 (2012)
5. TMMi Foundation: TMMi specification (reference model), release 1.2 (2018)
6. van Veenendaal, E., Shang, C., Xu, Y.: Achieving TMMi Level 3 – A Chinese Case Study, *Quality Matters Magazine* (2019)
7. Rungi, K., Matulevičius, R.: Empirical Analysis of the Test Maturity Model Integration (TMMi), *International Conference on Information and Software Technologies*, 403(32), pp 376-391 (2013)
8. Garousi, V., van Veenendaal, E.: Test Maturity Model integration (TMMi): Trends of Worldwide Test Maturity and Certifications, *IEEE Software*, 39(2), pp. 71-79, (2022)