TMMi FOUNDATION

THE NEW MDD AND TAMAR

A STUDY ON HOW MDD, THE NEW CMMI ASSESSMENT METHOD CAN AFFECT TMMI ASSESSMENTS

This paper is intended to help TMMi professionals interested in assessments. Specially TMMi assessors and lead assessors will find information about the structure of the MDD - the assessment method associated to CMMI V2 and how it could affect TAMAR requirements for TMMi assessments. However, it will also help those TMMi practitioners who use TMMi in the organizational context where also CMMI is used , eventually wishing to formally assess their organization against TMMi.

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1 Introduction

In 2018 CMMI Version 2 (CMMI V2 [1]) was released by the ISACA, the new owner of CMMI. Together with CMMI V2 the new appraisal Method Definition Document (further: MDD, see [2]) with requirements for CMMI V2 appraisals was released. The latest version of MDD at the time of publication of this white paper is version 2.3.

Information made publicly available indicate that CMMI V2 and its associated assessment method, the MDD, is now being accepted by the entire software development community that uses CMMI as a process improvement model. This fact makes this new version of the CMMI assessment method even more interesting for the testing community, since TMMi - the most used test process improvement model connected to software testing (see [3]) – is often used as a complementary model to the CMMI (while TMMi can also be used independent of the CMMI model). The TMMi world-wide user survey from 2021 states that no less than 54% of the TMMi user also use CMMI [4].

The latest version of TMMi, V1.3, released in 2022 [5] largely reuses the structure of CMMI V1.3 (e.g., it still uses Generic Goals and Generic Practices), but has some of its basic concepts conform to CMMI v2[1]. TMMi V1.3 elaborates on the testing-related activities performed in a software or system development company in much more detail than CMMI does. It is therefore an important question whether TMMi community should consider alignment, or at least learn from, the CMMI V2 assessment method structure.

After the MDD was published the question arose whether TAMAR – the TMMi Assessment Method Application Requirements (see [6]), which defines the requirements considered essential to assessment methods intended for use with the TMMi - should be updated based on the new MDD. To answer this question the TMMi Foundation formed a working group that analyzed and discussed the relevance of the updated MDD and its possible impact on TAMAR. In this paper we present the main results of this analysis for a larger audience.

In chapter 2 we present the main elements of the new MDD. We talk about relationship of this new MDD to the assessment methods that influenced TAMAR, such as: ISO 15504, ARC, SCAMPI. Next, the different appraisal types defined by MDD are described, followed by a description of phases in MDD. Sampling factors and rules are shortly presented, emphasizing the new concept of randomly generated sample. The performance report output is presented as an important new element of an appraisal. The chapter ends by a short description about virtual appraisal.

Chapter 3 is a reflection on possible TAMAR changes based on the new MDD method.

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[1] With all the declared complementarity to CMMI, the new version of TMMi demonstrates less dependency on CMMI. It is aligned with terminology and practice areas of CMMI V2. List and content of documents updated to align with ISO 29119-3. Non-functional quality characteristics are updated to align with ISO 25010. The Glossary has an improved alignment with ISTQB Glossary, CMMI V2 Glossary, and international standards (ISO 20246, ISO 25010, ISO 25040, ISO 29119-1, ISO 29119-3 and ISO 33061). References to withdrawn standards are removed. See TMMi Framework v1.3 [5]

Abbreviations used in this document:

Abbreviation	Definition
ARC	Appraisal Requirements for CMMI
CMMI	Capability Maturity Model Integration
MDD	Method Definition Document
OE	Objective Evidence
OU	Organizational Unit
PA	Process Area
PARS	Published Appraisal Results
RGS	Randomly Generated Sample
SCAMPI	Standard CMMI Appraisal Method for Process Improvement
TMMi	Test Maturity Model integration

Table 1 : Abbreviations

2 The New MDD

CMMI V2 is defined as "an integrated product suite consisting of 5 components that, when used together, provide a clear and proven path to achieving a company's business objectives".

The 5 components are: model, appraisal method, training and certifications, system and tools, adoption guidelines (see figure 1). CMMI is considered as an integrated product suite, in which the components are complementing each other and facilitating each other's usage.
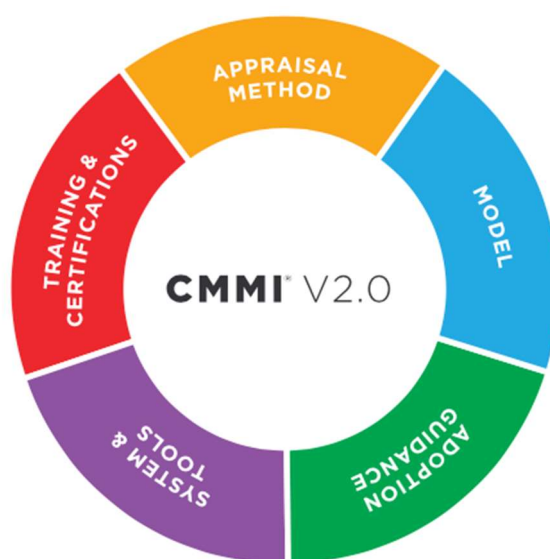

Figure 1: CMMI V2 Components

As the owners of the method declare: "The CMMI appraisal method is used to identify process implementation strengths and weaknesses as well as process persistence and habit. The method is

also used to link demonstrated business performance relative to the model adoption. It incorporates best practices and is based on the features of several legacy appraisal methods" (see [7]). We learn from the same page that it is the aim of the new appraisal method to support appraisals in a variety of contexts: benchmarking, internal performance and process improvement, process monitoring, supplier selection, risk reduction. It is an important new element in the MDD that improvement suggestions / plans become highly emphasized in all cases (e.g., performance report output, a list of recommended improvement actions, is now mandatory).

MDD is today the only accepted appraisal method for auditing CMMI V2-based quality systems and improvements. However, MDD is a closed system, needing license to access it. Lacking to have public access to the appraisal method is the first important change in doing CMMI appraisals. MDD is also substantially different in comparison to SCAMPI v1.3 [8], the previous appraisal method associated with CMMI[2].

Published Appraisal Results (PARS- see [9]) continues to be accessible by anyone. PARS contains information about appraisals executed, but the information shared is much less than those having been shared with SCAMPI appraisals. Looking to PARS, we can see that it contains 11.963 registered appraisals in total, all being CMMI V2 appraisals. The years of registered appraisals starts in 2020, when 3370 appraisals were registered. In 2021 we find 3843, in 2022 there are 4285 registered appraisals, while in 2023 reported until 05th March: 464.

2.1 MDD, SCAMPI , ARC, ISO 15504 and TAMAR

Specialists engaged into a CMMI-based or a TMMi-based assessments used to think about the requirements towards an appraisal in terms once formulated in SPICE (Software Process Improvement and Capability Evaluation) project and later generalized as process assessment requirements, described in ISO 15504 standards [11]. ISO 15504 served as basis for ARC (Appraisal Requirements for CMMI), and, later ARC-conformity was kept by the SCAMPI method. TMMi assessment are all based on TAMAR (TMMi Assessment Method Application Requirements), which, just like with ARC is again based on ISO 15504. TAMAR has used ARC as a source of inspiration, and is having a list of correlations with ISO 15504-2 requirements (see TAMAR Chapter 5, [12]). With the complete chain of inherited requirements and cross – references between ISO 15504, ARC and TAMAR, it seems a logical next step to look for the continuation of the reference chain within the new MDD. Refer to figure 2 for an overview of the relationships between the different documents as described.

Surprisingly, the new MDD does not explicitly refer to ARC, neither does this indirectly. In our opinion this is a major shortcoming of MDD, as it suggest that the entire compatibility with ARC, and/or ISO 15504 was lost – which is not true, as experience from more decades of ARC using SCAMPI to perform CMMI appraisals were undoubtedly taken into account when the new assessment method was defined.

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[2] SCAMPI stands for Standard CMMI Appraisal Method for Process Improvement, and was an appraisal method developed by the Software Engineering Institute in 2011 , specifically for appraisals based on the CMMI model. SCAMPI claimed conformity to the more generic requirements formulated in ARC-Appraisal Requirements for CMMI® Version 1.3 (ARC, V1.3) [9].

At a first glance we came to the idea that the current TMMi Assessment Method Application Requirements (TAMAR) is partly based on a withdrawn set of requirements which were documented in the Appraisal Requirements for CMMI (ARC). But, luckily, ARC was used only as source of inspiration, and it can be stated that TAMAR is largely based directly on the ISO 15504 standard series. ISO 15504 having meanwhile been replaced by the ISO 33000 series of standards, the correlations described in TAMAR with ISO 15504 needed to be replaced by the matching correlations from the adequate ISO 33000-family element. This has happened recently, and TAMAR v1.1 has recently been released [6].
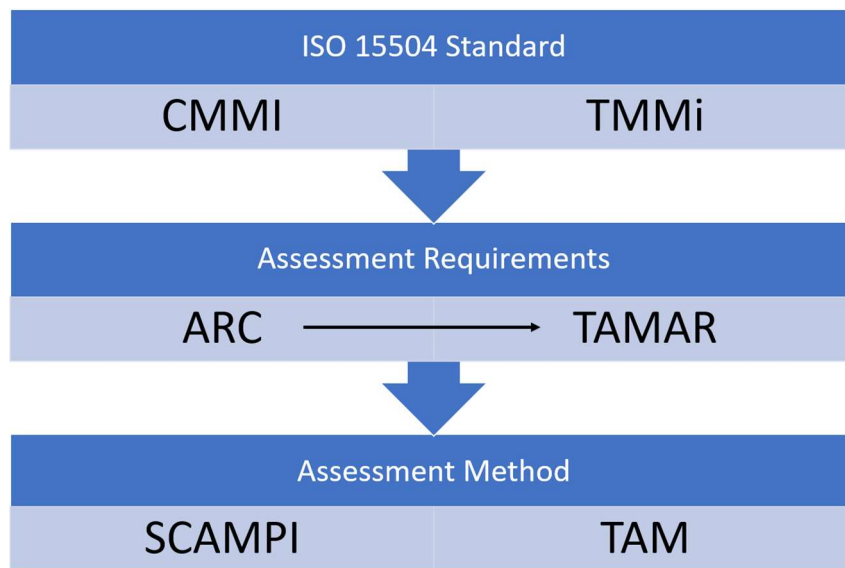

Figure 2: Relationship between various assessment documents

2.2 Assessment types in MDD

The Standard CMMI Appraisal Method for Process Improvement (SCAMPI) was designed to provide benchmark quality ratings relative to the previous versions of the Capability Maturity Model Integration (CMMI). The method had three standard variants based on the class structure defined in the Appraisal Requirements for CMMI (ARC), which specified three levels of formality for appraisals: SCAMPI A, B, C. The most formal appraisal type, using SCAMPI A method and conform to ARC Class A requirements, had rigorous standards for detailed data collection, and for identification and coverage of the organizational unit. With SCAMPI A provides an official rating is therefore the basis for a formal CMMI certification .

The SCAMPI B method retains some of the requirements for detailed data collection, but provides relaxed standards for sampling the organization. Evidence of implementation must be examined, in the form of direct artifacts. This rigorous method also requires the use of interview data in support of a team consensus process to derive the appraisal results. The requirements for formal assessments within TAMAR largely resemble ARC class B.

The SCAMPI C method has relaxed standards relating to evidence of usage, information is sought that describes the approach taken (or planned for the future) to implement practices consistent with the

intent of CMMI. The requirements for informal assessments within TAMAR largely resemble ARC class C.

The MDD recognized three appraisal types: benchmarking, sustainment and evaluation appraisals are now possible. The notion "Action Plan Reappraisal" was included as a "second chance" for organizations that failed a formal appraisal in some minor issues. Description about the MDD appraisal types can be found on the web pages of ISACA [13]. Here we briefly summarize the main characteristics of each appraisal type.

Benchmark appraisals (B) are the most rigorous ones, mainly corresponding to former SCAMPI A appraisals. Benchmark appraisals have the largest organizational scope and the most rigorous approach in gathering and checking objective evidence, thus providing high confidence in the appraisal outputs. This appraisal type generates ratings, has the requirement of doing random sampling (see in 2.4), and needs the highest commitment of people, time, and money. This appraisal type requires a CMMI Certified Lead Appraiser to manage the appraisal team at the organization's site. Team size must be minimum 4, team experience criteria are defined in detail in MDD. The results of a benchmark appraisal is valid for 3 years.

Sustainment appraisals (S) provide organizations with more frequent insight and validation of their performance improvement with a *reduced scope* on the appraised organization. It can be a means of checking organizational performance if the scope of CMMI (i.e. maturity level) did not change. Verifies initial benchmark ratings. A sustainment appraisal may be performed every 2 years if Organizational Unit (OU) remains stable (i.e. business remains the same, scope cannot increase, scope can decrease if work efforts close, no significant changes to "impact sampling factors" or sampling factor values). OU and model scope must be the same as original benchmark. Such an appraisal requires reduced commitment of people, time and cost compared to benchmark appraisal. No more than three Sustainment Appraisals in a row may be conducted before another Benchmark Appraisal is required. To maintain the previous rating validity, a Sustainment Appraisal must be completed and finalized before the validity period of the prior appraisal validity date expires. Rating are generated. This appraisal type requires a CMMI Certified Lead Appraiser to manage the appraisal team at the organization's site. Team size must be minimum 2, team experience criteria are again defined in detail in MDD. The results of a sustainment appraisal is valid for 2 years.

Evaluation appraisals (E) replace the CMMI V1.3 SCAMPI B & C appraisals. An evaluation appraisal does not generate formal ratings. Such an approach can be used for initial assessments in organizations new to CMMI, or for interim assessments between benchmark or sustainment appraisals. Allows for the highest degree of tailoring of the appraisal method. It requires reduced commitment of people, time, and cost, team can be formed of minimum 1 person, experience criteria are defined in detail in MDD.

Action plan re-appraisals (APR) may be conducted following a Benchmark or Sustainment Appraisal "that narrowly fails to achieve the target maturity level or capability level profile". An APR will update the ratings of a Benchmark or those of a Sustainment appraisal. APR's are not allowed when systemic issues are identified. Performing an APR requires authorization from ISACA. Further limitations apply

for performing APRs, such as: only one APR shall be performed per Benchmark or Sustainment appraisal; the appraisal team leader and team shall be the same as the initial Benchmark or Sustainment appraisal, etc. APRs must be completed within 4 months of the end of the prior appraisal.

2.3 Phases of an appraisal based on MDD

The phases of an appraisal based on the MDD are almost similar to those of the former SCAMPI appraisal method. See table 2 for the phases and activities of a SCAMPI appraisal (we only includes the phase and high level activity, without the detailed list of all the sub-activities).

ID	Phase / Activity
1.	**Plan and Prepare for Appraisal**
1.1	Analyze Requirements
1.2	Develop Appraisal Plan
1.3	Select and Prepare Team
1.4	Obtain and Inventory Initial Objective Evidence
1.5	Prepare for Appraisal Conduct
2.	**Conduct Appraisal**
2.1	Prepare Participants
2.2	Examine Objective Evidence
2.3	Document Objective Evidence
2.4	Verify Objective Evidence
2.5	Validate Preliminary Findings
2.6	Generate Appraisal Results
3.	**Report Results**
3.1	Deliver Appraisal Results
3.2.	Package and Archive Appraisal Assets

Table 2 : Phases and activities of a SCAMPI appraisal

Comparing MDD phases with SCAMPI phases, we can state that the 3 main phases (1. Plan and prepare for the appraisal, 2. Conduct appraisal, 3. Report results) remained 100% similar, while MDD contains an optional fourth phase, namely "Conduct Action Plan Re-appraisal".

Plan and Prepare for Appraisal
In the MDD, in the planning phase requirements are analyzed, team is set up, appraisal plan is developed and readiness to conduct the appraisal is checked. Adequacy and sufficiency criteria for the Objective Evidence are emphasized and changed compared to the associated rules in SCAMPI. The idea was to minimize the effort and cost in the appraisals executed with the new MDD, therefore the instances of projects and support function needed for sampling are regulated in detail. The notion of Random Sampling was introduced, which makes it possible for the appraisal team to work on a

substantially reduced set of Objective Evidence, in comparison with the SCAMPI appraisals. See further details about the notion of Random Sampling in section 2.4.

Conduct Appraisal

After starting Phase 2 activities, the appraisal must be completed within 90 days (similar as in SCAMPI). Very similar to SCAMPI, this phase describes how to collect and examine objective evidence coming from artifacts and affirmations. Basically, the MDD approach is a verification – based[3] one, where objective evidence is recommended to be gathered prior to starting of the Phase 2 activities. Checking the objective evidence coming from artifacts is usually checked as a first step of the Phase 2 activities (in MDD the first activity in Phase 2 is Collect and Examine Artifacts). A big difference compared to SCAMPI is that in MDD, due to the Random Sampling, the number of artifacts and affirmations can be significantly lower than these were in a SCAMPI appraisal, so the process of verification can be faster. In many cases interviews are combined with demonstrations, when the interviewees will show the evidence of their work on-line. This completes the objective evidence coming from artifacts.

The Phase 2 activities continue with the appraisal team characterization of the practices (similar to SCAMPI). Global and practice area level strengths, weaknesses, improvement suggestions, notes etc. are generated. The results are presented to the OU members participating in the appraisal, and are validated on one or more Preliminary Findings Sessions. Follow-up interviews or further data might be needed, as in case of the SCAMPI appraisals. After preliminary findings have been validated, final findings are derived and ratings are determined (in case these were requested). The rating values and rating scheme is similar to the one used in SCAMPI, with a slight change in naming (FM – Fully Meets , LM – Largely Meets, PM- Partially Meets, DM – Does Not Meet, NY – Not Yet). Practice Area, Maturity Level or Capability Level rating profile is determined by the team. Appraisal results are generated. Amond these Final Findings is similar to the one in SCAMPI appraisals. One added artifact is the Performance Report, which has the scope to support the improvement actions that would be started within the organization after the actual appraisal ends. The Performance Report is in close connections with the appraisal findings, and is a document in which different findings and recommendation can come into a set of efficient improvement suggestions.

Report Results

During this phase artifacts must be packaged and submitted to ISACA with feedback from all stakeholders, then they must be archived and disposed. This phase contains activities similar to the ones in SCAMPI appraisals.

Action Plan Re-appraisal

Phase 4 in MDD , the Action Plan Re-appraisal is new in comparison to a SCAMPI appraisal. It is in fact an option for a company that failed in some – limited number of - practice areas to be re-assessed only in the parts not met for the first time, without the need to do a complete assessment again. Eligibility criteria for an APR are very strictly formulated, and ISACA must approve the APR. Without going into detail, we can state that an APR is allowed only if the organization did not have systemic

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[3] In verification-based appraisals, where organizations already have detailed collections of artifacts organized by mappings to practices in the reference model, much of the appraisal team effort can concentrate on verifying the appropriateness of the data collected. Other possibilities are to run discovery-based appraisals, where the appraisal team must then work directly with the organization to identify, locate, organize, and evaluate these artifacts. Third possibility, as intermediate solution between the first two is to do managed discovery. [8]

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errors; having the same team and same organizational scope for an APR are also requirements. If eligible, an APR is in fact a new appraisal, similar to the one executed previously (Benchmark or Sustainment), having a much more limited scope in terms of Process Areas. An APR must be executed within 4 months after the previous appraisal ended.

2.4 Sampling rules, random sampling

Sampling is always a central problem in the appraisals, as it can make a lot a difference what are the activities, documents and procedures sampled. Staring from the rather generic "sample must be representative" statement, different appraisal methods tried to define sampling as objectively as possible making the definition of "representative" as concrete as possible. For instance, SCAMPI method suggested that projects and services should be grouped into "basic units", and that characteristics of the work should be defined by "sampling factors" gathering common features of the work. Based on these, it defined a formula for the minimum number of basic units to be selected from a given subgroups. In SCAMPI 1.3, (the minimum number of basic units to be selected from given subgroups) was equal to (number of subgroups x number of basic units in the given subgroups) / (total number of basic units).

Sampling in TAMAR is also done using a formula for this purpose. Sample size formula for formal assessments in TAMAR dictates the minimum number of projects to be selected for each organizational unit in the scope of the assessment: The greater of (2 or [Sum of (Domains, Development Methods & Project Sizes) + Log10(Number of projects)]). It is up to the assessment leader to determine the number and type of testing projects from which data will be gathered for analysis. This will depend partly on the formula included in TAMAR (for the minimum number of projects to be included) but mostly on the experience of the assessment lead for what aspects of which projects should be looked at for each Process Area.

The new MDD suggests to group the work done into "Sampled Projects" (in fact, these are the projects that use the technical, managerial and support PA s) and "Organizational Support Functions" (that provide support for more projects / the entire organization, like Configuration Management or Quality Assurance). Sampling factors must be identified (similar to the way SCAMPI handled these), and Sampled Projects must form groups in which work is executed in a similar way for all projects. Minimum number of instances to be sampled per PA is defined; to be noted that this will result in a smaller number of instances to be sampled.

It is very important to mention that the PA s replacing former Generic Goals : GOV (Governance) and II (Implementation Infrastructure) are included into the sample for each and every project and Support Function.

The interesting concept of **Random Sampling** was introduced to reduce the effort of checking objective evidence. The Random Sample is selected from the eligible sample, and it has the goal to maximize the coverage of the subgroups in the appraisal. After the sampling requirements have been met (and documented), generating a random sample is done. Generating the Random Sample can be done not earlier than a defined amount of days in advance of beginning Phase 2 activities. If Phase 2 start is delayed considerably compared to the original plan, a new Random Sample must be

generated. After the Random Sample is generated by an algorithm, it must be accepted by the organization. The possibility to request a new Random Sample exists, as well as the possibility to include further eligible elements into the Random Sample.

2.5 Virtual appraisals and emphasized IT help

Starting with the COVID-19 period, since summer 2020, 100% virtual appraisals are permitted in CMMI V2 appraisals. Rules are elaborated upon and described in MDD in detail (Virtual appraisal conditions and requirements). In case of virtual delivery, special measures must be taken to ensure confidentiality and non-attribution, proper access to information, seamless communication etc. Risks connected to virtual appraisals must be specifically addressed. In order to do entirely virtual appraisals, the Lead Appraiser must complete a training course and have the corresponding certification.

There is strict monitoring by ISACA on how appraisals are conducted. This is probably due to the fact that appraisals regarding CMM/CMMI-compliance have been conducted for more than 30 years, and experience showed that, in some cases, the appraised organizations tried to find the easiest way to get certified – which was made possible by the not-too-strict auditing rules and checks. Providing the monitoring and conducting Quality Audits lengthens sometimes the acceptance of an appraisal, which can be annoying both for the companies undergoing the appraisal and the Lead Appraiser. The rule is to have a maximum 30 days period for quality audits, but sometime more months were needed, due to the large number of appraisals submitted.

3 TAMAR Changes Recommended for Further Study

In this chapter we list some ideas regarding the changes that, in our opinion, could be or should be studied in detail at a later stage in the context of TAMAR 2.0.

It was the unanimous recommendation of the team doing the analysis that we wish to keep the TMMi assessment method open, and not close it similar to MDD. However, we must state that there are only the general guidelines, in fact the requirements for assessment methods, are freely available connected to TMMi assessments (TAMAR), while the concrete assessment methods based on TAMAR are available for licensing (TMMi Assessment Method) or can be developed by an assessment service provider themselves. Requirements for developing a TAMAR-compliant assessment method [6] are available, and this is at the level similar to ARC (and not MDD).

Based on the changes in MDD the working group proposes the investigate the following changes:

Assessment types
The new assessment types defined by MDD are interesting, and may well be mixed with the current formal and informal assessment defined in TAMAR. We propose to keep the current formal and informal assessment types but study how they can be improved / enhanced using the newly defined MDD assessment types.

Random Sampling

Revisit sampling with TAMAR and study the possibility of adding random sampling. Note, this should be less rigorous compared to MDD.

Virtual Assessments

Permit explicitly to conduct virtual assessment. TAMAR does not dictate how, physically, a virtual assessment is to take place.

Content and format of assessment documentation

Make the assessors and lead assessors more aware of quality requirements connected to TMMi assessments. Having more detailed requirements regarding the contents and the format of the assessment documentation, as well as a checklist containing the elements that will be checked by TMMi Foundation, would, in our opinion, ensure a more stable quality of the assessments.

Data validation and criteria

In TAMAR data validation elements are addressed (leaving it to the assessment team leader to check the criteria). However, we think that more validation of the assessment quality should be conducted.

Quality assurance process

Extend the existing quality assurance process within the TMMi Foundation to check the TMMi assessment process and data delivered by the assessment leader. To date, the validity of the data collected during an assessment has been left to the assessment leader to determine, while the TMMi Foundation reserves the right to audit any assessment. Data submissions are checked now by the accreditation chair and their deputy for their completeness and accuracy in terms of how assessments have been properly conducted according to the accredited method used.

Confidentiality issues

Confidentiality of the assessment (project) data within the assessed organization as well as language problems might be issues opposing quality audits. This could be handled by non-disclosure agreements signed by the members of the quality team. However, there are many organizations with extremely sensitive data, where an NDA would not be sufficient. Such organizations would probably not do the assessment. A template guiding quality audits will be useful.

It is worth noting that there are some changes in the MDD compared to ARC that we do **not** recommend to lead to changes in TAMAR. To make this explicit these are listed here:
- the TAMAR assessment phases will not change;
- the roles in a TAMAR assessment will not change;
- criteria for becoming a TMMi (lead) assessor will not change.

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