A Lightweight Supplier Evaluation based on CMMI

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Abstract: Software for international companies is often developed by a multiplicity of suppliers using different approaches and processes. Only a few of these suppliers are already rated according to CMMI, ISO 15504 or ISO 9001. Therefore Vodafone Global and sd&m have developed an approach to evaluate and to monitor the quality of suppliers' development processes with self-assessments based on a detailed questionnaire. This article gives a short introduction to CMMI[®], describes the selection of the relevant process areas, the creation of the questionnaire, and the automated evaluation of the results.

1 Motivation, Scope and CMMI

Vodafone, the leading global mobile telecommunications company, has many national Operational Companies (OpCo's). The software systems of Vodafone's Intranet are developed by both internal and external development centers. The underlying development processes are different, the quality and results vary. Vodafone wants to ensure that the different development processes for software projects worldwide will deliver predictable results with high quality. An alignment of the different development processes to a common standard was not possible. Because of this, Vodafone and sd&m have developed an approach to evaluate and to monitor the quality of the development processes.

The assessment method used is based on CMMI® (Capability Maturity Model Integration) V1.1. CMMI is a framework of management, engineering, and support best practices organized into 25 topics, called process areas [Cm02]. It has been developed by the Software Engineering Institute (SEI) at Carnegie Mellon University and can be

thought of as a set of "process requirements" that help guide an organization to define and implement processes related to the 25 topics.

CMMI was chosen as the basis for the assessment due to the fact that it covers various disciplines, it is based on practical best-practices, and it not only defines process requirements but also offers possibilities for constructive assessment of organizations. An international standard appropriate for large organizations was also one of the requirements for choosing the basic framework. Furthermore, there was a trend observed that more and more suppliers start with CMMI improvement programs. So it was convenient to speak the same language.

The requirements for assessing the capability according to CMMI are defined in [Cm00]. Since conducting a class A appraisal like SCAMPI^{SM} [Me01] is very time-consuming, research is concentrating on developing class B or C appraisals [Ha03]. The goal of our work was to define a customized supplier evaluation using CMMI as a basis, not to invent a new general assessment method.

To define the terms used in the following sections, we give a short summary of the CMMI concepts. For more details please refer to [CKS02] or [Kn02]. CMMI models are organized in two representations, continuous and staged. The continuous representation measures capability levels whereas in the staged representation an organization has to fulfill some areas to reach a maturity level. In our work we have chosen the continuous representation, since in this, an organization can select the process areas in which it wants to improve and the degree of capabilities. Therefore, capability levels (0-5) are used to express the capabilities and to measure the improvement within each selected process area. The basic concepts in CMMI for assessing the capability are goals and practices. To reach a capability level some goals must be achieved by conforming to some expected practices. CMMI differentiates between Specific Goals and Practices (SP), which are specific to a certain Process Area, and Generic Goals and Practices (GP), which are applicable to all Process Areas.

2 Selecting the relevant process areas

The criteria for selecting the process areas are:

1. The process areas shall address a reasonable maturity level.
2. The supplier shall be responsible for performing the process area.
3. The process of the supplier has an interface to a Vodafone process.

Add 1.) In the regarded context it is enough that the supplier achieves a maturity level of 3. Thus all process areas which correspond to level 4 and 5 in the staged representation were omitted (*Organizational Process Performance*, *Organizational Innovation and Deployment*, *Quantitative Project Management*, *Causal Analysis and Resolution*). These may come into focus after all essential suppliers have reached capability level 3 in all relevant process areas.

Add 2.) Based on work split it is necessary to distinguish for which process areas Vodafone is more responsible for and for which the supplier is mainly responsible. In the investigated organization the supplier contributes only minor parts to the process areas *Requirement Development*, *Product Integration* and *Validation*. The process areas *Supplier Agreement Management* and *Integrated Project Management* are mainly under control of Vodafone.

Add 3.) *Project Planning* and *Project Monitoring and Control* are strongly connected to the Vodafone planning and control process. The *Risk Management* of the supplier has to be integrated into the overall Risk Management of the project at Vodafone. The requirements of Vodafone are handled by the *Requirements Management* of the supplier. The *Technical Solution* has to follow Vodafone development guidelines and has to be accepted by Vodafone. By *Verification* the supplier has to fulfill some predefined quality gates. Finally *Configuration Management* is strongly related with the Configuration Management of Operations.

Each of these areas will be checked by a detailed questionnaire. The remaining process areas are checked by Generic Practices and not by individual questionnaires. The main reason for this is that Vodafone is mainly interested in the results of these processes and not on the processes themselves. For example regard the process area *Organizational Training*. Vodafone is mainly interested that the staff is well trained for the job they do, e.g. designing the architecture of a web application. How to arrange this is left to the supplier. Therefore *Organizational Training* is checked within other questionnaires through the generic practice *Train People* (GP 2.5). The same holds for the process areas *Organizational Process Focus* (GP 2.1 and GP 3.2), *Organizational Process Definition* (GP 3.1), *Process and Product Quality Assurance* (GP 2.9), *Measurement and Analysis* (GP 2.8), and *Decision Analysis and Resolution* (by SP).

3 Proposed Solution

The main requirements of Vodafone for the implementation of the questionnaires for the above process areas are:

- The questionnaires can be used for self assessment and for Vodafone appraisals.
- Answering the questionnaires requires only a basic understanding of CMMI (especially not a SCAMPI Certification).
- The questions should be as concrete as possible, to avoid mistakable answers in self-assessments (and to detect them in Vodafone appraisals).

The proposed solution is an Excel application, containing one sheet (questionnaire) for each of the seven process areas, one sheet for the assessment details, and one sheet for the presentation of results. Furthermore it supports the import, the evaluation and the export of assessment results. Especially the suppliers will not see the results and the formulas when filling out the self-assessment sheet. This is necessary to avoid that the

supplier answers the questions in a way optimizing the results. Another contribution is a part in the contract that agrees on penalties for answers which can not be verified in a succeeding appraisal.

Each questionnaire begins with a short description of the process area. According to the structure of CMMI, each questionnaire inspects first the specific goals and then the generic goals. Each goal is checked by specific practices or by generic practices. Since the specific and generic practices of CMMI are formulated very generally, for each practice some concrete checks are posed. These checks are focused to the type of supplier work which has to be performed when delivering products to Vodafone. Only these concrete checks have to be answered. The answer has to be given from the following range:

- "Yes": The statement is true in all aspects for all examined projects.
- "Partially": The statement is true in most aspects for the most examined projects.
- "No": otherwise.

A check answered with "Yes" is weighed with 100%, "No" is weighed with 0%, and "Partially" is weighed with 50%. The average of all checks of a practice will give a percentage scale from zero to one hundred percent. This is mapped to an estimated rating according to [Is98], section 6.7.2. To reach a capability level for a process area, the evaluated compliance for this level has to be at minimum "Largely". To reach a capability level greater than "1", all previous levels must have an evaluated compliance "Fully" (analog to "Satisfied" in [Me01], Section 2.4.2). In contrast to SCAMPI it is possible to give practices a weight ("Low", "Medium", "High") according to the requirements of Vodafone.

Since Vodafone wants to measure some so-called key performance indicators (KPI) for each process area, those KPIs are explicitly defined in the questionnaires. To fulfill the generic practice 2.8 the supplier has to record and report these KPIs to Vodafone. These KPIs are used by Vodafone e.g. to define quality gates (e.g. for entering the next stage in the product life cycle).
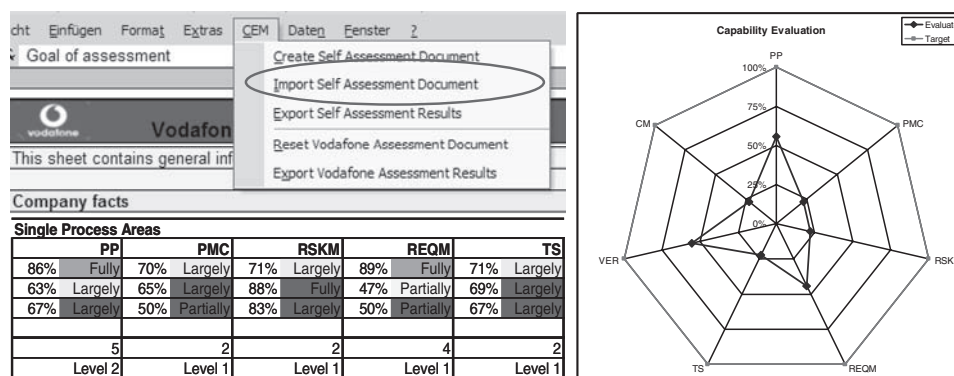

Figure 1: Import of questionnaire and representation of evaluation results

After the supplier has answered all questions, the questionnaire is imported by Vodafone as shown in *Figure 1*. Thus for each process area the evaluated compliance to each capability level and the total evaluated capability level are calculated. The results are shown in a summary table and displayed as a spider graph, see *Figure 1*. Afterwards Vodafone delivers the supplier the results of the evaluation and plans steps for improvement. The scope of a self-assessment will be a first evaluation of a new supplier or repeated evaluation to check process improvements alternating with appraisals by Vodafone.

4 Conclusion

In this article we have described a lightweight approach for using CMMI for internal assessments. We think that the proposed method to reduce the complexity of CMMI is useful in other contexts. From our point of view, CMMI gives very detailed guidance for software engineering, but the topics support and operations were not directly addressed. Furthermore we made the experience, that the influence of Level 2 practices on the assessment results is not easy to understand for the user. These two points are planned to be addressed in CMMI 1.2 and later versions [Ph05]. Currently the developed instruments are introduced at Vodafone and we are interested in comparing the results to previous assessments.

The views expressed in this article are not necessarily those of Vodafone. Vodafone is a trademark of the Vodafone Group. Other product and company names mentioned herein may be the trademarks of their respective owners.

5 Literature

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