FACULDADE DE ENGENHARIA DA UNIVERSIDADE DO PORTO

Electronic Assessment for Software Development Certifications

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Mestrado Integrado em Engenharia Informática e Computação

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Abbreviations

ARC	Appraisal Requirements for CMMI
CAR	Causal Analysis and Resolution
CM	Configuration Management
CMM	Capability Maturity Model
CMMI	Capability Maturity Model Integration
DAR	Decision Analysis and Resolution
IPM	Integrated Project Management
OE	Objective Evidence
OPD	Organizational Process Definition
OPF	Organizational Process Focus
OPM	Organizational Performance Management
OPP	Organizational Process Performance
OT	Organizational Training
OU	Organizational Unit
PI	Product Integration
PII	Practices Implementation Indicators
PM	Abstract Data Type
PMC	Project Monitoring and Control
PP	Project Planning
PPQA	Process and Product Quality Assurance
PSP	Personal Software Process
QPM	Quantitative Project Management
RD	Requirements Development
REQM	Requirements Management
RSKM	Risk Management
SaaS	Software-as-a-service
SAM	Supplier Agreement Management
SCAMPI	Standard CMMI Appraisal Method for Process Improvement
SEI	Software Engineering Institute
SPICE	Software Process Improvement and Capability Determination
SQI	Software Quality Institute
TS	Technical Solution
VAL	Validation
VER	Verification

Chapter 1

Introduction

This chapter presents the context and motivation of this thesis, describing the main goals, its objectives and the expected results.

1.1 Context and motivation

Nowadays current markets are changing, we can see more often the globalization phenomenon and with that organizations are compelled to streamline their business in order to achieve a favorable market position and be able to maintain or increase their competitiveness.

In our everyday lives software takes an important role, it is everywhere and is needed more often. When is in development it is important to make it more efficiently and with more quality. For organizations that have software currently in development failures and errors are not allowed and each one of them implies increased costs and resources being wasted. To avoid this scenario and to achieve maximum efficiency and agility, their processes and their methodologies need to be less time consuming and more effortless so good practices need to be followed in order to allow them focus on what really matters: value creation. This will provide them advantages and make them more trustful.

Organizations need to ensure that their products and services consistently meet customer's requirements, and that quality is consistently improved and certifications are a formal recognition of those ideals. Sadly those recognitions take too much time and effort and in some cases they are very painful and expensive.

Capability Maturity Model Integration(CMMI) is a framework of best practices and does not describe the processes themselves, it describes the characteristics of good processes in order to improve organizations and is required by many U.S. Government contracts, especially in software development.

SCAMPI is the Standard CMMI Appraisal Method for Process Improvement and it provided benchmark quality ratings relative to CMMI models.

SCRAIM is a life cycle and project management tool developed by Stronstep combined with process management techniques. It is going to provide the background and the base to work and simplify those kind of evaluations in order to save time and money. That way companies will deliver their products and services better, faster, and cheaper.

1.2 Goals and expected results

The main goal is of this dissertation is to develop a group of methodologies, techniques and tools integrated in the SCRAIM interface, that will make evaluations and certain parts of certifications easier and less painful for the SCRAIM users. Although there are a number of life cycle and project management tools, few combine this with process management techniques. SCRAIM combines the two and will provide the users new features that will semi-automate the assessment for certification of an organization.

As final result, it will be shown how each CMMI practice is evaluated.

The steps to achieve that evaluation are:

- Having SCRAIM as the basis for project activity take a sample of projects;
- Analyze the project activity in SCRAIM;
- Map the information to CMMI;
  - Determine what are the good practices presented in SCRAIM, that can be mapped to CMMI;
  - For each one of them investigate and conclude if that practice is being followed and fully satisfied;
- Generate a matrix:
  - Each column will represent a good practice that needs to be followed and be satisfied;
- Generate the final outputs and evaluations.

The full-automated process is not yet feasible, so human intervention is still mandatory. With the use of SCRAIM, good practices will be followed and in the end the generated information will facilitate the decision making process. We can see many advantages of this innovation, and we believe that the application of this innovation will help reducing the costs and time of one evaluation using the SCAMPI method.

1.3 Document structure

This document is divided into four main chapters. The first and present chapter serves as an introduction where is presented the context and motivation for this thesis and also the goals and expected results to be delivered.

In the chapter 2 is made a problem analysis, giving insight about CMMI, SCAMPI and the tool to be used SCRAIM.

Chapter 3 is a representation of the state of the art and related work for the assessment world. Is described in detail the most used and most important tools that are currently being used in the appraisals.

In the chapter 4 is made a proposal of the envision approach and presented the work plan for the semester.

The final chapter is made a resume of the document and presented the final conclusions about it.

Chapter 2

Problem analysis

The evaluation for certification is one complex process, and requires many approaches, some acquired knowledge and some experience. To understand the problem and objectives of this dissertation, it is necessary to understand what is CMMI, in particular the SCAMPI [SCA13] method and what is SCRAIM.

2.1 CMMI

2.1.1 What is CMMI

To understand better what is CMMI [CMM10] we need to understand what is Capability model.

Capability Maturity Models contain essentially elements of effective processes, based on concepts developed by Crosby, Deming, Juran, and Humphrey.

The SEI (The Carnegie Mellon Software Engineering Institute that is a federally funded research and development center headquartered on the campus of Carnegie Mellon University in Pittsburgh, Pennsylvania, United States) adopted the process management premise, "the quality of a system or product is highly influenced by the quality of the process used to develop it and keep it" and defined CMMs that incorporated this premise.

CMMI stands for Capability Maturity Model Integration and is an evolution of CMM like shown in the Figure 2.1. It is a framework of best practices administered and sold by the Carnegie Mellon University, and for some business activities is required and mandatory like many DOD (United States Department of Defense) and U.S. Government contracts, especially in software development.

The CMMI model does not describe the processes themselves; it describes the characteristics of good processes, thus providing guidelines for companies developing or honing their own sets of processes.

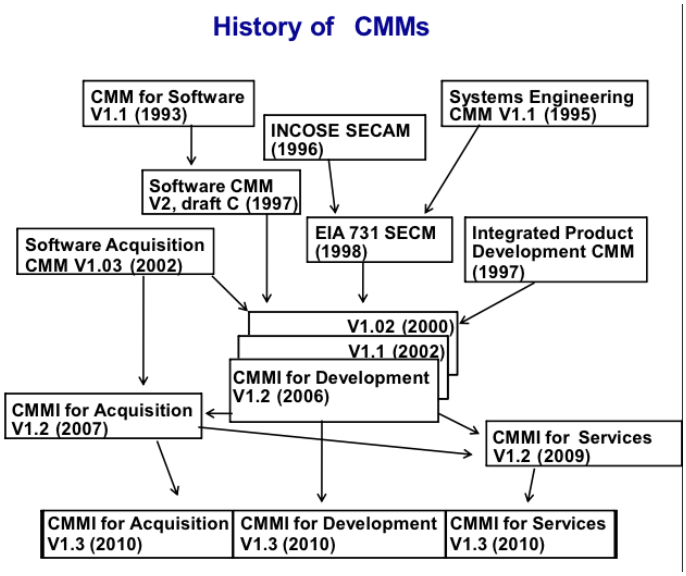

Figure 2.1: History of CMMs

Carnegie Mellon University says that CMMI can be used to guide an organization, a division and process improvement across projects. The CMMI processes and methodologies can be classified according to maturity levels.

Currently CMMI is on Version 1.3 and is registered in the United States Patent and Trademark Office by Carnegie Mellon University.

2.1.2 CMMI models and process areas

Best practices of CMMI are published in documents called models, each model addresses a different area of interest. The current version of CMMI, version 1.3, has three different areas of interest: development [CKS06], acquisition and services.

These models are produced taking for base the CMMI framework that contains all the goals and practices used to produce the models that are part of CMMI constellations. The CMMI models contain 16 core process areas, they cover basic concepts fundamental to process improvement in any area of interest.

For each process area can be defined a set of goals and practices, the Figure 2.2 is a diagram where is shown the connection between process areas, goals and practices.

There are two types of goals and practices:

- Generic goals and practices: Part of every process area.
- Specific goals and practices: Specific to a given process area.

A process area is satisfied only when the company processes cover all specific and generic practices and goals for the process area idealized.

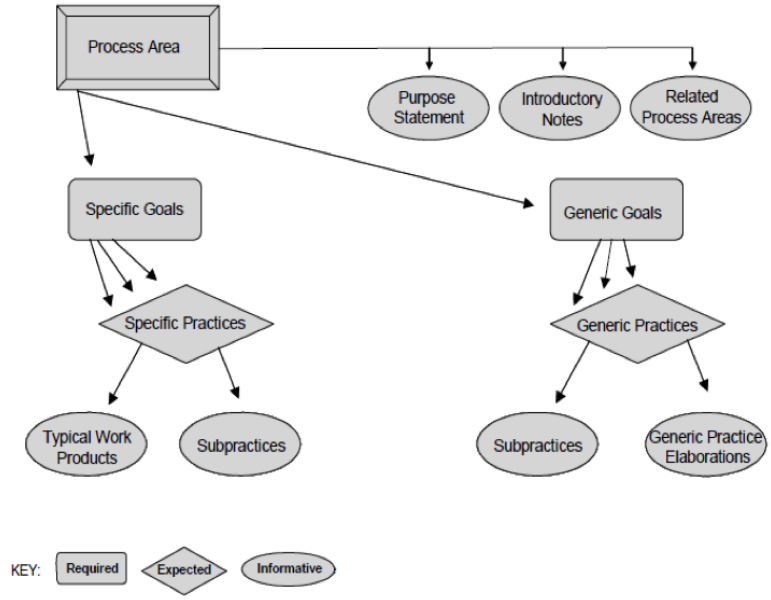

Figure 2.2: Specific and generic goals and practices

The material in core process areas is almost the same for all constellations of CMMI, the rest of the material need to be adjusted to a specific area of interest, so the material wont be exactly the same.

2.1.3 CMMI model framework

CMMI framework is a basic structure that organizes and groups the CMMI components, elements of the current models, rules, methods for model generations, appraisal methods and training material, contains too process areas that will vary for each one of the CMMI areas that will be used. Process areas are the areas that cover the organization processes.

For the latest version of CMMI for Development (Version 1.3) there are 22 Process Areas, which represents the product aspects and the coverage for the organizational processes.

2.1.4 CMMI representations

CMMI is available in two representations: continuous and staged.

The continuous representation is represented by capability levels. Allows each organization to select the order of improvement that best meets their business objectives or those to which the organization assigns a high degree of risks. Enables comparisons across and among organizations on a process-area by process-area basis.

The staged representation is designed to provide a standard sequence of improvements, by maturity levels, each serving as foundation for the next. This representation results in a single rating (Maturity Level) that summarizes appraisal results and can serve as a basis for comparing the maturity of different projects and organizations.

Each representation has advantages and disadvantages. Staged representation is focused by organizational maturity, continuous representation, by the hand is focused by process are capability.

Organizational maturity and process area capability are similar concepts. The difference between them is that organizational maturity pertains to a set of process areas across an organization, while process area capability deals with a set of processes relating to a single process area or specific practice.

In the pictorial diagram bellow in the Figure 2.3 both the presentations are represented where ML represents Maturity Level and PA represents Process Area.

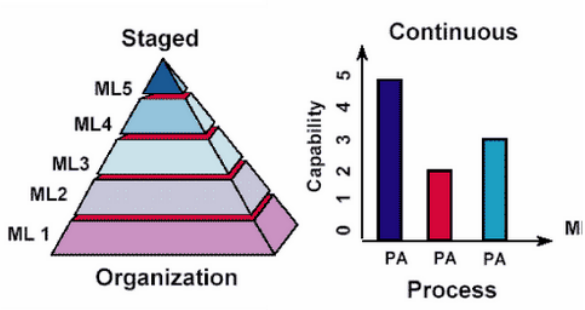

Figure 2.3: CMMI representations

2.1.5 Maturity levels in CMMI for development

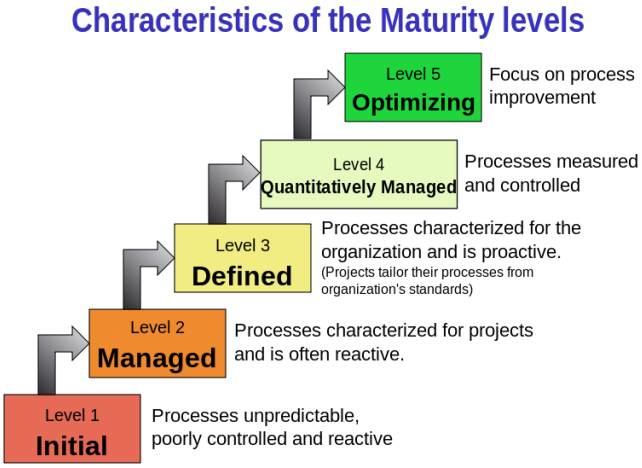

Figure 2.4: CMMI maturity levels

Processes under the CMMI methodology are rated and grouped in maturity levels. There are five maturity levels defined as: Initial, Managed, Defined, Quantitatively Managed, Optimizing.

These maturity levels that are rated are presented and awarded for levels 2 through 5. The following process areas listed show us the maturity levels for CMMI for Development:

2.1.6 Capability levels in CMMI for development

In CMMI models with a continuous representation, there are six capability levels designated by the numbers 0 through 5.

A capability level is a plateau that describes the organization's capability relative to a process area and consists in a group of related specific and generic practices associated with a process area; can improve the organization's processes in that process area.

Capability levels are also cumulative, so a higher capability levels contains the attributes of the lower levels.

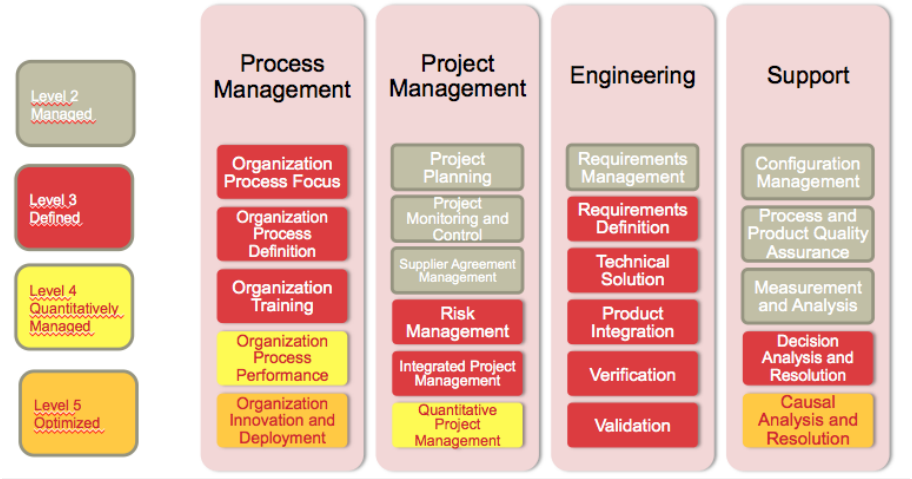

Figure 2.5: CMMI maturity levels

2.2 SCAMPI

Organizations cannot be certified in CMMI, so there is something called appraisal and an organization is appraised.

In an appraisal the organization gets awarded a maturity level from one to five or a capability level achievement profile. As said before many organizations are required to get some kind of recognition and others find value measuring their progress and determining how well the processes adopted by the organization are compared to CMMI best practices, to meet contractual and customers requirements and to know which areas they can improve and appraisals are the right way to do it.

Appraisals using a CMMI model must comply with the requirements set out in the Appraisal Requirements for CMMI (ARC) document. There are three classes of appraisals, A, B and C. All

of them compare the processes used in the organization to CMMI processes and best practices, that way is identified improvements to make. From all three classes of appraisals the most formal is class A and it is the only one that can output a level rating.

When an appraisal is done teams use a CMMI model and an ARC document. The results from the teams are used to plan improvements for the organization.

Statistics are made and updated every six months in a maturity profile since the release of CMMI show us that the median times to move from Level 1 to Level 2 is 5 months, and from that to Level 3 more 21 months.

2.2.1 What is SCAMPI

SCAMPI is the abbreviation for Standard CMMI Appraisal Method for Process Improvement and is an appraisal method that meets all the ARC requirements. In SCAMPI appraisals there are three types of distinct classes: Class A, B and C appraisal methods. The most rigorous method and officially recognized as that is the Class A method and its the only method that can result in a benchmark quality rating.

Results SCAMPI appraisal can be published on the CMMI web site of SEI, if the organizations approves this. This appraisal supports ISO/IEC 15504, Software Process Improvement and Capability Determination (SPICE), a set of technical standards documents for the computer software development process and related business management functions.

The ARC Class A appraisals is normally conducted by SCAMPI A appraisal. The SCAMPI A Method Definition Document is where is defined rules to ensure the consistency of the appraisal ratings, so the same maturity rated in two companies means they are equal in methodologies and business processes.

2.2.2 SCAMPI principles

As said before the class A appraisal is the only full comprehensive appraisal method that involves an ARC class A method and uses CMMI models as reference models.

This appraisal will allow organizations to gain insight about their capability by identifying the strengths and weaknesses of its current processes, prioritize improvement plans, focus on those improvements, correcting weakness that will generate risks, derive capability rating as a maturity level rating and identify risks relative to capability and maturity determinations.

This appraisal follows these principals:

- Start with a process reference model.
- Use a defined appraisal method.
- Involve senior management as an appraisal sponsor.
- Observe strict confidentiality and non-attribution.

- Approach the appraisal collaboratively. (When SCAMPI is used for Supplier Selection or Process Monitoring modes, it may not be possible to use a collaborative appraisal approach.)
- Focus on the sponsors business objectives

2.2.3 The SCAMPI process

The Method Definition Document is a document that describes SCAMPI appraisal method, this document sets the key elements of appraisal planning and the rules of conduct. It is also included in this document the level of process tailoring permitted, qualifications of the team members, evidence requirements, how to scope the appraisal and more.

There are essentially three phases in the process:

- Phase I - Plan and Prepare for Appraisal presented in the Figure 2.6
- Phase II – Conduct Appraisal presented in the Figure 2.7
- Phase III – Report Results

The following graphs shows us these phases where the last one includes the results report phase.

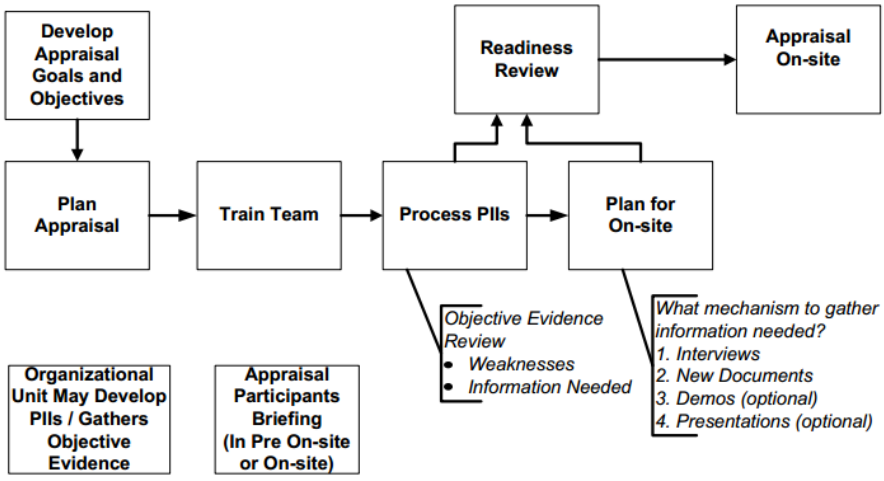

Figure 2.6: Plan and Prepare for Appraisal Activities

2.2.4 Special terms

There are some terms to consider with special meaning, Organizational Unit (OU), Organizational Scope, Subgroup, Basic Unit, Support Function, Objective Evidence, Instantiation, Database of Objective Evidence, Practice Characterization.

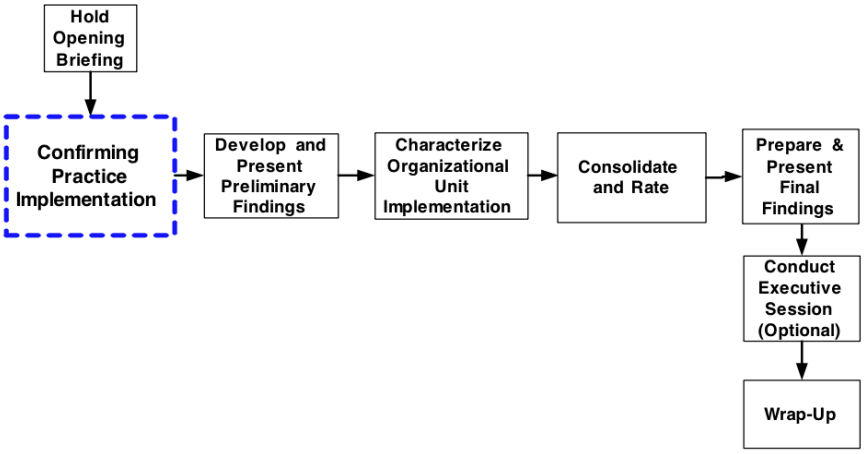

Figure 2.7: Conduct Appraisal Activities

Organizational Unit is the subject of an appraisal. Can be deployed one or more processes that have a consistent process context, operates in a coherent set of business objectives and is typically part of a larger organization. In a small organization, this unit can be the whole organization.

Basic Unit stands for a set of interrelated and managed resources that delivers products or services to a customer and usually works like planned. The plan is documented and specifies the services or products delivered or implemented, the funds, the future work and the work that is currently being done.

A collection of basic unit and support functions that represent practices used within and organizational unit is the Organizational scope.

A Subgroup is a cluster of basic units that are shared between similar process implementations and a common sampling factor alternatives.

Support Function is an organizational group that for a certain and well defined set of activities needed by other parts of the organizations provides products and/or services.

Objective Evidence (OE) are indicators of the implementation or institutionalization of model practices. Verifying practice implementation is the review of Objective Evidence to determine whether a practice is implemented within a basic unit, support function, and/or organization. Can be of two types: artifacts or affirmations. The artifacts are a tangible form of evidence indicative of work being done, which is both the main output of a practical model or a consequence of the implementation of a model of practice. Affirmation is an oral or written statement confirming or support the implementation (or lack of implementation) in a practical model provided by the practice performers, provide through an interactive forum in which the evaluation team has control over the interaction. In certain cases for some practices, documents are accepted as artifacts even if they are not the primary desired result of practical practice.

Instantiation is the implementation of a model practice used in its context in the organizational unit boundaries.

2.2.5 Practice characterization

Practices Implementation Indicators (PII) are a proof of a correct implementation of a certain CMMI Practice. When a Practice is performed will leave a mark or evidence of that operation, for example that evidence can be a document produced while the practice is performed.

Appraisers look for an objective evidence in order to make an assessment. There are three types of indicators presented in the Table 2.1.

Table 2.1: Indicators Types

Indicator Type	Description	Examples
Direct artifacts	The tangible outputs resulting directly from implementation of a specific or generic practice. An integral part of verifying practice implementation. May be explicitly stated or implied by the practice statement or associated informative material.	Typical work products listed in reference model practices Target products of an Establish and Maintain specific practice Documents, deliverable products, training materials, etc.
Indirect artifacts	Artifacts that are a consequence of performing a specific or generic practice or that substantiate its implementation, but which are not the purpose for which the practice is performed. This indicator type is especially useful when there may be doubts about whether the intent of the practice has been met (e.g., an artifact exists but there is no indication of where it came from, who worked to develop it, or how it is used).	Typical work products listed in reference model practices Meeting minutes, review results, status reports, presentations, etc. Performance measures
Affirmations	Oral or written statements confirming or supporting implementation (or lack of implementation) of a specific or generic practice. These statements are usually provided by the implementers of the practice and/or internal or external customers, but may also include other stakeholders (e.g., managers and suppliers).	Instruments Interviews Presentations, demonstrations, etc.

After the collection of an evidence and properly examined is made a characterization of the extent to which Model practices are implemented. The model practices are characterized as described in the Table 2.2.

Table 2.2: Practice characterization table

Fully Implemented (FI)	Sufficient artifacts and/or affirmations are present and judged to be adequate to demonstrate practice implementation, and no weaknesses are noted.
Largely Implemented (LI)	Sufficient artifacts and/or affirmations are present and judged to be adequate to demonstrate practice implementation, and one or more weaknesses are noted.
Partially Implemented (PI)	Some or all data required are absent or judged to be inadequate, Some data are present to suggest some aspects of the practice are implemented, and one or more weaknesses are noted. OR Data supplied to the team (artifacts and/or affirmations) conflict –some data indicate the practice is implemented and some data indicate the practice is not implemented, and one or more weaknesses are noted.
Not Implemented (NI)	Some or all data required are absent or judged to be inadequate, Data supplied does not support the conclusion that the practice is implemented, and one or more weaknesses are noted.
Not Yet (NY)	The basic unit or support function has not yet reached the stage in the sequence of work, or point in time to have implemented the practice.

2.2.6 Appraisal participants

In an appraisal there are several participants with roles and responsibilities crucial to its success.

The Appraisal sponsor is responsible to sponsor the appraisal and owns the appraisal results and signs the Appraisal Disclosure Statement.

Middle managers are originally from the line or staff management positions and are interviewees and data providers and if they are participant they review preliminary findings.

Basic Unit leaders have leadership responsibilities for a project, service. They are too interviewees and data providers and if they are participant they review preliminary findings too.

Support Function as the past roles are interviewees and data providers, they are practitioners and review preliminary findings.

2.2.7 Appraisal team

The appraisal team is composed by two main Key Roles: Team Leader and Team Members. Team Leader is the person who has the overall responsibility for the appraisal, is a SEI - Certified SCAMPI[SCA13] leader appraisal and has experience and training, he signs too the final findings. Team members are those who satisfy requirements of experience and training to be part of the team and they assume one or more specific roles.

One of the key roles of the appraisal team is the team leader who has overall responsibility for the appraisal. He is also responsible for assign team roles for each member, ensuring that the planning activities are complete, that the SCAMPI process is being followed, scheduling monitoring and checking performance, facilitate team resolution in case of conflicts and impasses and reporting results to SEI.

For each team member the team leader will assign a role that will ensure the proper function of the team and will facilitate the appraisal, those roles are the following:

- Appraisal coordinator

  Responsible for handling on-site logistics. This position is also composed by more than one member for a multi-site appraisal.

- Librarian

  Documents are managed by this member and in the end of the appraisal they are returned.

- Timekeeper

  For each mini-team can be one Timekeeper and his main purpose is track team time and schedule constraints during interviews and other activities.

- Note takers

  For all PAs is responsible for taking notes during data gathering sessions.

- Appraisal team

  All the work is reviewed by members.

- Mini-teams

  Teams typically consist of two or three members and verify the implementation of reference model practices, reviewing objective evidence provided and identify weaknesses in the implementation. The practices at instantiation levels are characterized by its implementation extent. They have the power to request addition information if needed.

2.2.8 SCAMPI results

The appraisal is completed after the collection and evaluation of objective evidence to support the implementation of practices.

Goal satisfaction depends on satisfaction of practices associated with it.

The goal is rated if and only if all associated practices are characterized as largely implemented or fully implemented, and all the weaknesses associated with the defined goal don't have a significant impact on goal achievement. With the help of a program we can obtain a matrix as shown in the Figure 2.8.

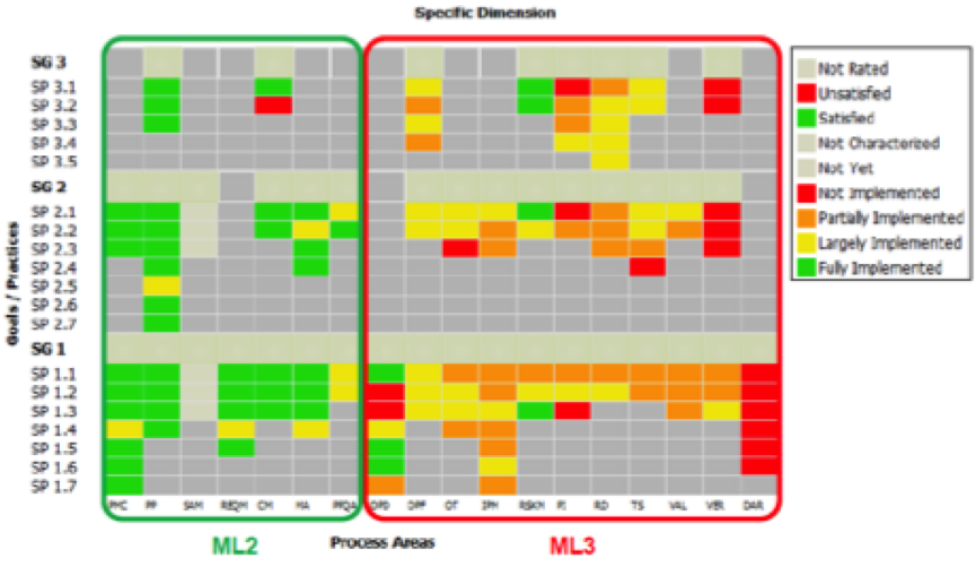

Figure 2.8: SCAMPI results

When a given Goal is determined to be either Satisfied or not, then a Capability Level (for the continuous representation) can be derived and its possible to appraise.

2.3 SCRAIM

SCRAIM [SCR] is a project management tool developed at Strongstep based on advanced methodologies with intelligent decision support mechanisms. It also has some ready-made processes that facilitate a better management.

2.3.1 Software-as-a-Service

SCRAIM is a SaaS, which stands for Software-as-a-Service. Software-as-a-service (SaaS) emerges as an innovative approach to deliver software applications based on cloud-computing technology. [CC07]

This type of software sometimes refered as simply hosted applications allows organizations and clients to access functionalities and all data stored on that platform everywhere, and it costs less than a typical licensed application. SaaS has many advantages compared to typical software, since is hosted remotely and accessed through Web they bypass server provisioning and software

installation as requirement, making software cheaper. Another advantage of this development type is that organizations don't need to perform and handle installation problems, updates and performing maintenance.

> "SaaS is one of the biggest technology trends to affect business applications in recent years." [Hou09]

2.3.2 Methodologies and Processes definition

One of the reasons that can lead to a project failure is the lack of use of a defined software development process, is also known that one of the success factors is the adoption of appropriate development process to the organizations projects.

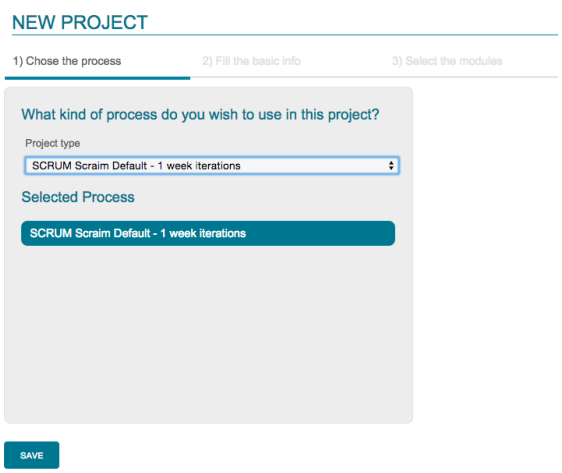

Figure 2.9: SCRAIM Process choose wizard

SCRAIM supports the most advanced technologies like CMMI [CMM10], TSP and SixSigma [Six] to help organizations increase projects quality. SCRAIM has a set of ready made processes like SCRUM [PQ11], chosen in the Figure 2.9 and its possible to adapt to the specific needs of a project and save to use it later.

2.3.3 Project planning and tracking

The Planning page represented by the Figure 2.10 presents to the user a chronological view of the project's iterations (Centralized on the current iteration).

In this page users are able to create, update and estimate tasks and assign those tasks to iterations and team members.

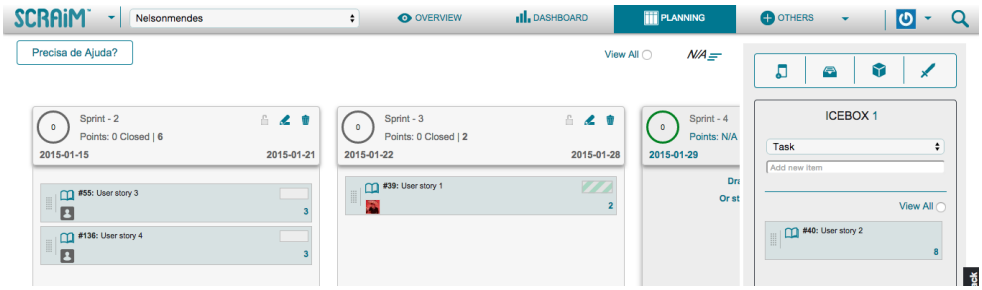

Figure 2.10: SCRAIM Planning Page

2.3.4 Risk and issue management

Risk Management is also supported by SCRAIM. This part of the software is designed to give the possibility to identify what can go wrong (risks), how to prevent that from happening (mitigation and contingency actions) and what to do if something happens (Impediments).

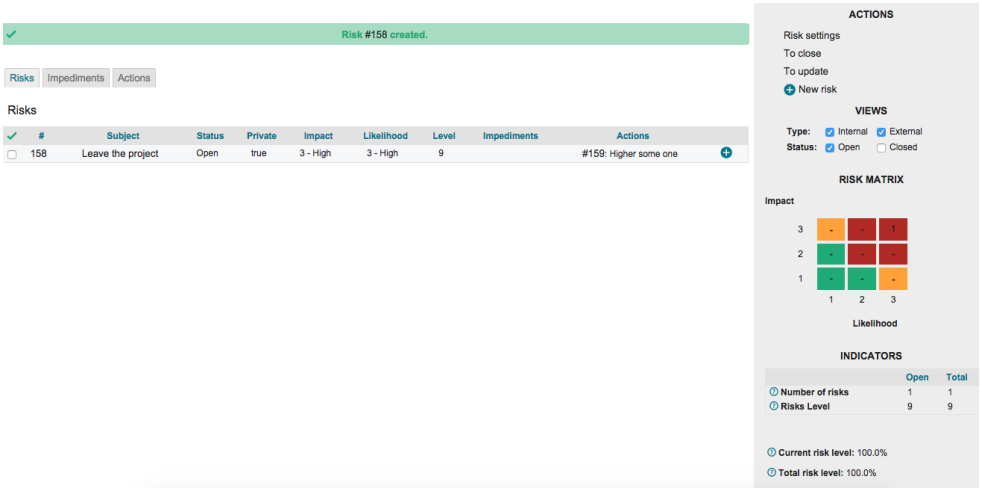

Figure 2.11: SCRAIM Risk View

2.3.5 Test management

Test management tools provided on SCRAIM are used to store information on how testing is to be done, plan testing activities and report the status of quality assurance activities.

In the Figure 2.12 is presented the project tests configuration, presenting all the actions that can be made by the user, and that are related to traceability and execution of test cases.

2.3.6 Other functionalities

The project information is easily trackable, SCRAIM allows to manage files and documentation associated to each one of the projects and to attach external repositories in order to track the changes of source code.

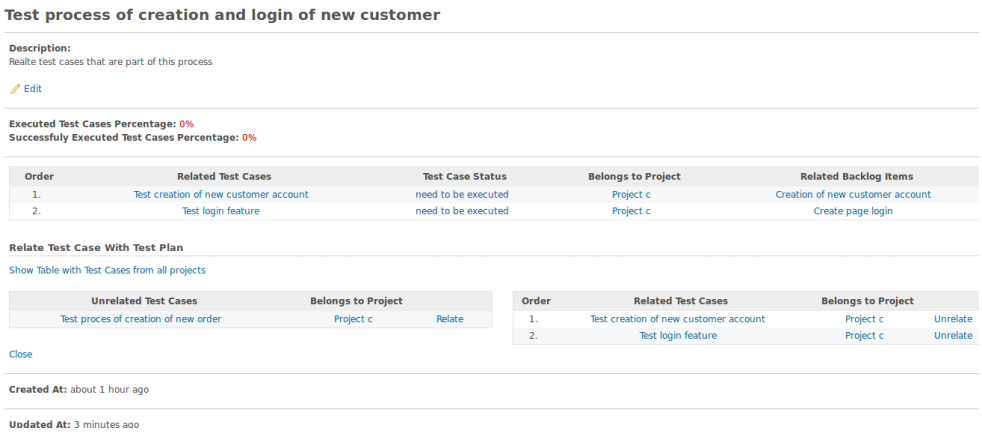

Figure 2.12: SCRAIM Test configuration view

In SCRAIM its possible to schedule deliverables for each release of the organization project, with this its possible to know in real time what's being delivered, what's being schedule and who's in charge of each deliverable.

Wiki, forums, news and notification system are other set of features that facilitate team collaboration.

Chapter 3

State of the art analysis

In this chapter is presented the related work. Are introduced some tools that are currently being used in the market and others made for teaching purposes.

3.1 CMMI assessment checklists and tools

Leaders are recommended to identify the key business capabilities by conducting a capability maturity assessment [Hut14], to determine and find what the organization need to build or strengthen the skills, designed to raise the company, business unit, or specific function to the next level. CMMI assessment checklists appear as an online solution to make a lightweight assessment tool and is a free online assessment tool that make possible get and track an organization capability across eight key business functions based in a group of 31 questions.

3.1.1 Assessment items

In this tool each assessment item has a statement about a particular capability or several capabilities and a scale that allow to indicate the level of agreement with the statement, based on the organization performance.

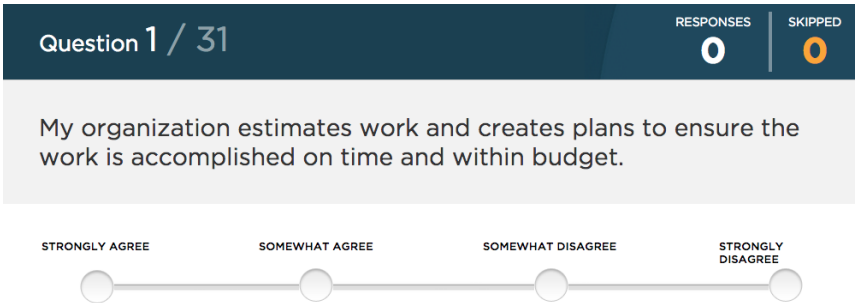

Figure 3.1: Assessment item question

The scale included in the assessment item also includes a descriptive information about the organization performance at both ends of the scale, visible on the example given below.

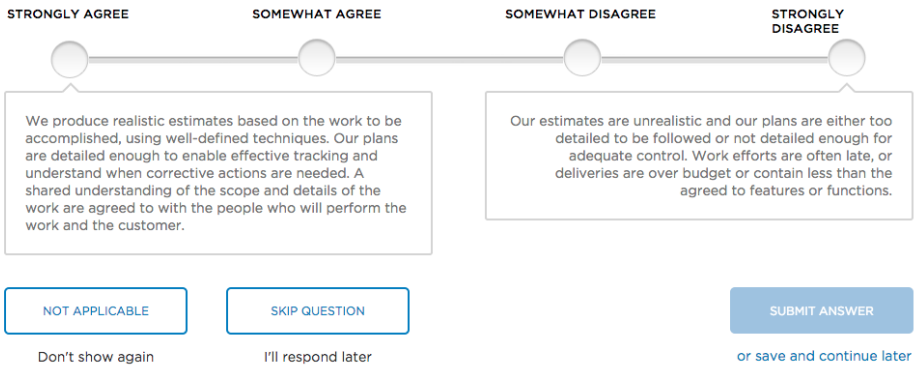

Figure 3.2: Assessment item scale

These descriptions are given to the user with the intention of helping the most accurate positioning of the organization on the scale.

The organization term in the assessment tool is defined by the user for purposes of self-assessment. The evaluated scope is also defined by the user and can be the company, organizational unit, division, directorate, department or work group.

It's possible to skip a question in the list of items and comeback later to answer and there is an option named Not Applicable to exclude the question from the results. This answer only should be chosen if:

- Actual question is related to an area outside of the organization scope.
- Its valid for the organization's but the performance of the activities is not known.
- The user that is performing the assessment have insufficient expertise in the subject to understand the intent of the question.

The answers are editable before the submission of the assessment in a screen for a final review. Is possible to save the current state and progress at any time and resume it later. It is only possible to submit and get an assessment if all questions are answered.

After answering all questions provided as requirement the survey is submitted and will be shown a high level snapshot of the organization current capability states and will be included in each item some suggestions for developing the next steps.

Figure 3.3: Example of a result an assessment

3.2 PSP assessment checklists and tools

Personal Software Process(PSP) [Hum05] is a process framework with the objective of guide developers to define their own processes, track and plan their work and manage the quality of the produced products.

3.2.1 PSPchecker

PSPChecker[PF10] is a tool that has the main objective of helping teachers to make decisions faster and help students to be able to achieve better results and understand PSP.

The PSPChecker was only made and planned for teachers as a support for evaluation and feedback is suitable for students too depending on the type of teaching, that way they can improve their work. A short period of time is required to use this tool and is currently only as a desktop application.

This desktop application has as main functionalities:

- Automatic verification of checklists

  Each checklist item has different types of verification and as output if an item in the checklist is completely satisfied, it is shown the line in green otherwise the line is highlighted in red or given a special message on the screen.

- Custom processes

The user when start the program can choose which items of the PSP process want to associate with this evaluation.

- Remote data importation
- Illustrative charts

  Charts that facilitate the perception of whats is wrong and well done to understand which points can be improved.

- Automation of support messages (use of knowledge acquired by specialists)

  Messages provided by specialist to understand the errors in a more complex level.

- Information Import/Export (Figure 3.4)

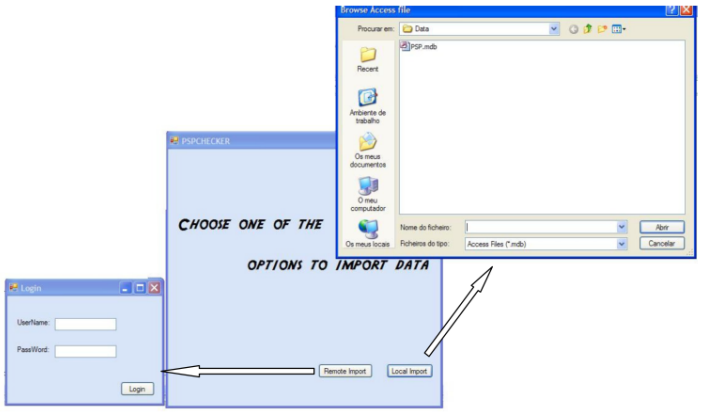

Figure 3.4: Example of a data import for PSPChecker

- Modularity and scalability

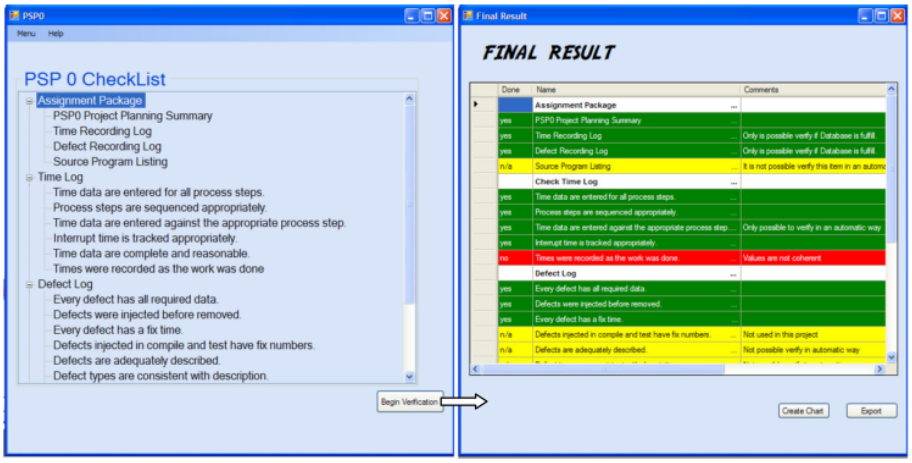

Figure 3.5: Final results of PSPChecker

In the Figure 3.5 is represented two of the last screens of PSPChecker. Is shown on the left side the checklist imported or chosen and on the right side the final screen, where we can generate charts and export the data.

Colors: yellow - are some items that are not available to check automatically red -

3.3 Appraisal Assistant

The Software Quality Institute of the Griffith University[Sof] developed Appraisal Assistant. The Appraisal Assistant[App] is a software application that supports the appraisal or assessment of process capability or organization maturity.

This tool follows consistent approaches with the requirements of ISO/IEC 15504(Information technology: Process assessment, and the Assessment Requirements for CMMI)[ISO] and it's distinguished from other tools by taking an evidence-driven approach to the record of evidences generated in an assessment.

SQI personnels have performed SCAMPI A and B appraisals and SPICE assessments with the help of Appraisal Assistant and have been using since the first beta release. The Beta release was used to examine relationships between ISO 15504-2 and SCAMPI appraisals

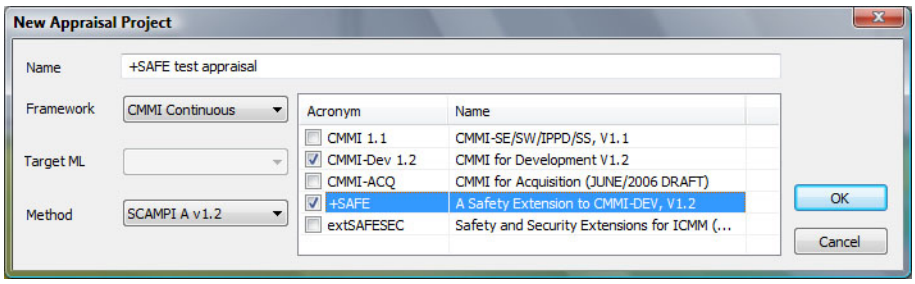

Figure 3.6: Appraisal Assistant New Project Screen

The Appraisal Assistant has many functionalities and can provide:

- Support for multiple process models as: ISO/IEC 15504-5, ISO/IEC 15504-6 (FDIS), Automotive SPICE, CMMI®-DEV v.1.2, +SAFE, and CMMI® SE/SW/IPPD/SS V 1.1.
- User defined appraisal models.
- Multiple methods for performing appraisal / assessment.
- User defined assessment methods.
- Conversion of results between frameworks
- Easy to split and consolidate evidence capture activities.

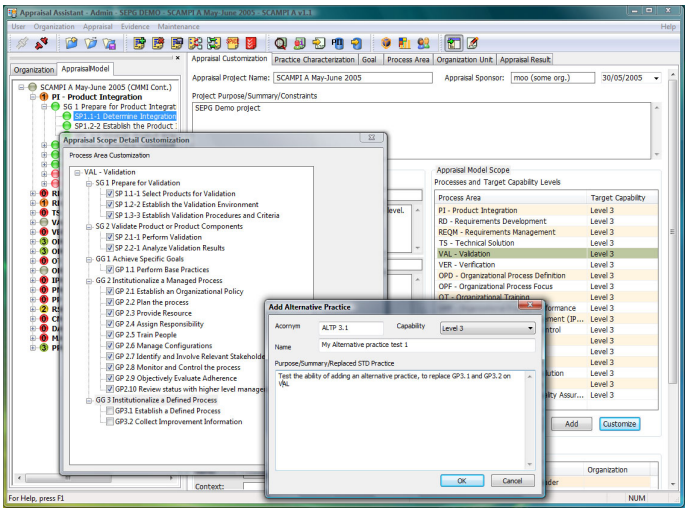

Figure 3.7: Appraisal Scope Customization

- Generate automatically reports as Appraisal Disclosure Statement, PIID, Assessment Record, Appraisal / Assessment Findings, Strength / Weakness summaries, Rating Profiles, and workload summaries.
- Model coverage and automatic reporting by collected evidence.

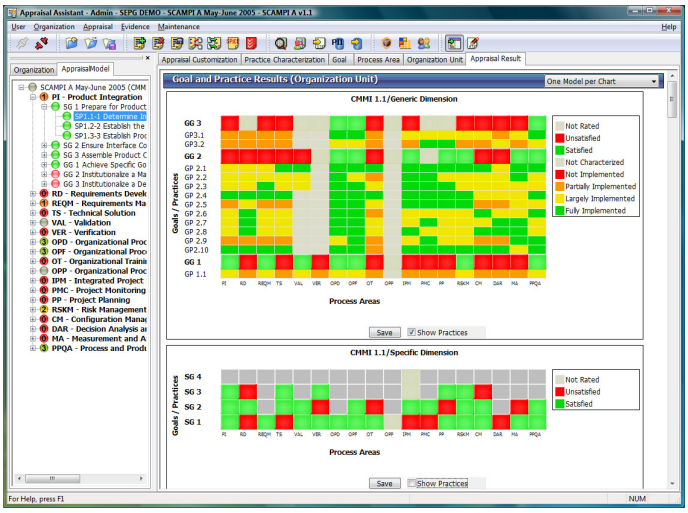

Figure 3.8: Appraisal Assistant Results

The Figure 3.8 shows an example of an appraisal result and output of the program after labeling all the process areas.

3.4 ITMark Appraisal tool

ITmark [ITM] is a certification scheme designed specifically for SMEs that combines various improvement models streamlined into only one scheme.

This certification is developed by leading appraisal providers across technical and business related disciplines, gathered in an International Consortium of Centers of Excellence dedicated to support Software Intensive Organizations throughout the world.

This certification assesses and certifies the processes in small organization in three different areas:

- Business Management
- Software, Systems and Services Engineering
- Security Management

It provides a group of analysis tools that help a company enhance its business, information security management and software development processes. A company can have additional recognition for their level of capability through ITMark certification.

ITMark will provide organizations:

- Process improvement of product development and services
- Improvement of other critical processes of the organization: business and security
- Low cost and quick implementation of the improvements
- Philosophy of quality
- Internationally recognized

The ITMark Appraisal tool fully supports this process.

When an assessment is created in the interface we can access the three areas and see all the specific questions that we need to be answered in order to get the results.

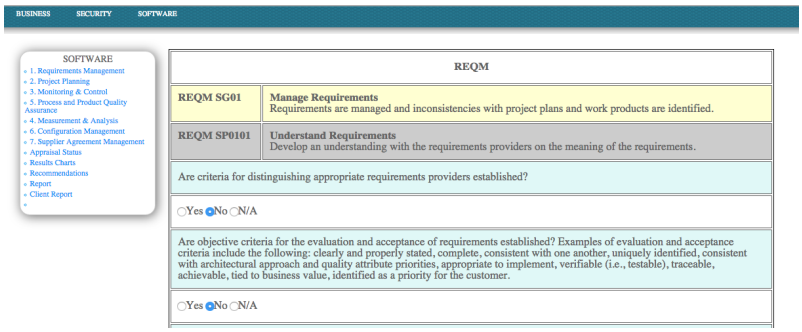

Figure 3.9: ITMark Appraisal tool question example

In the Figure 3.9 we can see in the top the three areas and an example of a question with the possible answers that are yes, no or not applicable.

After answering all the questions this tool will provide us graphs and some charts with the results of this assessment. We can see an example of those graphs in the Figure 3.10

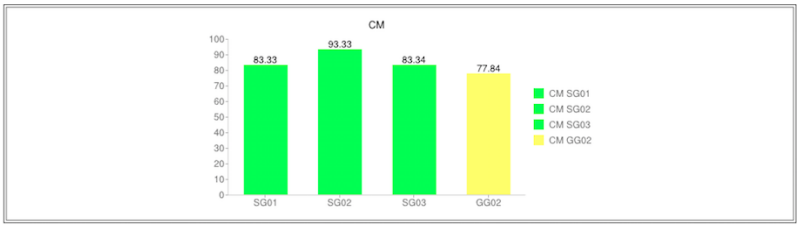

Figure 3.10: ITMark Appraisal tool result example

The overall assessment results will be available on a bar graph like the presented on the Figure 3.11, where we can see the maturity level associated.

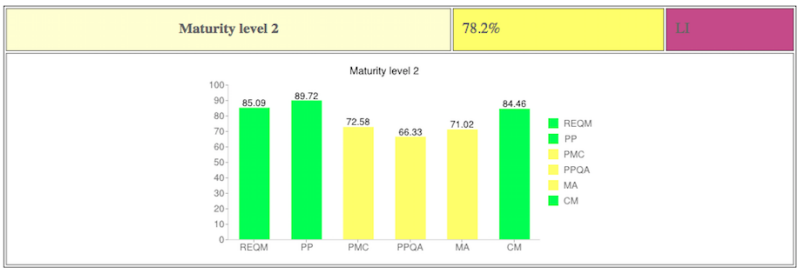

Figure 3.11: ITMark Appraisal tool result overall example

Chapter 4

Solution perspectives

4.1 Envisioned approach

The scheme represented by the Figure 4.1, resumes the envisioned approach.

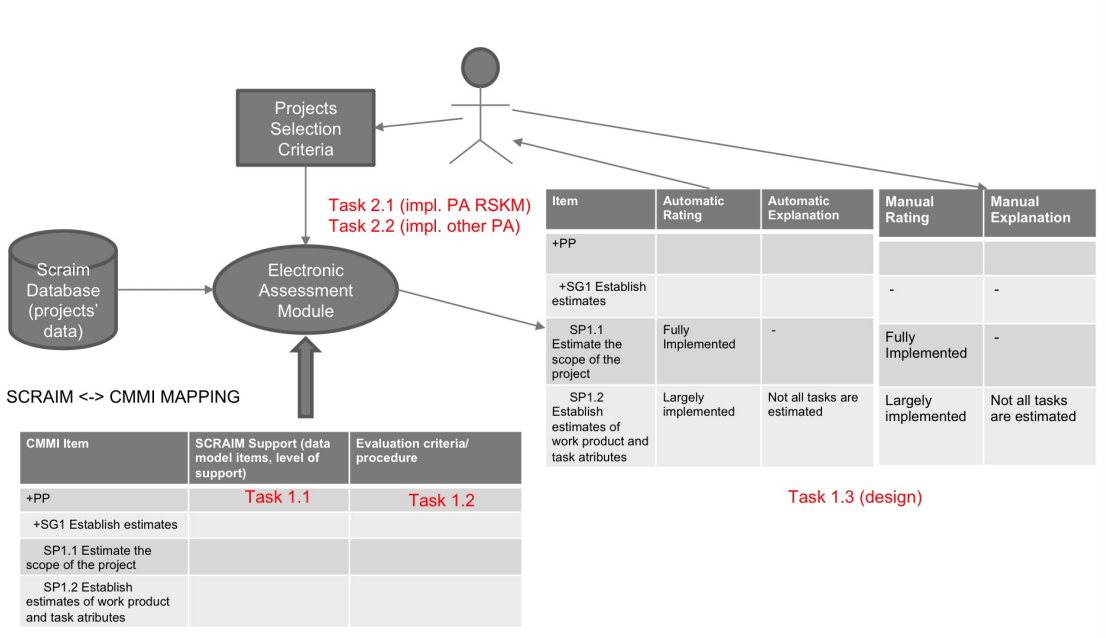

Figure 4.1: Envision approach scheme

The first step of this solution is to make a CMMI-SCRAIM mapping where it is going to be evaluated the data model items and the level of support available on SCRAIM and match them to CMMI best practices.

Then will be made the design of the module, where will be evaluated on a top level the data from SCRAIM database taking for base the previous mapping.

After completing these tasks will be evaluated the results obtained by this automatic rating and compared to manual ratings taking for base real projects selected from SCRAIM.

For example in the Table 4.1 its shown an automatic rating for the Project planning process area and the obtained explanation for that assessment.

Table 4.1: Automatic rating envision

Item	Automatic Rating	Automatic Explanation
SG1 - Establish estimates		
SP 1.1 - Estimate scope of the project	Fully implemented	-
SP 1.2 - Establish estimates of Work product and task attributes	Largely implemented	Not all tasks are estimated
SP 1.3 - Define project lifecycle phases	Fully implemented	-
SP 1.4 - Estimate effort and cost	Fully implemented	-
SG2 - Develop a project plan		
SP 2.1 - Establish the budget and schedule	Fully implemented	-
SP 2.2 - Identify project risks	Partially implemented	Not all projects have risks identified
SP 2.3 - Plan data Management	Fully implemented	-
SP 2.4 - Plan the project's resources	Fully implemented	-
SP 2.5 - Plan needed knowledge and skills	Fully implemented	-
SP 2.6 - Plan stakeholder involvement	Not implemented	Not implemented
SP 2.7 - Establish the project plan	Fully implemented	-
SG3 - Obtain commitment to the plan		
SP 3.1 - Review plans that affect the project	Fully implemented	-
SP 3.2 - Reconcile work and resource levels	Fully implemented	-
SP 3.3 - Obtain plan commitment	Largely implemented	Missing first meeting

4.2 Work plan

The work plan consists in four main tasks that are:

- Conception - that contains the CMMI-SCRAIM mapping, definition of evaluation rules and user interface design.
- Implementation - consists in 6 iterations of one week each.
- Validation - analyze the results obtained by the module produced comparing to real assessments.
- Thesis and article writing

The Gantt of is presented on the Figure 4.2.

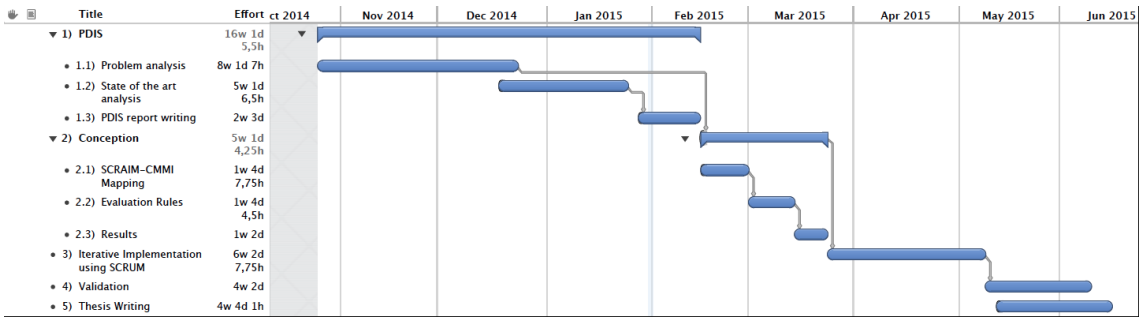

Figure 4.2: Gantt Diagram

Chapter 5

Conclusions

In this documented was presented in detail the problem, giving some insights of CMMI and SCAMPI the main appraisal method.

After a study of the field was required, and was found several appraisal tools and checklists that are currently available for assessments. Those tools are listed on this report and for each one is made a description of their main functionalities and process coverage. This study was helpful in order to find similar methods and approach techniques to create a group of methodologies and tools.

Other objective of this study is find a possible solution for the problem described, fulfilling the goals described at the start. All objectives have been accomplished.

At the end of will be expected a new module on SCRAIM capable of provide a level of maturity and show the results in a clean and simple interface.

Conclusions

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