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A Maturity Model for Implementing ITIL v3

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Articles

This section will summarize all the papers that were submitted on conferences, as well as the correspondent verdict, on this thesis scope.

We can see at table 1 a historic of the papers submitted during this master thesis, it were four papers with at least two of them accepted.

Only first paper (CAiSE'10) was submitted during thesis project, the rest of the papers were submitted during the dissertation.

All papers feedbacks helped me to complete and improve the methodology and maturity model developed.

Table 1. Papers submitted to conferences

Conference	Verdict
The 22nd International Conference on Advanced Information Systems Engineering (CAiSE'10) 7 de Junho, Tunisia	
5ª Iberian Conference of Information Technologies Systems (CISTI'2010) 16 de Junho, Santiago de Compostela	
2010 IEEE Sixth World Congress on Services (SERVICES 2010, IEEE) 5 de Julho, Miami	
6th International Conference on Network and Service Management (CNSM 2010, IEEE) 25 Outubro, Niagara falls	

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I specially would like to thank the opportunity given to me by Professor Mira da Silva to evolve my proposal in his class as well as my classmates that helped me in the collection of the results. I was able to collect much more results and consequently draw much more conclusions and improve the model.

Resumo

Information Technology Infrastructure Library (ITIL) é a *framework* de "boas práticas" mais popular para gestão de serviços de tecnologias de informação (TI). Contudo, implementar ITIL não só é uma tarefa extremamente complicada como não existem boas práticas para tal. Como resultado disso, as implementações de ITIL são geralmente bastante longas, dispendiosas, e de elevado risco. Esta tese propõe um modelo de maturidade para avaliar a implementação do ITIL nas organizações e fornecer um *roadmap* para melhoramento baseado em prioridades e dependências do ITIL. O modelo de maturidade proposto foi aplicado na prática através de questionários para os processos *Incident Management*, *Configuration Management* e para a função *Service Desk*. Os questionários foram executados em 7 organizações onde no total foram feitas 17 avaliações.

Foi também desenvolvido um protótipo, tendo a metodologia desenvolvida este tese como base, para que as organizações possam avaliar o seu ITIL de forma mais profissional e eficiente.

Palavras chave: ITIL, implementação, modelo de maturidade.

Abstract

Information Technology Infrastructure Library (ITIL) is the most popular “best practices” framework for managing Information Technology (IT) services. However, implementing ITIL is not only very difficult but also there are no best practices for implementing ITIL. As a result, ITIL implementations are usually long, expensive, and risky.
This thesis proposes a maturity model to assess an ITIL implementation and provide a roadmap for improvement based on priorities, dependencies and guidelines. Then it is demonstrate a practical application of the proposed model with a questionnaire to assess the Incident Management and Configuration Management processes as well as the Service Desk Function. We also evaluated the questionnaires in 17 assessments in seven Portuguese organizations and then implemented a prototype to support the assessments.

Keywords: ITIL, implementation, maturity model.

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Acronyms

ITSM - Information Technology Service Management

IT - Information Technology

ITIL - Information Technology Infrastructure Library

OGC - Office of Government commerce

UK - United Kingdom

IS - Information Systems

CEO - Chief Executive Officer

CMM - Capability Maturity Model

SEI - Software Engineering Institute

PMF - Process Maturity Framework

ITSCMM - Information Technology Service Capability Maturity Model

CMMI - Capability Maturity Model Integration

CMMI-SVC - Capability Maturity Model Integration for Services

CobiT - Control Objects for Information and related Technology

1 Introduction

IT Service Management (ITSM) is the discipline that strives to better the alignment of information technology (IT) efforts to business needs and to manage the efficient providing of IT services with guaranteed quality [1]. Although there are many other frameworks, the Information Technology Infrastructure Library (ITIL) has become the most popular for implementing ITSM [1,2] and, as a result, the framework of choice in the majority of organizations [3]. With ITIL, organizations aspire to deliver services more efficiently and effectively, with more quality and less costs [2,3,4]. Furthermore, preliminary results have shown that ITIL works in practice [4].

ITIL was launched by the Central Computer and Telecommunications Agency (now OGC) in the United Kingdom (UK) with the aim of providing technology-related services in a cost-efficient and reliable manner, by offering a systematic approach to the delivery of quality IT services [5]. ITIL presents a comprehensive set of guidelines for defining, designing, implementing and maintaining management processes for IT services from an organizational (people) as well as from a technical (systems) perspective [6].

Many organizations that decide to implement ITIL completely fail. Many others keep implementing ITIL long after the planned deadline. Empirical evidence shows that most organizations underestimate the time, effort, and risks – not to mention the cost – of implementing ITIL. The problem is that implementing ITIL is not easy [7].

1.1 Maturity models

Maturity models in IT management have been proposed at least since 1973 [8]. More than one hundred different maturity models have now been proposed [9] but most are too general and, as a result, not well defined and documented [10]. The Process Maturity Framework (PMF) is the only maturity model specifically designed for ITIL but, in a few pages, cannot provide enough information to help an ITIL implementation.

The maturity model proposed in this thesis is more descriptive, detailed, and useful because it was designed specifically for ITIL and contains comprehensive questionnaires for each ITIL process. This model can be used to help an ITIL implementation step-by-step by assessing the maturity of the existing processes and suggesting what to improve or implement next.

1.2 Problem

ITIL is a methodology to improve delivery service efficiently and effectively, with high quality, based on the best practices of service. Every year more organizations desire implementing ITIL. However a

considerable percentage of them fail and some organizations collapse trying it [7, 11]. Some of the most common mistakes made by organizations when implementing ITIL are [11]:

- Lack of management commitment
- Spend too much time on complicated process diagrams
- Not creating work instructions
- Not assigning process owners
- Concentrating too much on performance
- Being too ambitious
- Failing to maintain momentum
- Allowing departmental demarcation
- Ignoring constant reviewing of the ITIL
- Memorizing self ITIL books

Certainly, many other reasons cause ITIL implementations to fail. In particular, reasons that cause information system (IS) projects in general to fail – such as organizational resistance to change, unproven business value, strong organizational culture, and so on – are also to blame, as ITIL implementations are usually based on complex IT platforms. But these other reasons can be dealt with general techniques for implementing projects in general.

ITIL implementation is too expensive and Chief Executive Officer (CEOs) think twice before go forward with the implementation. Combine that with unrecoverable money losses in many known ITIL implementation failures and this, certainly, becomes a problem. The key is making the ITIL implementation easier, understandable and secure.

As can be seen above the ITIL implementation is hard and complex. The organizations recurrently fall in the same mistakes. ITIL dictates organizations “what they should do” but is not clear in “how they should do it” based on a large number of tightly integrated processes. Faced with so many processes, the majority of organizations have no idea which process to implement first and/or how far they should go with that first process. Then the problem is repeated for the second process, and so on, until they get lost and start looking for help. But since each ITIL implementation is unique there are no “silver bullets” to solve this problem. This is the problem that this thesis will try to solve. All the other reasons, previously appointed, also to blame for ITIL implementation failure won’t be consider in the scope of this thesis.

1.3 Research Methodology

The chosen research methodology for this thesis is Action Research Methodology. Toward the end of the 1990s it began growing in popularity for use in scholarly investigations of information systems. The method produces highly relevant research results, because it is grounded in practical action, aimed at solving an immediate problem situation while carefully informing theory [12]. Composed by 5 stages (as shown in Fig. 1):

igure 1. Action Research Methodology

- **Diagnosing -** Diagnosing corresponds to the identification of the primary problems that are the underlying causes of the organization's desire for change.
- **Action Planning -** This activity specifies organizational actions that should relieve or improve these primary problems. The discovery of the planned actions is guided by the theoretical framework, which indicates both some desired future state for the organization, and the changes that would achieve such a state.
- **Action Taking –** Is the implementation of the planned action. The researchers and practitioners collaborate in the active intervention into the client organization, causing certain changes to be made.
- **Evaluating –** includes determining whether the theoretical effects of the action were realized, and whether these effects relieved the problems. Where the change was successful, the evaluation must critically question whether the action undertaken, among the myriad routine and non-routine organizational actions, was the sole cause of success.
- **Specifying Learning -** While the activity of specifying learning is formally undertaken last, it is usually an ongoing process. The knowledge gained in the action research can be directed to three audiences:

- First the restructuring of organizational norms to reflect the new knowledge gained by the organization during the research.
- Second, where the change was unsuccessful, the additional knowledge may provide foundations for diagnosing in preparation for further action research interventions.
- Finally, the success or failure of the theoretical framework provides important knowledge to the scientific community for dealing with future research settings.

According to this methodology it will be designed a maturity model and then chosen an organization to assess their ITIL (or part of ITIL) in which we could test the model. After the assessment, the results will be studied, conclusions will be taken and then the model improved according to the conclusions. Finally, the learnings of the new experience of assess an organization with the proposed model will be described. Each ITIL assessment will be a complete action research cycle with the correspondent application and improvement.

2 Related Work

After studying the ITIL and understanding all the processes, goals and dependencies, the extensive relations between ITIL processes became clear. Therefore, it was important to develop a processes dependencies map. It doesn't have all the possible communications between them, only the most important ones, otherwise it was impossible to represent it graphically or to understand it.

With a map of dependencies it was possible to have a perception of the priority of each process and then understand which processes need to be implemented together. With this, it was possible to precede to the study of the existing maturity models.

As mentioned earlier, there are many maturity models but few have succeeded. This thesis mainly focuses in maturity models related with ITSM. The development of a new maturity model must be substantiated by a comparison with existing ones.

But with so many models it's important to choose the right ones, therefore, those that we consider to be, currently, the most important and interesting models were selected.

2.1 ITIL

ITIL (Information Technology Infrastructure Library) is a standard that was introduced and distributed by the Office of Government Commerce (OGC) in the UK and includes all IT parts of organizations.

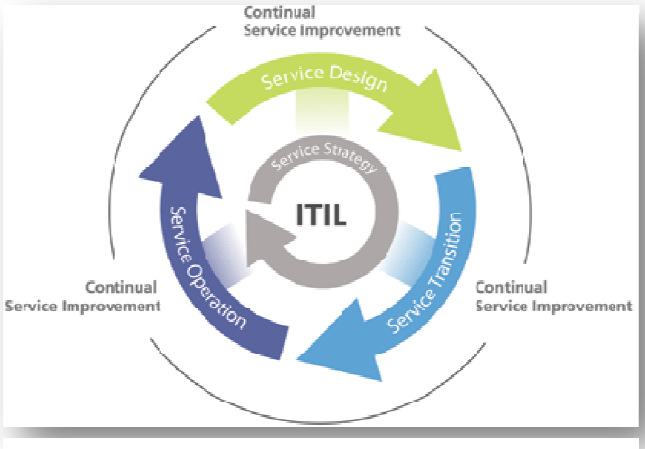

Figure 2. ITIL v3

At present, ITIL is the most widely accepted approach to IT Service Management in the world. It has an iterative, multidimensional and lifecycle form structure [3]. ITIL has an integrated approach as required by the ISO/IEC 20000 standard, with the components that we can see in Fig. 2.

2.1.1 Service Strategy

Service Strategy provides guidance on how to design, develop, and implement service management not only as an organizational capability but also as a strategic asset. Topics covered in Service Strategy include the development of markets, internal and external, service assets, Service Catalogue, and implementation of strategy through the Service Lifecycle.

Financial Management, Service Portfolio Management, Organizational Development, and Strategic Risks are among other major topics [13].

Organizations already practicing ITIL may use this publication to guide a strategic review of their ITIL-based service management capabilities and to improve the alignment between those capabilities and their business strategies.

Include the processes:

- Financial Management
- Service Portfolio Management
- Demand Management

2.1.2 Service Design

Service Design provides guidance for the design and development of services and service management processes. It covers design principles and methods to convert strategic objectives into portfolios of services and service assets.

The scope of Service Design is not limited to new services. It includes the changes and improvements necessary to increase or maintain value to customers over the life cycle of services, the continuity of services, achievement of service levels, and conformance to standards and regulations. It guides organizations on how to develop design capabilities for service management [14].

Include processes:

- Service Level Management
- Service Catalogue Management
- Supplier Management
- Availability Management
- Capacity Management
- IT Service continuity
- Information Security

2.1.3 Service Transition

Service Transition provides guidance for the development and improvement of capabilities to transition new and changed services into operations. It provides guidance on how the requirements of Service Strategies encoded in Service Design are realized effectively in Service Operation while controlling the risks of failure and disruption. It provides guidance on managing the complexity related to changes in services and service management processes, preventing undesired consequences while allowing for innovation [15].

Include processes:

- Change Management
- Service asset and Configuration Management
- Release and Deployment Management
- Knowledge Management
- Transition Management and Support
- Evaluation
- Service Validation and Testing

2.1.4 Service Operation

Service Operation provides guidance on achieving effectiveness and efficiency in the delivery and support of services so as to ensure value for the customer and the service provider.

Guidance is provided on ways to maintain stability in Service Operations, allowing for changes in design, scale, scope, and service levels. Managers and practitioners are provided with knowledge that allows them to make better decisions in areas such as managing the availability of services, controlling demand, optimizing capacity utilization, scheduling operations, and fixing problems.

Guidance is provided on supporting operations through new models and architectures such as shared services, utility computing, Web services, and mobile commerce [16].

Include processes:

- Incident Management
- Problem Management
- Request Fulfillment
- Access Management
- Event Management

2.1.5 Continual Improvement

This provides instrumental guidance in creating and maintaining value for customers through better design, introduction, and operation of services. It combines principles, practices, and methods from Quality Management, Change Management, and Capability Improvement.

Organizations learn to realize incremental and large-scale improvements in service quality, operational efficiency, and business continuity.

Guidance is provided to link improvement efforts and outcomes with service strategy, design, and transition [17].

Include processes:

- Service Measurement
- Service Reporting
- Service Improvement

2.2 Maturity Models

This section will describe all the maturity models studied to build a solid base for the ITIL maturity model proposed. All the important features of each model will be identified.

2.2.1 CMM

The Capability Maturity Model (CMM) was developed by the Software Engineering Institute (SEI) of Carnegie Mellon University and specifies five maturity levels to assess an organization's process capability by measuring the degree to which processes are defined and managed:

- **Level 1: Initial.** At the initial level, an organization typically does not provide a stable environment for developing and maintaining software. It's called ah-doc or chaotic, at this level capability is a characteristic of individuals, not organizations.
- **Level 2: Repeatable.** Policies for managing a software project and procedures to implement those policies are established. The planning and management of new projects is based on experiences with similar projects.
- **Level 3: Defined.** A typical process for developing and maintaining software across the organization is documented, including both software-engineering and management processes, and these processes are integrated as a whole. At this level organizations can be summarized as standard and consistent because both software-engineering and management activities are stable and repeatable.

- **Level 4: Managed.** An organization sets quantitative quality goals for both products and processes and uses processes with well-defined and consistent measurements. These measurements establish the quantitative foundation for evaluating a project's processes and products.
- **Level 5: Optimizing.** The entire organization is focused on continuous process improvement. The organization has the means to identify weaknesses and strengthen the process proactively, with the goal of preventing defects. Organizations analyze defects and determine their causes.

The CMM presents sets of recommended practices in a number of key process areas that have been shown to enhance software-development and maintenance capability [18].

Each maturity level consists in some key process areas that are classified in goals and common features. In each key process area several goals are defined to represent the desired outcomes of the process. To fulfill the goals, practices are provided in order to lead to the transition of an organization's process to the next higher maturity level. This maturity model doesn't solve this thesis problem because it was designed to guide and assess software development projects and not service delivery or ITIL projects.

2.2.2 Trillium

Trillium is a model that covers all aspects of software development life cycle and was designed to be applied to embedded systems like telecommunications [19]. It was based on:

- CMM version 1.1
- ISO 9001
- ISO 9000-3

It's composed by 8 capability areas, each one having one or more associated road maps and, in turn, each roadmap has associated practices, as shown in Table 2. For a given road map, the level of practices is based on their respective degree of maturity. The fundamental practices are at the lower levels, whereas more advanced ones are at the higher levels. In order to increase effectiveness of higher level practices, it is recommended that the lower level practices be implemented and sustained [20].

Trillium consists of five levels of maturity that can be described in the following way:

- **Level 1: Unstructured.** The development process is ad-hoc. Projects frequently cannot meet quality or schedule targets. Success, while possible, is based on individuals rather than on organizational infrastructure.

- **Level 2: Repeatable and Project Oriented.** Individual project success is achieved through strong project management planning and control, with emphasis on requirements management, estimation techniques, and configuration management.
- **Level 3: Defined and Process Oriented.** Processes are defined and utilized at the organizational level, although project customization is still permitted. Processes are controlled and improved. ISO 9001 requirements such as training and internal process auditing are incorporated.
- **Level 4: Managed and Integrated.** Process instrumentation and analysis is used as a key mechanism for process improvement. Process change management and defect prevention programs are integrated into processes, as well as CASE tools.
- **Level 5: Fully Integrated.** Formal methodologies are extensively used. Organizational repositories for development history and process are utilized and effective.

Table 2. Road maps for each capability area of Trillium

Capability Areas	Road maps	Nº of Practices
Organizational Process Quality	– Quality Management – Business Process Engineering	35
Human Resource Development and Management	– Human Resource Development and Management	52
Process	– Process Definition – Technology Management – Process Improvement & Engineering – Measurements	99
Management	– Project Management – Subcontractor Management – Customer-Supplier Relationship – Requirements Management – Estimation	107
Quality	– Quality System	33
System Development Practices	– Development Process – Development Techniques – Internal Documentation – Verification & Validation – Configuration Management – Re-Use – Reliability Management	110
Development Environment	– Development Environment	12
Customer Support	– Problem Response System – Usability Engineering – Life-Cycle Cost Modeling – User Documentation – Customer Engineering – User Training	60

To achieve a Trillium level, an organization must satisfy a minimum of 90% of the criteria in each of the 8 Capability Areas at that level. Levels 3, 4 and 5 require the achievement of all lower Trillium levels [19].

2.2.3 Bootstrap

The Bootstrap methodology for software process, assessment and improvement, originated in a European Community project, with a focus on evaluating investments in technology was based on [20]:

- CMM
- ISO 9001
- ISO 9000-3
- ISO 15504

The Bootstrap process architecture rests on a triad of process categories in the areas of organization, Methodology and Technology. These three major categories consist of several process areas. Each process area specifies several key practices and activities [20].

Bootstrap was developed through a European Project (ESPRIT Project) in order to provide a method for assessing and improving the software process. It was the base for SPICE (now ISO 15504), was extended over time and adopted to include guidelines in the ISO 9000 [21].

- **Level 0:** Incomplete
- **Level 1:** Performed
- **Level 2:** Managed
- **Level 3:** Established
- **Level 4:** Predictable
- **Level 5:** Optimizing

The Bootstrap reference model includes all processes and base practices of the ISO 15504 reference model. However on process-level, some process names are different, and a few ISO 15504 processes are divided into two or more Bootstrap processes.

Software Process Improvement programs are implemented in many organizations. A frequently used and successful methodology for improving the software process is the Bootstrap methodology [22].

This maturity model doesn't solve this thesis problem because it was designed to improve and assess software development projects and not service delivery or ITIL projects.

2.2.4 Process Maturity Framework

Process Maturity Framework (PMF), is described in the ITIL book. It can be used either as a framework to assess the maturity of the ten Service Management processes individually, or to measure the maturity of the overall Service Management process as a whole [23].

However PMF is only described in ITIL v2 books and not on ITIL v3 books and this creates some doubts about its usefulness and success.
The PMF is useful for examining the entire Continuous Service Improvement Program (CSIP) and all implemented ITIL processes, or just an individual process. It is defined in 5 levels as shown in Table 3.

Each level is characterized by a combination of five elements:

- Vision and steering
- Process
- People
- Technology
- Culture

Table 3. PMF levels and description

Level	PMF	Focus	Comments
1	Initial	Technology	Technology excellence/experts
2	Repeatable	Product/Service	Operational processes (e.g., Service Support)
3	Defined	Customer Focus	Proper service level management
4	Managed	Business Focus	Business and IT aligned
5	Optimizing	Value Chain	Seamless integration of IT into the business and strategy making

Each element has one or more goals that the organization needs to implement to achieve the correspondent level. Focus in ITIL, this maturity model doesn't solve this thesis problem. Is a small model, very simple (6 pages), and as we saw before, the ITIL implementation is a complex project, it's unrealistic to think that someone could implement ITIL, based on such maturity model.

2.2.5 IT Service CMM

The IT Service CMM described in this document originates from two multi-partner research projects, partly supported by the Dutch Ministry of Economic Affairs. Partners in these projects – 'Concrete Kit'

and ‘Kwintes’ – were Cap Gemini, Twijnstra Gudde, the Tax and Customs Computer and Software Centre of the Dutch Tax and Customs Administration, the Technical Universities of Delft and Eindhoven, and the Vrije Universiteit Amsterdam. These projects were aimed at developing a method to specify and control IT services.

The IT Service CMM is a capability maturity model that describes different maturity levels for organizations that provide IT services.
The main focus of the model is on the maturity of the service provided by the organization. The model does not measure the maturity of individual services, projects or organizational units [24]. The model covers the service delivery process.

The main goals are:

1. To enable IT service providers to assess their capabilities with respect to the delivery of IT services
2. To provide IT service providers with directions and steps for further improvement of their service capability

The IT Service CMM is based on the Software CMM for two reasons:

1. The Software CMM is a widely used and well-known software process improvement model. Its structure is generic enough to facilitate other areas besides software processes.
2. They wanted to provide organizations with a mechanism with which they can perform step-wise improvement. Improvement should be an integral part of the framework. This is the case with the CMM where the framework functions as a prescriptive model and assessments are used to compare the actual situation with the model.

It’s composed by 22 process areas and each one is structured using common features. Common features are practices that, when performed together, guarantee that the key process area is implemented and institutionalized. Common features consist of key practices that describe activities that have to be performed or infrastructures that have to be present. These common features are:

- Commitment to Perform
- Ability to Perform
- Activities Performed
- Measurement and Analysis
- Verifying Implementation

Among the 22 process areas there are few key processes, for IT Service CMM to reside on a certain maturity level, it needs to implement all key processes for that maturity level (Table 4) – and those for

lower levels [24]. It's a complete and detailed model that provides several good practices to improve the service.

It consists of five maturity levels, which are:

- **Level 1 Initial**: The IT service delivery process is characterized as ad hoc, and occasionally even chaotic. Few processes are defined and success depends on individual effort and heroics.
- **Level 2 Repeatable**: Basic service management processes are established. The necessary discipline is in place to repeat earlier successes on similar services with similar service levels.
- **Level 3 Defined**: The IT service processes are documented, standardized, and integrated into standard service processes. All services are delivered using approved, tailored versions of the organization's standard service processes.
- **Level 4 Managed**: Detailed measurements of the IT service delivery process and service quality are collected. Both the service processes and the delivered services are quantitatively understood and controlled.
- **Level 5 Optimizing**: Continuous process improvement is enabled by quantitative feedback from the processes and from piloting innovative ideas and technologies.

Table 4. Key process areas assigned to process categories

<table>
<tr><th>Process Categories

Levels</th><th>Management

Service planning</th><th>Enabling

Support and standardization</th><th>Delivery

Actual service delivery</th></tr>
<tr><td rowspan="2">Optimizing</td><td></td><td colspan="2">Technology Change Management</td></tr>
<tr><td colspan="2">Process Change Management</td><td>Problem Prevention</td></tr>
<tr><td rowspan="2">Managed</td><td colspan="2">Quantitative Process Management</td><td rowspan="2">Service Quality Management</td></tr>
<tr><td>Financial Service Management</td><td></td></tr>
<tr><td>Defined</td><td>Integrated Service Management</td><td>Organization Process Focus

Organization Process Definition

Organization Service Definition

Training Program

Intergroup Coordination

Resource Management

Problem Management</td><td>Service Delivery</td></tr>
<tr><td>Repeatable</td><td>Service Commitment Management

Service Delivery Planning

Service Tracking and Oversight

Subcontract Management</td><td>Configuration Management

Service Request and Incident Management

Service Quality Assurance</td><td></td></tr>
<tr><td>Initial</td><td colspan="3">Ad hoc process</td></tr>
</table>

This maturity model doesn't solve this thesis problem, although designed to guide and assess service delivery; it does not take in consideration ITIL culture.

2.2.6 CMMI for Services

The Capability Maturity Model Integration for Services (CMMI-SVC) provides guidance for the application of CMMI best practices by the service provider organization. Best practices in the model focus on activities for providing quality services to the customer and end users. CMMI-SVC integrates bodies of knowledge that are essential for a service provider. It was designed to improve mature service practices and contribute to the performance, customer satisfaction, and profitability of the economic community [25].

CMMI-SVC draws on concepts and practices from several service-focused standards and models, including:

- Information Technology Infrastructure Library (ITIL)
- ISO/IEC 20000: Information Technology—Service Management
- Control Objects for Information and related Technology (CobiT)
- Information Technology Services Capability Maturity Model (ITSCMM)

CMMI-SVC provides two ways of assessment: it can assess the whole organization (staged) or each process (continuous). There are 24 processes that are characterized by specific goals and specific practices; however there are some generic goals and generic practices used for all the processes.

Table 5. Levels for Stage and Continuous models

Level	Continuous Representation Capability Levels	Staged Representation Maturity Levels
Level 0	Incomplete	(not applicable)
Level 1	Performed	Initial
Level 2	Managed	Managed
Level 3	Defined	Defined
Level 4	Quantitatively Managed	Quantitatively Managed
Level 5	Optimizing	Optimizing

The continuous representation is concerned with selecting both a particular process area to improve and the desired capability level for that process area [25].

Description of Continuous representation levels:

- **Level 0: Incomplete**. One or more of the specific goals of the process area are not satisfied and no generic goals exist.
- **Level 1: Performed.** Satisfies the specific goals of the process area. It supports and enables the work needed to provide services.
- **Level 2: Managed.** It is planned and executed in accordance with policy; employs skilled people who have adequate resources to produce controlled outputs; involves relevant stakeholders; is monitored, controlled, and reviewed; and is evaluated for adherence to its process description.
- **Level 3: Defined.** The standards, process descriptions and procedures for a project are tailored from the organization's set of standard processes to suit a particular project or organizational unit and therefore are more consistent, except for the differences allowed by the tailoring guidelines.
- **Level 4: Quantitatively Managed.** Process is controlled using statistical and other quantitative techniques. Quantitative objectives for quality and process performance are established and used as criteria in managing the process.
- **Level 5: Optimizing.** Process that is improved based on an understanding of the common causes of variation inherent in the process and continually improves the range of process performance through both incremental and innovative improvements.

The staged representation is concerned with the overall maturity of the organization, whether individual processes are performed or incomplete is not the primary focus [25].

Description of Staged representation levels:

- **Level 1: Initial**. Processes are usually ad hoc and chaotic
- **Level 2: Managed.** Projects establish the foundation for an organization to become an effective service provider. The service provider ensures that processes are planned in accordance with policy.
- **Level 3: Defined**. These standard processes are used to establish consistency across the organization. Projects establish their defined processes by tailoring the organization's set of standard processes according to tailoring guidelines.
- **Level 4: Quantitatively Managed.** Service providers establish quantitative objectives for quality and process performance and use them as criteria in managing processes. Quantitative objectives are based on needs of the customer, end users, organization, and process implementers.

- **Level 5: Optimizing.** Process that is improved based on an understanding of the common causes of variation inherent in the process and continually improves the range of process performance through both incremental and innovative improvements.

It's proved that the adoption of CMMI by companies brings good results with the regard to delivery time and the reduction of defects and costs [26]. This maturity model doesn't solve this thesis problem, although designed to guide and assess service delivery; it does not take in consideration ITIL culture.

2.3 Comparison

There isn't much difference between the models, all have levels, goals, practices, but there are important aspects to take into account to make the selection.

At this point is important a comparison between the diverse models in order to select the one that offers the most. In Table 6 we can see a comparison of the models, based on the main features.

Table 6. Comparison of the diverse models

Models	Is it a success model?	Is it a known model?	Does it have Staged Model and/or Continuous Model?	How detailed is it?	What is the main focus?	Was it basis for other models?
CMMI for Services	Yes, highly	Very well known	Both models	Well detailed	Services	No
ITSCMM	Yes	Not well known	Only Stage Model	Very well detailed	Services	For CMMI
CMM	Yes, highly	Very well known	Only Stage Model	Well detailed	Software	For many models
PMF	No	Not well known	Both models	Very simple	ITIL	No
Trillium	Yes	Not well known	Only Continuous Model	Not well detailed	Software	No
Bootstrap	Yes	Not well known	Only Continuous Mode	Not well detailed	Software	No

Trillium and Bootstrap are good and successful models, but are mainly based and focus in software development and quality and not in service delivery and quality, which is the main focus of ITIL. They both follow a continuous model and don't have a stage model. This could be seen unfavorable for organizations that want to be more aggressive in the improvement. Besides, they are old models and they are not enough description details.

CMM is a model very well known worldwide and used as basis by a set of many other models. It's consistent, coherent and complete; however, it was made for software development and only has staged model representation.

PMF is a small model, resumed to 6 pages in the book of ITIL, with few goals by level. In the reality of the business world, it is surreal to think that some organizations could improve efficiently and effectively their ITIL maturity with this model. On the other hand PMF describes the continuous and staged model and that is an important feature for the proposed model.

ITSCMM is a very interesting model based on service delivery; it is detailed and complete; so interesting, that the author was invited to join the team that would develop the CMMI-SVC. The processes are similar to the ITIL process and the practices could be very useful.

CMMI-SVC is known worldwide, is a very complete model, focuses on service and contains concepts of CMMI and the most known standards like in ITIL, Cobit and others. It's also a very detailed model. Describes both models continuous and staged and that is excellent. Besides, the evolution of CMM is focused on services.

3 Proposal

This thesis proposes a complete maturity model that organizations could use as guidelines to assure that they don't fall in any of the most common mistakes made by organizations in ITIL implementation.

Today many organizations spend a lot of money in ITIL implementation projects and fail. A maturity model will solve this problem as it will allow not only assessing the level of ITIL in organizations but also will guide them and will tell them what they miss or need to achieve the level they want.

Nowadays there isn't any complete and detailed maturity model for ITIL that could guide organizations in ITIL implementation or assuring that they will do it correctly.

3.1 Objectives

The main goal is to design a model that provides a roadmap to help the organizations in ITIL implementation, in a correct way and avoiding errors that already made other organizations failed and collapsed. For that we need to accomplish a few objectives:

- **Global vision of ITIL:** The study of ITIL is essential to realize a good work, understand the process, dependencies, relation, goals, etc. Only with a good knowledge of ITIL it is possible to design a model to evaluate it.
- **Processes dependencies:** The processes dependencies are important to understand which process should be implemented, when, with which other process, how high, etc. Therefore a dependencies map should be done. It can be seen in [Appendix 1.5].
- **Study maturity models:** Comparing existing maturity models is an important goal in order to identify the most reliable model(s).
- **Chose the right maturity models:** Select the advantages of each maturity model studied to design a good maturity model that could be applied to ITIL.
- **Mapping processes:** Mapping the processes between the maturity model(s) selected and ITIL to identify the relevant goals and practices of the model(s).
- **Design staged model:** Based on the model(s) selected, on dependencies map and on the mapping of processes made before, design a staged model leveling the processes with coherence.
- **Create questionnaire for the largest number of ITIL processes:** After identifying the processes of the selected models that correspond to each ITIL process a questionnaire for each process should be created and leveled by a maturity scale. If possible test each questionnaire in organizations.
- **Design continuous model:** After creating a questionnaire for each ITIL process, collect them all and design the continuous model.

- **Assess organizations:** With the questionnaires we'll be able to assess organizations and get results in order to demonstrate the potential of the designed maturity model.
- **Results:** Collect the results of the several assessments performed, get a conclusion and improve the model.

3.2 Processes Dependencies

After the initial ITIL bibliographic research it was important to understand how complex and deep were the dependencies among ITIL processes. Fig. 3 shows the map of dependencies designed and highlights the complexity of dependencies and connections among ITIL processes.

This result matches the initial statements on this thesis about the huge problems faced by the organizations in ITIL implementation, such complexity isn't obviously easy to implement.

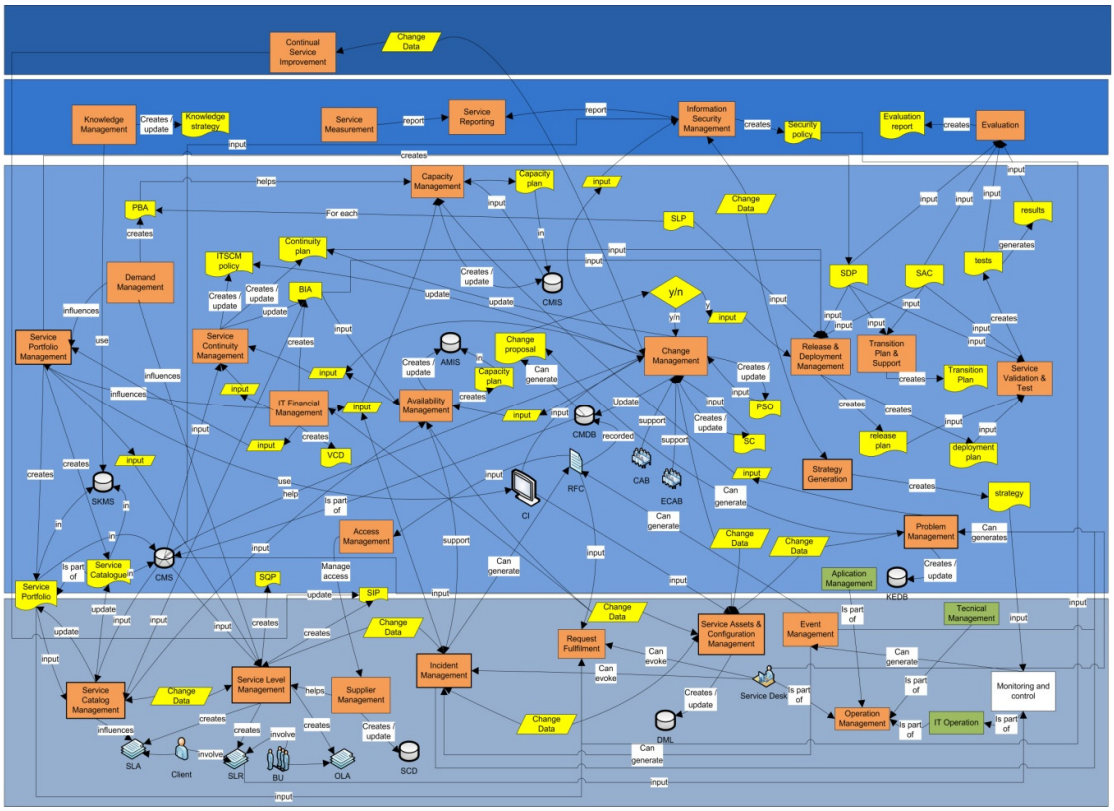

Figure 3. Map of dependencies

Legend:

AMIS → availability management information system
BIA → business impact analyses
BU → business units
CAB → change advisory board
CI → configuration items
CMDB → configuration management data base
CMIS → capacity management information system
CMS → configuration management system
DML → definitive media library
ECAB → emergency change advisory board
KEDB → known Error Database
OLA → operation level agreement
PBA → pattern of business activity
PSO → projected Service Outage
SAC → service acceptance criteria
SC → schedule of change
SCD → supplier contract database
SDP → service design package
SIP → service improvement plan
SKMS → service knowledge management system
SLA → service level agreement
SLP → service level package
SLR → service level requirement
SQP → service quality plan
VCD → variable cost dynamics

 → Process

 → Function

 → Operation

 → Plan / Policy / Document

 → Exchanged Information / Data

 → Data Base

There are processes that connect with almost all the other processes and the representation of all these connections would be graphically redundant. Therefore, not all connections between ITIL processes are represented on Fig. 3 otherwise it would be much more complicated to understand the map and the utility of the map would be lower.

Fig. 3 was design in conformity with the Levels of Maturity of the Staged Model and it could be seen by each layer color with the lower level on bottom and the higher level of maturity on top. This is useful to better understand the flux of information, as well as the complexity of dependencies among the levels.

As the most used framework to implement ITSM and with IT as the scope, ITIL should be seen by inside as an aggregation of processes each one with their activities, tasks, actors, responsibilities, etc. All these processes are related and depend of each other. The IT, as part of IS, intends to help manage the information with the most appropriate technology. ITIL, as a framework of best practices for IT and defined by processes, should be specific in how the processes are related. The conceptual map designed (Fig. 3) is a useful tool to understand how, by ITIL rules, the information flows among the processes, what are the responsibilities of each process, what are the inputs and outputs of each process, etc.

All the symbols and boxes in Fig. 3 represent important features of ITIL, and with the conceptual map we easily understand why so many organizations keep failing ITIL implementation as well as lose money and other resources trying to implement ITIL. ITIL, as shown by Fig.3, is a complex connection of several processes with several dependencies of each others. Without a guide it becomes hard to believe in organization's success.

As mentioned at the beginning, there are other kinds of problems that could originate ITIL implementation failure, but we are just considering the lack of guide of a complex framework as ITIL that will create recursive mistakes and consequently ITIL implementation failure, as proved before. All the other reasons, previously appointed, also to blame for ITIL implementation failure won't be consider in the scope of this thesis.

Summarizing, a guide to help organizations in such complex framework as ITIL is crucial and with this map of dependencies we easily understand it and see how the organization should work according to ITIL best practices. We can see the flux of information between processes, the tasks to accomplish, the crucial activities, processes, in some cases people and hardware and the sequential relationships among all these features. This map provides a macro vision of how organization's ITIL should be and will be very helpful in the next steps of this thesis.

3.3 Selected Models

Section 3.7 shows that the most interesting models are CMM, CMMI-SVC, ITSCMM and PMF. However CMMI-SVC is an evolution of CMM with the advantage of being focused on services, than it makes no sense consider CMM.

PMF is a simple model and it's the only one that was made for ITIL purpose, so it will be taken in consideration but the main focus will be on ITSCMM and CMMI for services.

Next step was mapping all processes of ITSCMM and CMMI-SVC with ITIL processes and design a Staged model, then collect all the goals and practices of each process of ITIL (and similar processes of the models) and create the questionnaire that will assess the correspondent process in the organization. At the end, with all questionnaires, it's supposed to have a Continuous model.

3.4 Mapping processes

At [Appendix A.4] we can see a mapping of all the ITIL processes with ITSCMM and CMMI-SVC processes. As it shows, some ITIL processes have more than one process of each other models, but there are cases where an ITIL process apparently doesn't have any match process of the other models.

With this it's possible start analyzing the goals and practices of each process, collect them and try transform it in a realistic questionnaire based on CMMI-SVC and ITSCMM but applicable to ITIL.

3.5 Staged model and Continuous Model

In our maturity models research we identified two kinds of models: staged model and continuous model, both useful in different occasions. While Staged Model is more useful for organizations with no idea of their priority processes, Continuous Model is more useful for organizations that are conscientious of their priority processes. However, to design a complete maturity model both models must be taken in consideration and should be present. With Staged Model the organizations have a global vision about the main processes to implement while Continuous Model enables the assessment of each ITIL process.

As told before, we based our maturity model in CMMI – SVC and ITSCMM. In order to assign a Staged Model level to each ITIL process a process mapping between the studied maturity models processes and ITIL processes was needed.
Therefore we used the process mapping explained in the previous topic (3.4), as well as the description of each Staged maturity level to assign a maturity level to each ITIL process. It was

important to build a reliable Staged Model based on successfully maturity models and this procedure ensure that statement.

We can see at [Appendix A.3] all the Staged Model levels assigned to each ITIL processes and a summary of it at Table 7.

Table 7. Summary of Appendix A.3

ITIL		Level
Service Strategy	Service Generation	3
	Demand Management	3
	IT Financial Management	3
	Service Portfolio Management	3
Service Design	Service Catalogue Management	2
	Service Level Management	2

The Staged model will be classified by five levels of maturity:

- **Level 1. Initial:** Characterized as ad hoc, and occasionally even chaotic. Success depends on individual effort and heroics.
- **Level 2. Managed:** Basic service management processes are established. The service provider ensures that processes are planned in accordance with policy. Processes related to service operation are addressed in this level because they support day-to-day activities and are critical to keep the organization IT operational.
- **Level 3. Defined:** The IT service processes are documented, standardized, and integrated into standard service processes. Most IT processes are included up to this level to allow high levels of performance in the management of IT.
- **Level 4. Quantitatively Managed:** Service providers establish quantitative objectives for quality and process performance and uses them as criteria in managing processes. Quantitative objectives are based on needs of the customer, end users, organization, and process implementers.
- **Level 5. Optimizing:** Continuous process improvement is enabled by quantitative feedback from the processes and from piloting innovative ideas and technologies.

When an organization try to implement more than one or two processes at the same time could not be the rightist choice and some organizations may not be prepared for the effort. It becomes important design a Continuous model that allows organizations to implement and assess only a particular process.

Each ITIL process will be assessed by a questionnaire, so, in order to have a complete Continuous Model we must have the questionnaires for all ITIL processes. Once we just made three questionnaires over this thesis, the Continuous Model won't be complete.

The questionnaires must be complete, detailed, with solid bases and focused on ITIL scope. To build each questionnaire we studied all the practices and goals of correspondent process of CMMI-SVC and ITSCMM to see if they are focused in ITIL scope. Then we studied the ITIL books and deeply analyzed all ITIL processes.

The first questionnaire created was for "Incident Management", because it is one of the most popular processes between the organizations that implement ITIL and we already had an organization to test it.

We can see part of one questionnaire in Table 8 and a little more at [Appendix A.5].

Table 8. Summary of Appendix A.5

Nível 3		
Key	Is there a description of how to notify customers or end users that could be affected by an incident reported? Describe the following parameters:	
Non Key	• Definitions of impact	
Non Key	• Response time	
Non Key	• Resolution time	
Non Key	• Rules for ordering	
Non Key	• Expectations in providing feedback to users	
Depend Key (Change M.)	Is created when needed a request for change to solve an incident?	

The questionnaire will have three kinds of questions, classified as follows:

- **Key** → The main questions that really need to be implemented
- **Non Key** → The questions that don't need to be all implemented
- **Depend Key** → The questions that only need to be implemented if the related process also is implemented

The questions will be classified as "Key" questions that must always be implemented to achieve the correspondent level. Regarding the "Non Key" questions the organization must satisfy at least 75% of

them to achieve the correspondent level. If there is any “Depend Key” question and the correspondent process is implemented too than the “Depend Key” question becomes a “Key” question and to achieve the correspondent level it must be implemented.

The assignment of the one of these classifications to each question was made by the importance of each question. The importance was measured during the research work by the relevance of each topic that was addressed.

Each questionnaire will have 5 levels and to achieve one of them the organization must have all levels before correctly implemented, all “Key” questions of the level implemented and at least 75% of “Non Key” questions implemented (e.g.: to achieve the level 2 the organizations must have all “key” questions of level 2 implemented and at least 75% of “Non Key” questions implemented but to achieve the level 3 the organization must have level 2 correctly implemented and “Key” questions of level 3 implemented and at least 75% of “Non Key” questions implemented).

Both CMMI-SVC and ITSCMM, as well as the other maturity models that were studied but not adopted, have the particularity of achieve the next level only if all the processes of the level below are fully implemented. This implies that to achieve a certain level, the organization should totally implements a set of processes and this is a huge effort to the organization.

Therefore, an innovative feature of this proposal is the incremental effort of the Staged Model. For example, to achieve the level 2 of Staged Model an organization must have all the processes for level 2 of Staged Model at level 2 of Continuous Model, and to achieve level 3 of Staged Model must have all the processes for level 3 of Staged Model at level 3 of Continuous Model and all processes of level 2 of Staged Model at level 3 of Continuous Model also, and the same for the rest of the levels.

We can see in [Appendix A.2] that in incremental Staged Model the organizations have an incremental level of effort on the implementation and in [Appendix A.1], a non incremental Stage Model, the effort at the beginning is huge. Obviously the first option is a better choice because the organizations avoid a huge first impact effort that will avoid some mistakes.
It is visible that in [Appendix A.2] to achieve Level 2 the company must reach 10 processes at Level 2 and in [Appendix A.1] to achieve Level 2 the company must reach 10 processes at Level 5 that is obviously much effort.

The staged Model and Continuous Model are correlated. As we can see at Table 9 the different colors identify the relation between the staged Model levels and Continuous Model levels

Table 9. Staged Model and Continuous Model relationship

ITIL Processes	Stage Model Maturity Level	Continuous Model Maturity Levels			
		Level 2	Level 3	Level 4	Level 5
Service Catalogue Management	2				
Service Level Management					
Supplier Management					
Service Asset & Configuration Management					
Event Management					
Incident Management					
Request Fulfillment					
Monitoring & Control					
Service Desk					
Technical Management					
Service Generation	3				
Demand Management					
IT Financial Management					
Service Portfolio Management					
Capacity Management					
Availability Management					
IT Service Continuity Management					
Transition Plan & Support					
Change Management					
Release & Deployment Management					
Service Validation & Testing					
Problem Management					
Access Management					
Application Management					
Information Security Management	4				
Evaluation					
Knowledge Management					
Service Report					
Service Measurement					
Service Improvement	5				

4 Results

This section will show the results of the assessments made on several Portuguese organizations. The section has a first topic that describes how the assessments were performed, followed by a topic for each organization and process assessed. For ethical reasons, as wish by the organizations, the name of the organizations assessed won't be revealed. We will just introduce each organization, describing the kind of business and not much else.

4.1 Procedure

The procedure was the same for all the assessments. However, the model was improved over the time with the evaluation of the results. An assessment is composed by three main steps:

- First, it is provided a mini questionnaire (3-5 questions) with questions that should be answered before each process assessment.
- Second, it is provided the process questionnaire and the responsible for the ITIL process on the organization should be the responsible for questionnaires answers.
- Third, it is provided a mini questionnaire (3-5 questions) with questions that should be answered after each process assessment.

4.2 Organization 1

The Organization 1 is from business banking. Their IT department employs 215 people and they start the ITIL implementation in 2010. Obviously the ITIL implementation is not finished yet and they continue, on present, their ITIL implementation process.

Table 10. Organization 1, Incident Management assessment result

Level	Questions	Nº	Processes needed	Organization				
				Implemented	Not Implemented	Don't Know	In implementation	Approved
Level 2	Key	39	n/a	13	2		24	NO
	Non-Key	48	n/a		1		47	NO (2%)
	Depend Key	3	SLM				2	YES
			SA&CM				1	YES
	TOTAL	90		13	3	0	74	NO
Level 3	Key	23	n/a	4			19	NO
	Depend Key	10	PM				1	YES
			SLM				7	YES
			CHM				2	YES
	TOTAL	33		4	0	0	29	NO
Level 4	Key	9	n/a				9	NO
	Non-Key	13	n/a				13	NO (0%)
	Depend Key	2	SD				2	YES
	TOTAL	24		0	0	0	24	NO
Level 5	Key	5	n/a				5	NO
	Depend Key	1	CSI				1	YES
	TOTAL	6		0	0	0	6	NO
	TOTAL	153		17	3	0	133	11%

We can see on Table 10 that organization 1 is implementing almost all the questions, however there are two Key questions they didn't considerer to implement and they should in order to achieve maturity level 5. They clearly understand all the questions and at the moment few questions are implemented.

Table 11. Organization 1, Configuration Management assessment result

Level	Questions	Nº	Processes needed	Organization				
				Implemented	Not Implemented	Don't Know	In implementation	Approved
Level 2	Key	68	n/a	33	32	3		NO
	Non-Key	78	n/a	17	60	1		NO (21%)
	Depend Key	2	SD		1			NO
			IM		1			YES
	TOTAL	148		50	94	4	0	NO
Level 3	Key	29	n/a	14	9	4	2	NO
	Non-Key	10	n/a	1	9			NO (10%)
	Depend Key	8	PM		1			YES
			ITSCM		1			YES
			FM		1			YES
			CHM	1	1			YES
			AM		1			YES
			RM		1			YES
			CM		1			YES
	TOTAL	47		16	25	4	2	NO
Level 4	Key	21	n/a	5	15	1		NO
	Non-Key	20	n/a	4	16			NO (20%)
	TOTAL	41		9	31	1	0	NO
Level 5	Key	5	n/a		5			NO
	Depend Key	1	CSI		1			YES
	TOTAL	6		0	6	0	0	NO
	TOTAL	242		75	156	9	2	31%

Table 11 show us that Configuration Management isn't a priority ITIL process at the moment for organization 1. Almost all the questions aren't implemented and there are no signs that they will do it in a near future.

Few questions weren't well understood. It could be normal as they don't consider Configuration Management as a priority process and then they don't understand all the questions. They certainly are not so aware of this process.

Table 12. Organization 1, Service Desk assessment result

Level	Questions	Nº	Processes needed	Organization				
				Implemented	Not Implemented	Don't Know	In implementation	Approved
Level 2	Key	33	n/a	18	3	12		NO
	Non-Key	75	n/a	36	6	33		NO (48%)
	Depend Key	10	IM		1	3		YES
			SLM			4		YES
			SCM	1				YES
			SA&CM		1			YES
	TOTAL	118		55	11	52	0	NO
Level 3	Key	12	n/a	1	9	2		NO
	Non-Key	1	n/a		1			NO (0%)
	Depend Key	8	PM	1		1		YES
			SA&CM		1			YES
			CHM	1	4			YES
	TOTAL	21		3	15	3	0	NO
Level 4	Key	19	n/a	5	3	11		NO
	Non-Key	13	n/a	6		3		NO (46%)
	TOTAL	28		11	3	14	0	NO
Level 5	Key	5	n/a			5		NO
	Depend Key	3	CSI		1	2		YES
	TOTAL	8		0	1	7	0	NO
	TOTAL	175		69	30	76	0	39%

After review the results of Service Desk questionnaire (Table 12) we can conclude that who answered the questionnaire wasn´t the right person to do it. A lot of questions were not understood and that's not normal for a responsible for Service Desk function.

Assuming that the responsible answered "Don't Know" when he didn't know if the question was in implementation or not it's strange and doesn't follow ITIL books rules.

However, by the amount of questions said as "implemented", we can conclude that as well as Configuration Management and Incident Management this process is in a low stage of maturity. Incident Management appears to be the priority process in the organization at this moment.

4.3 Organization 2

Organization 2 is a public organization that works for Portuguese government. Their IT department employs 250 people and they start the ITIL implementation in 2007. The ITIL implementation has already finished in the organization.

Table 13. Organization 2, Incident Management assessment result

Level	Questions	Nº	Processes needed	Organization				
				Implemented	Not Implemented	Don't Know	In implementation	Approved
Level 2	Key	39	n/a	36	1		2	NO
	Non-Key	48	n/a	43	5			YES (90%)
	Depend Key	3	SLM	2				YES
			SA&CM				1	NO
	TOTAL	90		81	6	0	3	NO
Level 3	Key	23	n/a	19	4			NO
	Depend Key	10	PM				1	YES
			SLM	5	2			YES
			CHM	1			1	YES
	TOTAL	33		25	6	0	2	NO
Level 4	Key	9	n/a	8	1			NO
	Non-Key	13	n/a	5	8			NO (38%)
	Depend Key	2	SD	2				YES
	TOTAL	24		15	9	0	0	NO
Level 5	Key	5	n/a	5				YES
	Depend Key	1	CSI	1				YES
	TOTAL	6		6	0	0	0	NO
	TOTAL	153		127	21	0	5	83%

We can see on Table 13 that the implementation of Incident Management in Organization 2 is advanced (83%). However there are few "Key" questions that keep being missed by the organization and should be implemented in order to achieve a higher level of maturity. If we look to level 2 and level 3 we can easily see that with more 5 Key questions implemented they were at level 3 of maturity instead of level 1.

Table 14. Organization 2, Service Desk assessment result

Level	Questions	Nº	Processes needed	Organization				
				Implemented	Not Implemented	Don't Know	In implementation	Approved
Level 2	Key	33	n/a	33				YES
	Non-Key	75	n/a	66	9			YES (96%)
	Depend Key	10	IM	4				YES
			SLM	3			1	YES
			SCM	1				YES
			SA&CM	1				YES
	TOTAL	118		108	9	0	1	YES
Level 3	Key	12	n/a	12				YES
	Non-Key	1	n/a	1				YES (100%)
	Depend Key	8	PM	1			1	YES
			SA&CM				1	YES
			CHM				5	YES
	TOTAL	21		14	0	0	7	NO
Level 4	Key	19	n/a	16	3			NO
	Non-Key	9	n/a	6	3			NO (67%)
	TOTAL	28		22	6	0	0	NO
Level 5	Key	5	n/a	5				YES
	Depend Key	3	CSI	3				YES
	TOTAL	8		8	0	0	0	YES
	TOTAL	175		152	15	0	8	87%

After review the results of Service Desk questionnaire (Table 14) we can see that the process is very well implemented on the Organization 2. Few questions are missing on level 4 (4 questions) to achieve level 5 of maturity.

In summary, Organization 2 achieved very good results on the assessments made. They are just missing some important questions to achieve higher level of maturity in both processes.

4.4 Organization 3

Organization 3 is a public organization that works for Portuguese government and works as a Regulatory Authority. Their IT department employs 24 people and they start the ITIL implementation in 2009. The implementation is not finished yet.

Table 15. Organization 3, Configuration Management assessment result

Level	Questions	Nº	Processes needed	Organization				
				Implemented	Not Implemented	Don't Know	In implementation	Approved
Level 2	Key	68	n/a	49	1		18	NO
	Non-Key	78	n/a	59	2		17	YES (88%)
	Depend Key	2	SD				1	NO
			IM				1	NO
	TOTAL	148		108	3	0	37	NO
Level 3	Key	29	n/a	9			20	NO
	Non-Key	10	n/a				10	NO (0%)
	Depend Key	8	PM				1	YES
			ITSCM				1	YES
			FM				1	YES
			CHM				2	YES
			AM				1	YES
			RM				1	YES
			CM	1				YES
	TOTAL	47		10	0	0	37	NO
Level 4	Key	21	n/a	3	1		17	NO
	Non-Key	20	n/a	5			15	NO (25%)
	TOTAL	41		8	1	0	32	NO
Level 5	Key	5	n/a				5	NO
	Depend Key	1	CSI				1	YES
	TOTAL	6		0	0	0	6	NO
	TOTAL	242		126	4	0	112	52%

Table 15 shows us that Organization 3 is on track to achieve the level 5 of maturity. They have half questions implemented and the other half in implementation. They are just missing two Key questions (one in level 2 and another in level 4) that must be implemented.

Table 16. Organization 3, Incident Management assessment result

Level	Questions	№	Processes needed	Organization				
				Implemented	Not Implemented	Don't Know	In implementation	Approved
Level 2	Key	39	n/a	10			29	NO
	Non-Key	48	n/a	5	1		42	NO (12%)
	Depend Key	3	SLM				2	YES
			SA&CM				1	YES
	TOTAL	90		15	1	0	74	NO
Level 3	Key	23	n/a				23	NO
	Depend Key	10	PM				1	YES
			SLM				7	YES
			CHM				2	YES
	TOTAL	33		0	0	0	33	NO
Level 4	Key	9	n/a				9	NO
	Non-Key	13	n/a				13	NO (31%)
	Depend Key	2	SD				2	NO
	TOTAL	24		0	0	0	24	NO
Level 5	Key	5	n/a				5	NO
	Depend Key	1	CSI				1	YES
	TOTAL	6		0	0	0	6	NO
	TOTAL	153		15	1	0	137	10%

Table 16 shows that Organization 3 is implementing nearly all questions. If all questions said as "in implementation" are successfully implemented then they will be at level 5 of maturity.

Table 17. Organization 3, Service Desk assessment result

Level	Questions	№	Processes needed	Organization				
				Implemented	Not Implemented	Don't Know	In implementation	Approved
Level 2	Key	33	n/a	23	1	1	8	NO
	Non-Key	75	n/a	46	6		23	NO (61%)
	Depend Key	10	IM	4				YES
			SLM	3	1			YES
			SCM	1				YES
			SA&CM	1				YES
	TOTAL	118		78	8	1	31	NO
Level 3	Key	12	n/a		1		11	NO
	Non-Key	1	n/a	1				YES (100%)
	Depend Key	8	PM	2				YES
			SA&CM				1	YES
			CHM	3			2	YES
	TOTAL	21		6	1	0	14	NO
Level 4	Key	19	n/a	6	1		12	NO
	Non-Key	9	n/a	1			8	NO (11%)
	TOTAL	28		7	1	0	20	NO
Level 5	Key	5	n/a				5	NO
	Depend Key	3	CSI				3	YES
	TOTAL	8		0	0	0	8	NO
	TOTAL	175		91	10	1	73	52%

After review Table 17 we easily conclude that Service Desk assessment follows the same line of previous assessments in Organization 3 with most questions being "in implementation". However, few Key questions that must be implemented in order to achieve the maximum level of maturity at the end of the implementation remain unimplemented.

4.5 Organization 4

Organization 4 is a public organization that works for Portuguese government and works as a Regulatory Authority. Their IT department employs 30 people and they start the ITIL implementation in 2008. Only Incident Management was assessed and the implementation has already finished.

Table 18. Organization 4, Incident Management assessment result

Level	Questions	Nº	Processes needed	Organization				
				Implemented	Not Implemented	Don't Know	In implementation	Approved
Level 2	Key	39	n/a	33	6			NO
	Non-Key	48	n/a	25	23			NO (52%)
	Depend Key	3	SLM	2				YES
			SA&CM	1				YES
	TOTAL	90		61	29	0	0	NO
Level 3	Key	23	n/a	14	9			NO
	Depend Key	10	PM		1			YES
			SLM		7			YES
			CHM	1	1			YES
	TOTAL	33		15	18	0	0	NO
Level 4	Key	9	n/a	6	3			NO
	Non-Key	13	n/a	8	5			NO (62%)
	Depend Key	2	SD		2			YES
	TOTAL	24		14	10	0	0	NO
Level 5	Key	5	n/a	3	2			NO
	Depend Key	1	CSI	1				YES
	TOTAL	6		4	2	0	0	NO
	TOTAL	153		94	59	0	0	61%

We can see at Table 18 that Organization 4 is quite far from the objective. They are at level 1 of maturity and keep lacking too much important question to achieve next level of maturity.

It's strange that the organization already ordered the end of the implementation when they are in such low level of implementation. This fact will be better discussed in next section.

4.6 Organization 5

Organization 5 does outsourcing of informatics services. Their IT department employs 20 people and they start the ITIL implementation in 2009. Only Incident Management was assessed and the implementation has already finished.

Table 19. Organization 5, Incident Management assessment result

Level	Questions	Nº	Processes needed	Organization				
				Implemented	Not Implemented	Don't Know	In implementation	Approved
Level 2	Key	39	n/a	35	4			NO
	Non-Key	48	n/a	22	26			NO (46%)
	Depend Key	3	SLM		2			YES
			SA&CM		1			YES
	TOTAL	90		57	33	0	0	NO
Level 3	Key	23	n/a	15	8			NO
	Depend Key	10	PM		1			YES
			SLM		7			YES
			CHM		2			YES
	TOTAL	33		15	18	0	0	NO
Level 4	Key	9	n/a	7	2			NO
	Non-Key	13	n/a	12	1			YES (92%)
	Depend Key	2	SD		2			YES
	TOTAL	24		19	5	0	0	NO
Level 5	Key	5	n/a	4	1			NO
	Depend Key	1	CSI		1			YES
	TOTAL	6		4	2	0	0	NO
	TOTAL	153		95	58	0	0	62%

Table 19 shows us that Organization 5 is quite far from the final objective. They don't have implemented several questions that are crucial for the success of ITIL implementation.

All the questions were understood and they don't have any question in implementation and appears that the process is no more in implementation on the Organization.

4.7 Organization 6

Organization 6 does outsourcing of operational support. On this organization two teams were assessed (two Service Desks, two Incident Managements and one Configuration Management). The teams support different clients. They have 500 people on IT department divided by teams. The first team has 60 employees and the second team has 56 employees. Both teams started the ITIL implementation on 2008, however only team 1 already finished a process implementation (Incident Management). We don't know if they just have Configuration Management in one of the teams since they just sent one Configuration Management questionnaire answered. However, a comparison of the performance of two teams on the same organization will be made.

Table 20. Organization 6, team 1, Incident Management assessment result

Level	Questions	Nº	Processes needed	Organization				
				Implemented	Not Implemented	Don't Know	In implementation	Approved
Level 2	Key	39	n/a	39				YES
	Non-Key	48	n/a	46	2			YES (96%)
	Depend Key	3	SLM	2				YES
			SA&CM	1				YES
	TOTAL	90		88	2	0	0	YES
Level 3	Key	23	n/a	23				YES
	Depend Key	10	PM	1				YES
			SLM	7				YES
			CHM	2				YES
	TOTAL	33		33	0	0	0	YES
Level 4	Key	9	n/a	5		4		NO
	Non-Key	13	n/a	4	6	3		NO (31%)
	Depend Key	2	SD	2				YES
	TOTAL	24		11	6	7		NO
Level 5	Key	5	n/a	2	3			NO
	Depend Key	1	CSI	1				YES
	TOTAL	6		3	3			NO
	TOTAL	153		138	8	7		90%

After review the results of Incident Management questionnaire (Table 20) we can conclude that the team 1 of Organization 6 is advanced on Incident Management. Remains the doubt about why they didn't understand the 7 questions at level 4. The effort needed to achieve level 5 of maturity is minimum.

Table 21. Organization 6, team 1, Service Desk assessment result

Level	Questions	Nº	Processes needed	Organization				
				Implemented	Not Implemented	Don't Know	In implementation	Approved
Level 2	Key	33	n/a	33				YES
	Non-Key	75	n/a	72	2	1		YES (96%)
	Depend Key	10	IM	4				YES
			SLM	4				YES
			SCM	1				YES
			SA&CM	1				YES
	TOTAL	118		115	2	1	0	YES
Level 3	Key	12	n/a	12				YES
	Non-Key	1	n/a	1				YES (100%)
	Depend Key	8	PM	2				YES
			SA&CM	1				YES
			CHM	5				YES
	TOTAL	21		21	0	0	0	YES
Level 4	Key	19	n/a	19				YES
	Non-Key	9	n/a	8	1			YES (89%)
	TOTAL	28		27	1	0	0	YES
Level 5	Key	5	n/a	5				YES
	Depend Key	3	CSI	3				YES
	TOTAL	8		8	0	0	0	YES
	TOTAL	175		172	3	1		98%

Table 21 reveals that team 1 of Organization 6 has Service Desk at level 5 of maturity. This team had the maximum level of maturity in all assessments made on this thesis.

Table 22. Organization 6, team 1, Configuration Management assessment result

Level	Questions	Nº	Processes needed	Organization				
				Implemented	Not Implemented	Don't Know	In implementation	Approved
Level 2	Key	68	n/a	40	28			NO
	Non-Key	78	n/a	23	53	2		NO (29%)
	Depend Key	2	SD	1				YES
			IM	1				YES
	TOTAL	148		65	81	2	0	NO
Level 3	Key	29	n/a	16	12	1		NO
	Non-Key	10	n/a	3	7			NO (30%)
	Depend Key	8	PM	1				YES
			ITSCM		1			YES
			FM	1				YES
			CHM	2				YES
			AM		1			YES
			RM		1			YES
			CM		1			YES
	TOTAL	47		23	23	1	0	NO
Level 4	Key	21	n/a	7	14			NO
	Non-Key	20	n/a	5	15			NO (25%)
	TOTAL	41		12	29	0	0	NO
Level 5	Key	5	n/a	3	2			NO
	Depend Key	1	CSI		1			YES
	TOTAL	6		3	3	0	0	NO
	TOTAL	242		103	136	3		43%

We can see at Table 22 that configuration Management is not the priority of the Organization 6. Compared with Table 20 and Table 21 (Incident Management and Service Desk) this process is not so evolved.

Table 23. Organization 6, team 2, Incident Management assessment result

Level	Questions	Nº	Processes needed	Organization				
				Implemented	Not Implemented	Don't Know	In implementation	Approved
Level 2	Key	39	n/a	39				YES
	Non-Key	48	n/a	41	7			YES (85%)
	Depend Key	3	SLM	2				YES
			SA&CM	1				YES
	TOTAL	90		83	7	0	0	YES
Level 3	Key	23	n/a	22	1			NO
	Depend Key	10	PM	1				YES
			SLM	7				YES
			CHM	2				YES
	TOTAL	33		32	1	0	0	NO
Level 4	Key	9	n/a	9				YES
	Non-Key	13	n/a	10	3			YES (76%)
	Depend Key	2	SD	2				YES
	TOTAL	24		21	3	0	0	NO
Level 5	Key	5	n/a	5				YES
	Depend Key	1	CSI	1				YES
	TOTAL	6		6	0	0	0	NO
	TOTAL	153		142	11	0	0	93%

After review Table 23 we easily see that Team 2 of Organization 6 doesn't have Incident Management at level 5 of maturity just by one not implemented Key question. It seems unfair, but it could happen in any maturity model because there are boundaries that must be followed. We believe that the effort to accomplish the missed question is worth.

Table 24. Organization 6, team 2, Service Desk assessment result

Level	Questions	№	Processes needed	Organization				
				Implemented	Not Implemented	Don't Know	In implementation	Approved
Level 2	Key	33	n/a	24	1	7	1	NO
	Non-Key	75	n/a	58	1	6	10	YES (77%)
	Depend Key	10	IM	4				YES
			SLM	4				YES
			SCM				1	YES
			SA&CM	1				YES
	TOTAL	118		91	2	13	12	NO
Level 3	Key	12	n/a	9		3		NO
	Non-Key	1	n/a	1				YES (100%)
	Depend Key	8	PM	2				YES
			SA&CM	1				YES
			CHM	4		1		YES
	TOTAL	21		17	0	4	0	NO
Level 4	Key	19	n/a	16		3		NO
	Non-Key	9	n/a	3	1	5		NO (44%)
	TOTAL	28		19	1	8	0	NO
Level 5	Key	5	n/a	4	1			NO
	Depend Key	3	CSI	3				YES
	TOTAL	8		7	1	0	0	NO
	TOTAL	175		134	4	25	12	77%

Table 24 shows us Team 2 of Organization 6 is very near of the Level 5 of maturity. On this case they didn't understand few questions that are consider important for the implementation of Service Desk. The implementation is advanced but they are missing some crucial questions.

4.8 Organization 7

Organization 7 is a hospital. Their IT department employs 20 people and they start the ITIL implementation in 2009. Only Incident Management and Service Desk were assessed and the implementation is not finished yet.

Table 25. Organization 7, Incident Management assessment result

Level	Questions	Nº	Processes needed	Organization				
				Implemented	Not Implemented	Don't Know	In implementation	Approved
Level 2	Key	39	n/a	26	12	1		NO
	Non-Key	48	n/a	20	27	1		NO (42%)
	Depend Key	3	SLM	1	1			NO
			SA&CM		1			NO
	TOTAL	90		47	41	2	0	NO
Level 3	Key	23	n/a	9	14			NO
	Depend Key	10	PM		1			NO
			SLM		7			NO
			CHM	1	1			NO
	TOTAL	33		10	23	0	0	NO
Level 4	Key	9	n/a	3	6			NO
	Non-Key	13	n/a	6	7			NO (46%)
	Depend Key	2	SD	2				YES
	TOTAL	24		11	13	0	0	NO
Level 5	Key	5	n/a		5			NO
	Depend Key	1	CSI		1			YES
	TOTAL	6		0	6	0	0	NO
	TOTAL	153		68	83	2	0	44%

Table 25 shows us that Organization 7 has a long way to go. The implementation level is low as well as the maturity level (level 1).

Table 26. Organization 7, Service Desk assessment result

Level	Questions	Nº	Processes needed	Organization				
				Implemented	Not Implemented	Don't Know	In implementation	Approved
Level 2	Key	33	n/a	27	7			NO
	Non-Key	75	n/a	40	31	3		YES (77%)
	Depend Key	10	IM	2	2			YES
			SLM		4			YES
			SCM	1				YES
			SA&CM	1				YES
	TOTAL	118		71	44	3	0	NO
Level 3	Key	12	n/a	4	8			NO
	Non-Key	1	n/a	1				YES (100%)
	Depend Key	8	PM	1	1			YES
			SA&CM		1			YES
			CHM	1	4			YES
	TOTAL	21		7	14	0	0	NO
Level 4	Key	19	n/a	12	7			NO
	Non-Key	9	n/a	8	1			YES (89%)
	TOTAL	28		20	8	0	0	NO
Level 5	Key	5	n/a	2	3			NO
	Depend Key	3	CSI		3			YES
	TOTAL	8		2	6	0	0	NO
	TOTAL	175		100	72	3	0	57%

On Table 26 we can see that Service Desk and Incident Management are at same level on Organization 7. They should implement all the Key question missing starting by the level 2.

5 Evaluation

After all these assessments and the correspondent results a discussion is missing. In this section the results will be discussed and evaluated. We will also describe how the model was improved over the time and how the improvements were related with the assessments results. At the end an evaluation of our own model with the pros and cons will be made.

Table 27. Assessments results compilation

Process	Organization	Simple	Complete	Copy	State	Model state	Start	Finish	People	Budget (€)	Level
Service Desk	1	No	Yes	Yes	15%	39%	2010	No	215	10M	1
	2	Yes	Yes	Yes	100%	87%	2007	Yes	250	13M	2
	3	Yes	Yes	Yes	95%	52%	2009	No	24	2,5M	1
	6 (Team 1)	Yes	Yes	Yes	70%	98%	2008	No	60/500	---	5
	6 (Team 2)	No	Yes	Yes	70%	77%	2008	No	56/500	---	1
	7	Yes	Yes	Yes	90%	57%	2009	Yes	20	1.5M	1
Configuration Management	1	No	Yes	Yes	10%	31%	2010	No	215	10M	1
	3	Yes	Yes	Yes	90%	52%	2009	No	24	2,5M	1
	6	Yes	Yes	Yes	60%	43%	2008	No	60/500	---	1
Incident Management	1	No	Yes	Yes	15%	11%	2010	No	215	10M	1
	2	Yes	Yes	Yes	100%	83%	2007	Yes	250	13M	1
	3	Yes	Yes	Yes	100%	10%	2009	No	24	2,5M	1
	4	Yes	Yes	Yes	60%	61%	2008	Yes	30	6M	1
	5	Yes	Yes	Yes	90%	62%	2009	Yes	20	500K	1
	6 (Team 1)	Yes	Yes	Yes	90%	90%	2008	Yes	60/500	---	3
	6 (Team 2)	Yes	Yes	Yes	90%	93%	2008	No	56/500	---	2
	7	Yes	Yes	Yes	90%	44%	2009	Yes	20	1.5M	1
Average					72,6%	58,2%					1,47

Organization 1 got better results that they were expecting in two questionnaires. We believe that the reason is related with the strong investment on CMMI they made before starting to implement ITIL. We cannot forget that this maturity model was based on CMMI-SVC and ITSCMM, it's completely reasonable and credible that an organization with a strong investment on CMMI-SVC has a better percentage compared with one organization without the same investment.

On Table 10 we can see that Incident Management is their top priority at moment as they are implementing almost all the questions of the process. On the other hand the Service Desk results on Table 12 show us that they didn't understand the majority of the questions. We believe that the person responsible for the Service Desk questionnaire wasn't the most appropriated.

Summarizing, they still are at level 1 in all the processes assessed. They are at the beginning of the implementation and the level of maturity achieved is adequate.

Organization 2 is one of the organizations that achieved best results. However, they are exaggeratedly optimistic. First their supposed percentage of implementation are overvalued in all the process assessed (they said 100% in two processes), second, although a high percentage of achieved implementation, their maturity level is far from the ideal.

Summarizing, although being at maturity level 2 in Service Desk, they are far away from the maturity levels that they should be. They clearly skipped some important details on the implementation that makes them miss the objective and could bring serious problems in future. Additionally, is strange affirming simultaneously that 90% of Configuration Management was implemented and the process implementation is done.

Organization 3 is another interesting case, they don't give the implementation by ended but they believe to be at 100% of implementation in Service Desk and Incident Management. We believe, after had evaluated the results (Table 16 and Table 17), that they believe to be at 100% of these processes taking into account the answers that they said as "In implementation". Even taking into consideration the "In implementation" answers their level of maturity, with the exception of the Incident Management that actually would be at level 5 and near 100%, they won't reach more than level 1.

Organization 4 is clearly aware of their maturity level. However, they keep being in a low level of maturity and gave as completed the ITIL implementation. This is strange because they believe to be at 61% of implementation; they are at level 1 of maturity, they start the implementation in 2008 and affirm that already finished the implementation. Seems like a waste of efforts during the last two years since the beginning of ITIL implementation. There are two possible reasons, and both identified in the problem of this thesis: they were completely lost in the implementation and didn't know the next steps, or they just reach the limit budget and demonstrate bad finance management.

Organization 5 is not aware out of their real implementation. They got a low percentage and the lowest level of maturity (level 1) and believe to be much more forward on the implementation. Once more this organization gives the implementation as terminated and 90% as the total of the implementation that is very strange.

Organization 6 achieved the best results and they were clearly aware of their maturity level. Service Desk of Team 1 was a little pessimistic about their level but Incident Management of Team 1 had less percentage and a higher level of maturity compared with Incident Management of Team 2. Nevertheless, with 90% they should be in a higher level of maturity and the reason they are not should be investigated.

Organizations 4 and 5 were the first organizations where the questionnaires were tested. At that time we already had two mini questionnaires to make before and after each assessment. After those assessments and the evaluation of the results the mini questionnaires were improved in order to gather important information to be able to draw more accurate conclusions.

During the rest of the assessments the improvements was just on the main questionnaires, with some Key questions that come to Non Key, or some superficial improvements as repeated questions or redundant information.

In order to do a self evaluation of the proposed model it should be presented the pros and cons of the model. The identified pros of the model are:

1. Extremely useful for helping organizations implementing ITIL
2. Very detailed and complete
3. Can be used to assess and guide an ITIL implementation
4. The Staged Model follows an incremental path that reduces the initial effort
5. Enables organization to know “where they are” and “what they should do” regarding ITIL
6. Organizations that follow the proposed model avoid the most common mistakes
7. The questions are easily understood by most organizations
8. The model is useful and interesting, until now all organizations wished a copy of the questionnaires results

However, some cons of the model were identified:

1. Two processes and one function, amongst the 24 processes found on the ITIL v3 books, only cover so far a small part of ITIL
2. The Staged Model cannot be assessed because we are still lacking the questionnaires for most of the level 2 processes
3. The sequence of implementation proposed by the Staged Model may not be the most appropriate for all organizations

Summarizing, organization 6 got the better results and is the most evolved organization in the ITIL implementation. With the average of 1,47 of maturity level we can affirm that the implementation wasn’t well performed or isn´t being well perform. Almost all the organizations believe to be in a better state of implementation (72,6) that they actually are (58,2) in average. All these conclusions match the initial statements on this thesis about the difficulty by the organizations to implement ITIL.

6 Prototype

A prototype was designed and created in order to allow the organizations to assess their ITIL processes more professionally, easily and efficiently. Although with an organization interested in assessing their ITIL with the prototype, we couldn't make it in time of the delivery of this thesis because the prototype was designed too late. Despite not having used the prototype to assess the ITIL implementation of any organization, the prototype follows the methodology of this thesis and it's obviously a better way to perform the assessment in worldwide present context.

The prototype has two facets, as single organization and multi-client (i.e. an organization with two or more Service Desks or Incident Managements). This enables comparison between teams of the same organization.

The prototype allows the organizations to assess the processes, delegate questions to other people that the responsible believes to be more appropriated to answer, see the reports of the assessments, see an evolve of the assessments of the same process, compare assessments of multi-clients and provide a roadmap with the most appropriate next steps to implement.

The concern to design the prototype simple and with many graphics with available information, some on real time, to the responsible of the assessments, was taken into account; therefore the home page is a dashboard and has easily access to all reports and roadmaps.

Fig. 4 is a screenshot of the home page (dashboard) and we can see 3 kinds of information:

1. The percentage of the implementation of each process. On this case we have two teams (clients) and we can see the percentage of both.

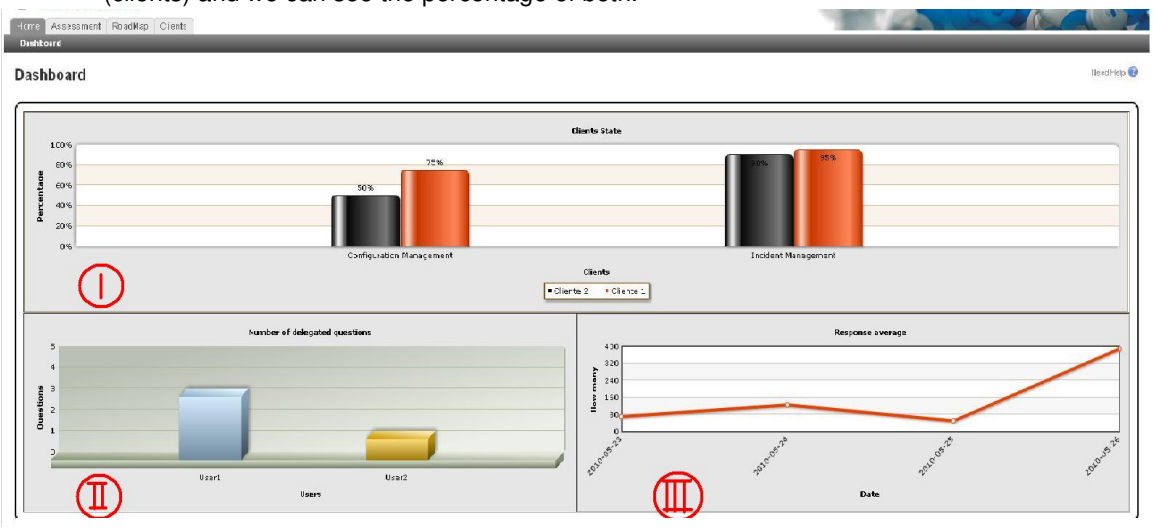

Figure 4. Application home page (Dashboard)

2. The amount of questions that each user introduced in the application has to respond (delegated questions); this is useful to control the work of each person around the questionnaire.
3. The amount of questions responded per day. With this graph we can have an idea of the accession of the people and estimate how long the assessment will take, and in some cases accelerate the process if needed.

Another important feature of the aplication is the roadmap that is provided at the end of each process assessment, Fig. 5. With the roadmap the organization knows each step they need to achieve the level of maturity that they want.

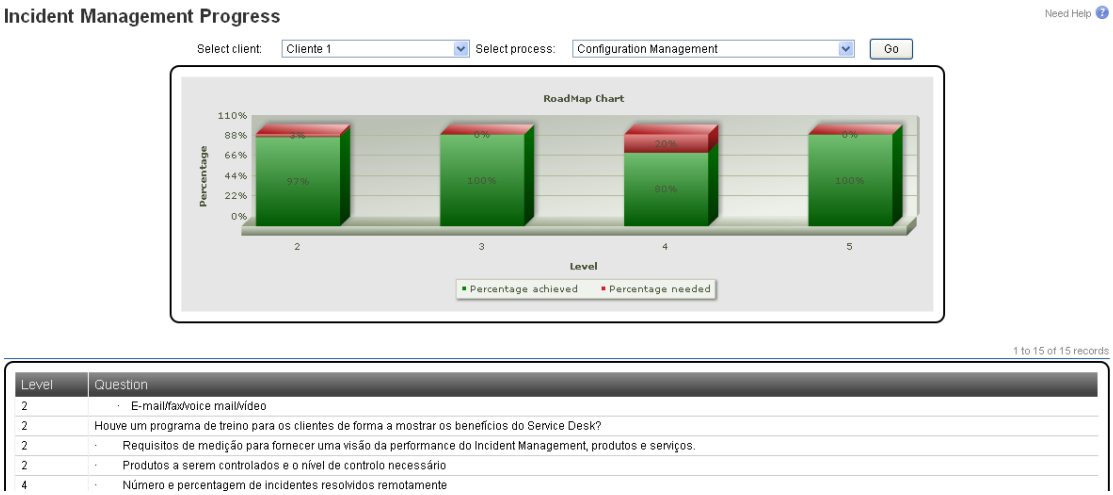

Figure 5. Roadmap provided

The application allows the manager (responsible for the assessment) to control all the questions, even the ones that are delegated and how long are them delegated. It's also possible to send an advise to the correspondent person in order to remember.

Every time a question is delegated or an advise is sent, an email is sent with a link for the application atached to it.

7 Conclusion

Implementing ITIL is not easy, as seen by the fact that several organizations fail in their efforts to do so; they clearly need something to facilitate that as well as to recover more benefits from the investments.

The maturity model proposed to help organizations assess the maturity level of their ITIL implementations and presents a roadmap for improvement was successfully tested on practice and validated on international conferences.

An evaluation of the model was made by 17 assessments in 7 organizations; the results were previously presented, as well as the pros and cons of the proposed model discussed.

With the 17 assessments made we may conclude the following:

- Most organizations are at level 1 of maturity, even some with a high percentage of ITIL implementation. This means that they are skipping important details when implementing ITIL.
- Organizations with a low percentage of implementation cannot understand all the questions. Perhaps in the future the model should be improved in order to make it more flexible and more adaptable to the maturity level of each organization.
- Some organizations finish their ITIL implementation and do not even have the level 2 of maturity. We should investigate why this is happening because it may be caused by extremely difficulty, high price, and /or a lack of benefits. Again, the proposed model may help solve this problem.
- An organization already with CMMI can have better results than expected but never reach more than level 1. This is completely normal because the proposed model was based on CMMI-SVC and ITSCMM.
- Table 27 shows us that the average of maturity level of the organizations is very low. Probably this happens because organizations are not implementing ITIL properly.

On the other hand, there are other points of view from which we can draw further and different conclusions. They are:

- Size of the organizations
- Budget of the organizations
- Public Vs Private organizations
- Teams of the same organization

We can see at Table 27 that the larger the organization, the better the results. It's an interesting conclusion; the largest organizations are more careful with the implementation and spend their time, efforts and money more appropriately.

Budget subject is quite sensitive, not all organizations were comfortable in provide their budget so we cannot get an accurate conclusion. However, after visiting the workplace of the organization 6 as well as knowing the dimension of the same, it's completely reasonable to assume that this organization is the one with the bigger budget between all the organizations assessed. Based on this assumption we can easily conclude that a larger budget is a synonymous of better results.

Distinguish the organizations in public and private is not fair since they are not in the same number, have different sizes, different budgets; however it's an interesting viewpoint to evaluate. Organization 1, 5 and 6 are private and the rest are public organizations. Private organizations clearly achieve better results in percentage of implementation and maturity level achieved.

We can see on Table 27 that both teams said to be on the same level of implementation. However, the results show that apparently they are not with the same percentage of implementation as well as the same maturity level. After review Table 21 and 24, we believe that the difference is on the questions that the responsible of Team 2 answered as "Don't Know", maybe the responsible wasn't as aware of the implementation as the Team 1. Without that answers the assessments results of the Teams would have been very similar. Due to this, we can conclude that inside the same organization the results become very similar

Summarizing, in most cases, ITIL implementation is not at the level that organizations believe it is. Besides that, the results show that almost all organizations skip important steps and the level of maturity is only 1.47 in average. The problem that this thesis is trying to solve is thus worth this research effort because most organizations are, in fact, implementing ITIL incorrectly and are not properly getting the benefits from their ITIL implementation.

Most organizations implement ITIL as they wish, i.e. not following the ITIL best practices. The maturity model proposed in this thesis is very useful because the organizations find what they are not doing properly.

Finally, the assessments demonstrate the usefulness and importance of this research work and the proposed model.

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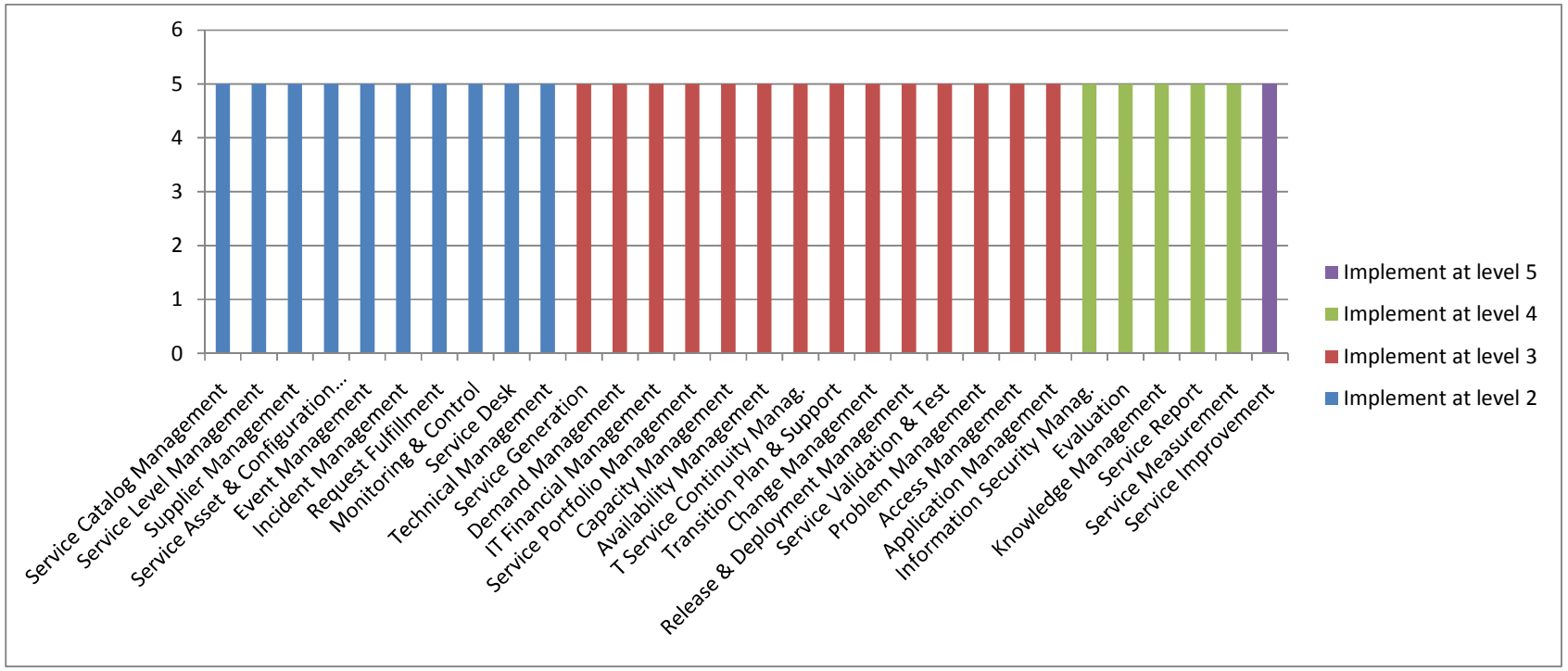
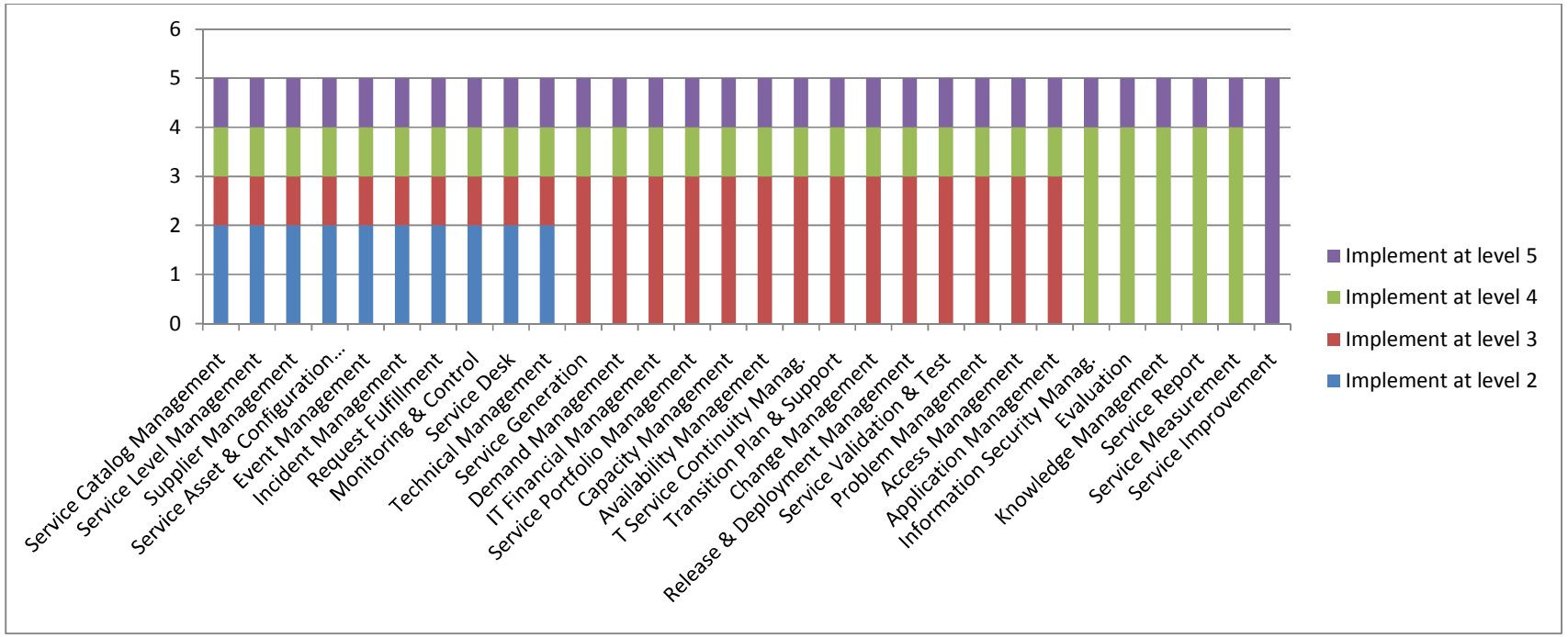
Appendixes

A.1 Non incremental path



A.2 Incremental path



A.3 Level of the ITIL processes on proposal maturity model

ITIL		Level				
Service Strategy	Service Generation			3		
	Demand Management			3		
	IT Financial Management			3		
	Service Portfolio Manag.			3		
Service Design	Service Catalogue Manag.	2				
	Service Level Management	2				
	Capacity Management			3		
	Availability Management			3		
	IT Service Continuity Manag.			3		
	Information Security Manag.				4	
	Supplier Management	2				
Service Transition	Transition Plan & Support			3		
	Change Management			3		
	Service Asset & Configuration Management	2				
	Release & Deployment Management			3		
	Service Validation & Test			3		
	Evaluation				4	
	Knowledge Management				4	
Service Operation	Event Management	2				
	Incident Management	2				
	Problem Management			3		
	Request Fulfillment	2				
	Access Management			3		
	Operation Management					
	→ IT Operation Manag.					
	→ Monitoring & Control	2				
	→ Service Desk	2				
	→ Technical Management	2				
	→ Application Management			3		
Continual Service Improvement	Service Improvement					5
	Service Report				4	
	Service Measurement				4	

A.4 Relationship between ITIL, CMMI-SVC and ITSCMM processes

ITIL		CMMI	ITSCMM
Service Strategy	Service Generation	Project Planning Service System Development	
	Demand Management	Project Planning Capability and Availability Manag. Risk Management	
	IT Financial Management	Project Planning Capability and Availability Manag. Risk Management	Financial Service Manag.
	Service Portfolio Manag.	Organization Process Definition Service System Development Strategic Service Management	Service Commitment Manag. Organization Process Defen. Organization Service Defen. Intergroup Coordination
Service Design	Service Catalogue Manag.	Strategic Service Management	Service Commitment Manag. Organization Process Defen. Organization Service Defen.
	Service Level Management	Requirement Management Service Delivery Service System Development Strategic Service Management	Service Commitment Manag. Service Delivery Planning Service Tracking and Oversight Service Quality Assurance
	Capacity Management	Capability and Availability Manag.	Service Delivery Planning Integrated Service Man. Quantitative Process Man. Resource Management
	Availability Management	Capability and Availability Manag.	Service Delivery Planning Integrated Service Man. Quantitative Process Man.
	IT Service Continuity Manag.	Organization Process Focus Service Continuity	Organization Process Focus Process Change Management Technology Change Manag.
	Information Security Manag.		
	Supplier Management	Supplier Agreement Management	Subcontract Management
Service Transition	Transition Plan & Support	Service Delivery Service System Transition	Service Delivery Planning Service Delivery
	Change Management	Configuration Management	Process Change Management Technology Change Manag.
	Service Asset & Configuration Management	Configuration Management	Configuration Management
	Release & Deployment Management	Service Delivery Service System Development Service System Transition	Service Delivery
	Service Validation & Test	Service Delivery Service System Development	Service Delivery
	Evaluation	Organization Process Performance Quantitatively Project Management Decision Analysis and Resolution	Quantitative Process Manag. Service Quality Management
	Knowledge Management		
Service Operation	Event Management	Incident Resolution and Prevention	Service Request and Incident M.
	Incident Management	Incident Resolution and Prevention	Service Request and Incident M.
	Problem Management	Causal Analysis and Resolution	Problem Management Problem Prevention
	Request Fulfillment	Service Delivery	
	Access Management	Configuration Management	
	Operation Management		
	→ IT Operation Manag.		
	→ Monitoring & Control	Process Monitoring and Control	Service Tracking and Oversight Service Quality Assurance
	→ Service Desk		Service Request and Incident M.
	→ Technical Management	Organizational Training Process and product quality assur.	Training Program
	→ Application Management	Organizational Training	Training Program Resource Management
Continual Service Improvement	Service Improvement	Organization Innovation and Deploy.	Organization Process Focus Process Change Management Technology Change Manag.
	Service Report	Measurement and Analysis	Service Tracking and Oversight
	Service Measurement	Measurement and Analysis Quantitatively Project Management	Quantitative Process Manag. Service Quality Management

A.5 Part of one of the questionnaires

Level 3		
Key	Is the policy for the planning and implementation of the process documented?	
Key	Was a plan defined for the implementation of the process?	
Key	• Was the plan reviewed by the stakeholders and had their consent?	
Key	• Is the plan revised when necessary?	
Key	Is the plan for the execution of the process documented?	
Key	Is the description of the incident management documented?	
Key	Is described how the responsibility in the handling incidents are assigned and transferred?	
Key	Is there a description of the process that tells the needs and objectives for the implementation of the process?	
Key	• Is it maintained?	
Key	• Is it updated?	
Key	• Is it revised when necessary?	
Key	Is there a description of how to notify customers or end users that could be affected by an incident reported? Describe the following parameters:	
Non Key	• Definitions of impact	
Non Key	• Response time	
Non Key	• Resolution time	
Non Key	• Rules for ordering	
Non Key	• Expectations in providing feedback to users	
Key	Is the repository audited in accordance with a documented procedure?	
Depend Key (Change M.)	Is created when needed a request for change to solve an incident?	