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**Implementing best practices for managing
services in a software company**

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Master Dissertation

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Abstract

Organisations must succeed in increasing customer satisfaction and ultimately improve business performance. Customer satisfaction means providing quality services that deliver value to customers and that the perceived service is in line with the expected service. Most organisations are already operating according to processes certified to a given standard so it is also key to understand the gap between current practices and established models for process improvement.

Models have been developed that specify best practices for quality service provision and how quality is affected by activities performed by the organisation. This thesis relates a model with best practices to provide quality services with a model of activities that impact service quality. This relation proposes that some practices are key and that they should be identified in order to best control how perception of service quality is affected.

The application of this proposal is done within the scope of a gap analysis between practices of an organisation already certified to some standards and a new model that specifies best practices to provide quality services to customers and end users.

The gap analysis identified aspects to improve and process areas that need a complete implementation within the organisation. Key practices in terms of service quality were highlighted to help the organisation understand how customer satisfaction is being affected by current practices or the lack of them. Communication was identified as a key aspect for improvement both at the organisation level and at the model level that specifies best practices in terms of service provision.

Implementação de melhores práticas para a gestão de serviços numa empresa de *software*

Resumo

As organizações devem ter sucesso no aumento da satisfação do cliente e melhorar o desempenho dos negócios. A satisfação do cliente significa fornecer serviços de qualidade que agregam valor para os clientes e que o serviço percebido está em linha com o serviço esperado. A maioria das organizações já opera de acordo com processos certificados a um determinado padrão e por isso é importante perceber a diferença entre as práticas atuais e modelos estabelecidos para melhoria de processos.

Foram desenvolvidos modelos que especificam as melhores práticas para prestação de serviços de qualidade e como a qualidade é afetada por atividades realizadas pela organização. Esta tese relaciona um modelo com as melhores práticas para prestar serviços de qualidade com um modelo de atividades que têm impacto na qualidade de serviço. Esta relação sugere que algumas práticas são fundamentais e que devem ser identificadas a fim de melhor controlar a forma como a percepção da qualidade do serviço é afetada.

A aplicação desta proposta é feita no âmbito de uma análise de lacunas entre as práticas de uma organização já certificada a algumas normas e de um novo modelo que especifica as melhores práticas para prestação de serviços de qualidade aos clientes e utilizadores finais.

A análise de lacunas identificou aspetos a melhorar e áreas de processo que precisam de uma implementação completa dentro da organização. Foram identificadas práticas fundamentais em termos de qualidade de serviço para ajudar a organização a entender como a satisfação do cliente está a ser afetada pelas práticas atuais, ou a falta delas. A comunicação foi identificada como um aspeto fundamental para melhoria tanto ao nível da organização como ao nível do modelo que especifica as melhores práticas em termos de prestação de serviços.

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1 Introduction

In the Introduction to this thesis, the first subsection shows the context in which the thesis was executed, followed by the problem it addresses.

There is also an introduction to the methodology used, Action Research, highlighting its differences with consulting activities.

The last section of Introduction shows the structure of this thesis to facilitate navigation and understanding.

1.1 Context

Critical Software (CSW) is a privately held Portuguese company created in 1998 with three offices, Coimbra (headquarters), Porto and Lisbon, in Portugal, and subsidiaries in San Jose (USA), Southampton and Yeovil (UK), Sao Paulo (Brazil), Maputo (Mozambique), Luanda (Angola) and Frankfurt (Germany).

These geographical locations provide CSW a global market focus and multinational culture that supported the company penetrating markets around the globe and made it possible to better understand customer needs and business requirements. Since 1998, CSW has been able to compete in the more mature markets, overthrowing entry barriers and consolidating its presence by excelling in a customer focus approach to the business.

The self-funded offices, with advanced infrastructure, a modern environment and the proximity to the well-known Engineering University campus in Coimbra, Porto, Lisbon, Southampton and São Paulo provide a crucial link to R&D centres and facilitate the engagement of skilled human resources. CSW is an international company, founded in 1998, which specialises in the delivery of reliable solutions, services and technologies for business-critical information systems, providing software solutions and technologies that protect individuals, provide valuable insights, monitor the safety of equipment and guarantee business-critical processes are carried out securely and efficiently.

In today's business landscape, the failure of critical IT systems can irreparably damage corporate profitability reputation. In more extreme cases, software reliability can be a matter of life and death. CSW creates and deploys software solutions that guarantee support for key operational functions. CSW delivers software tools that protect personnel, monitor the safety of equipment and ensure that critical processes are conducted securely and efficiently. Across a range of markets, from Aerospace to Defence & Homeland Security and from Manufacturing to Financial services, clients depend on CSW to develop solutions that simply must not fail.

CSW success lies in bringing quality and innovation to customers' information systems in a timely and cost effective manner. CSW has a solid track record of on-time, on-budget and on-quality projects and have successfully released technologies and products worldwide in specific niche markets. With a range of software development, validation and verification services, CSW ensures that clients' critical systems and processes embody highly reliable software.

As a knowledge-intensive company, CSW's core competences cover a wide array of expertise – Enterprise Application Integration, Embedded and Real-Time, Command & Control, Security and Infrastructure, Database, High Performing Computing, Verification, Validation

and Reliability, Availability, Maintainability and Safety (RAMS) – that are flexibly used in order to better address customer requirements and engineering solutions for multidisciplinary projects profile.

The fact that CSW is independent from large manufacturers and proprietary platform providers places CSW in a unique position to best choose and employ the most adequate technologies and systems for the benefit of customers. Being vendor-independent, enables CSW to accurately select and recommend the most suitable and cost-effective third-party technologies to each customer specific requirements.

CSW's growth has been continuous and sustained over the years and the company has managed to keep on boosting its profitability ratios. Figures show an average two digit increases in yearly turnover, since its founding, around 75% of which are foreign market based since 2007. Hence, CSW was ranked, for several years, as one of the Fast Growing European companies in the "Europe 500 Scoreboard", published annually by Business Week.

CSW has two Business Units: Critical ASD that aggregates Aeronautics, Space, Defence, Transports markets; and Critical ECS (Enterprise Critical Solutions) that aggregates Finance, Public Sector, Telecom and Energy markets.

CSW is structured into five distinct areas: Shared Services, Delivery, Sales, Product Management and Managed Services.

The Delivery area, responsible for the software engineering activities, is certified to the Capability Maturity Model Integration (CMMI) for Development (CMMI-DEV) version 1.3, with Maturity Level 5. This certification covers Lisbon, Coimbra and Porto in Portugal, and São José dos Campos in Brazil. This certification was obtained on the 21st December 2012, and expires on the 21st December 2015. A Standard CMMI Appraisal Method for Process Improvement (SCAMPI) type A, version 1.3, was conducted, in order to obtain the certification.

The Managed Services area, specializes in application outsourcing, whether off-site (off-shore and near-shore), on-site or using a mixed model. The range of services is provided within a flexible arrangement and tailored to customers' needs, to enable the exploration of the potential of application outsourcing – from a single application to an entire application portfolio.

All services are designed to be cost effective, but they are also tailored to meet organisations' needs, both at management and operational level, so that organisations can start realizing benefits straight from the beginning. This is possible based on comprehensive management and engineering methodologies. By delivering key performance metrics, CSW assures service delivery according to standards and measures the real continuous improvement of activities. CSW's level of engagement can vary from a simple staff augmentation to gain share and continuous optimization commitments, depending on the strategic level of the relationship.

CSW operates according to a Quality Management System (QMS), current at version 6. The QMS specifies processes across the company, organised into Primary, Supporting and Organisational process areas. Primary includes Customer and Engineering processes, whereas Organisational includes Management and Organisational processes.

1.2 Problem

Part of CSW’s commercial strategy is to establish long term relationships with customers. The Managed Services area should be creating and maintaining these long term relationships. In the Managed Services area, as depicted in Figure 1, CSW wants to guarantee long term relationships and service level, where the risk is also reduced, in comparison with the development of Products, where CSW requires maturity in terms of business knowledge, and where the risk is higher.

These long term relationships are important financially, not only on the medium to long term, but also on the short term. They provide for continuous cash flow, which leads to a decrease in financing needs via bank loans.

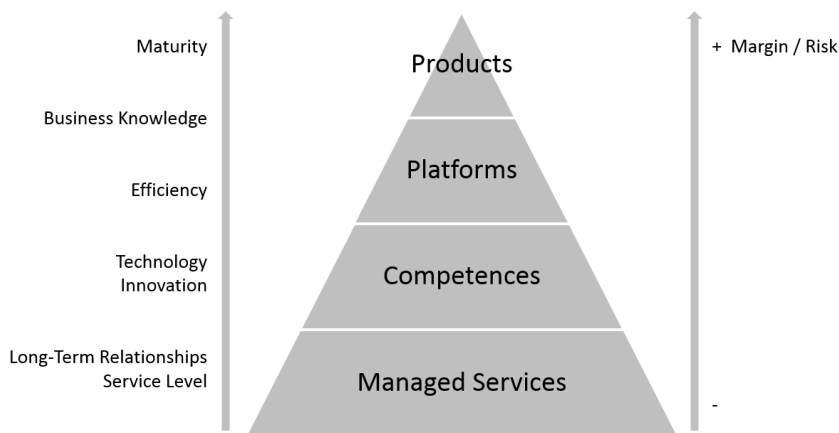


Figure 1 – CSW commercial strategy

On the medium to long term, Managed Services will provide for cash flow required to invest in Competences, Platforms, and Products. Managed Services, from a viewpoint of a BCG Matrix, as depicted in Figure 2, will be seen as a Cash Cow, whereas the remaining will be Question Marks and Stars. The ultimate goal is for these to become Cash Cows as well.

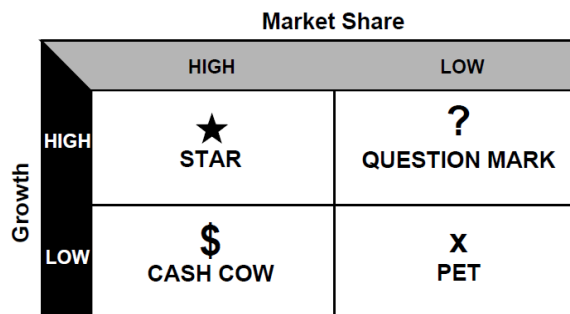


Figure 2 – BCG Matrix (Henderson 1970)

Long term relationships will only be possible via customer satisfaction. By continuously providing value, customer satisfaction will lead to customer loyalty. Customer loyalty will then result in recurring business and business performance.

This chain of events, the satisfaction-profit chain, is shown in Figure 3.

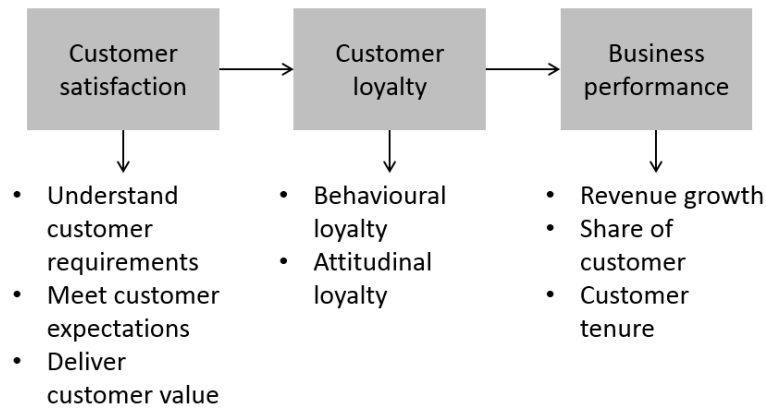


Figure 3 – The satisfaction–profit chain (Buttle 2009)

A model representation of Customer Satisfaction has been created. This representation is the Service Quality Model (Parasuraman, Zeithaml, and Berry 1985). This model shows four different gaps as a result of the service delivery, and a fifth one which is a function of the previous four.

Figure 4 shows the Service Quality Model, with the five different gaps.

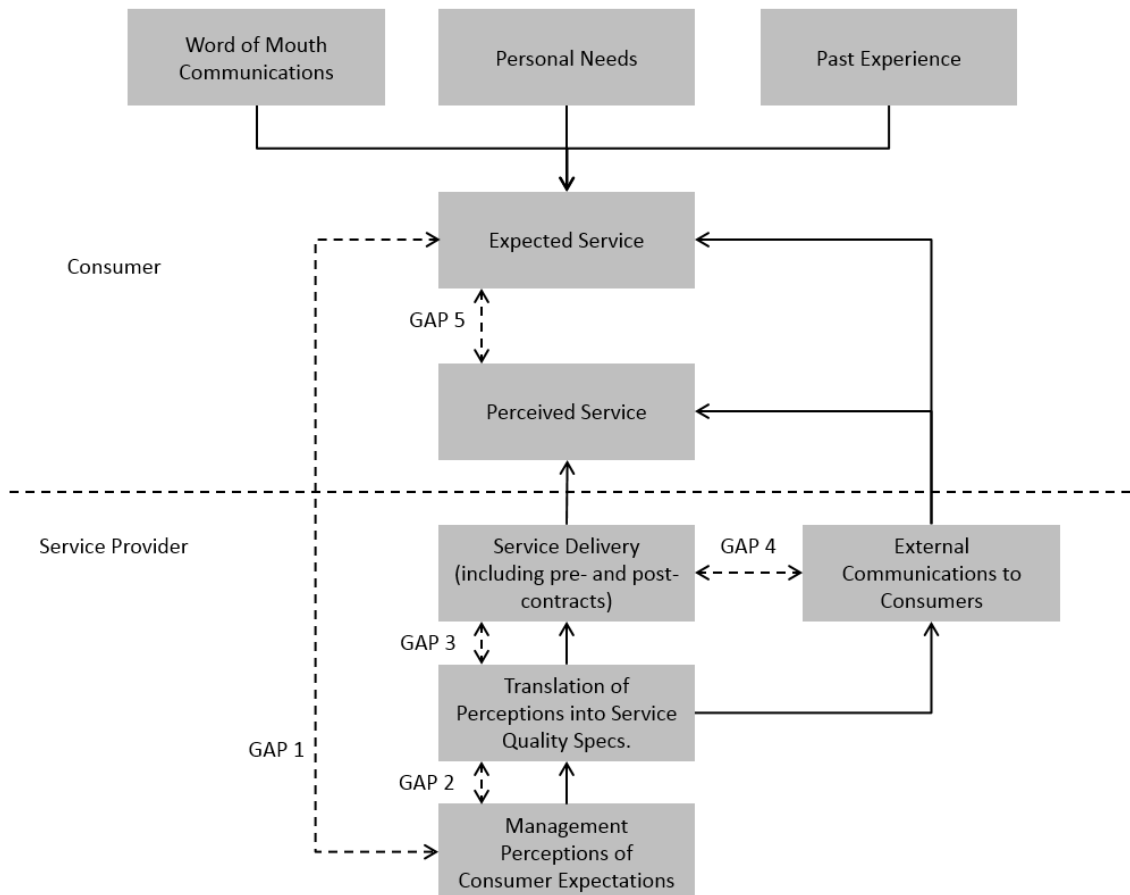


Figure 4 – Service Quality Model (Parasuraman, Zeithaml, and Berry 1985)

From the Service Quality Model there could be a discrepancy between:

1. Consumer expectation and management perception – **gap 1**;

2. Management perception and service specifications – **gap 2**;
3. Service specifications and what is delivered – **gap 3**;
4. What is delivered and what is communicated – **gap 4**;
5. Expectation and perception – **gap 5**.

Organisations control the Management Perceptions of Consumer Expectations, Translation of Perceptions in Service Quality Specifications, Service Delivery and External Communication to Consumers activities, which create gaps 1 through 4.

On the consumer side, there is the Expected Service and the Perceived Service, which are the result of the activities performed on the service provider side. Gap 5, the gap between the Expected Service and Perceived Service, may be described across five different dimensions. These dimensions are (Parasuraman 1988):

- Reliability – ability to perform the promised service dependably and accurately;
- Assurance – knowledge and courtesy of employees and their ability to inspire trust and confidence;
- Tangibles – physical facilities, equipment, and appearance of personnel;
- Empathy – caring, individualized attention the firm provides its customers;
- Responsiveness – willingness to help customers and provide prompt service.

In this context, this thesis has the objective of answering how a software company, certified to CMMI Maturity Level 5, can increase customer satisfaction in its Managed Services area.

CSW must understand how customer satisfaction is obtained from the expected and the perceived service, and how internal processes may affect relationships with customers, in order to establish long term relationships.

1.3 Methodology

Action research is an established research method in use in the social and medical sciences since the mid-twentieth century, and has increased in importance for information systems toward the end of the 1990s (Baskerville 1999).

The approach first requires the establishment of a client-system infrastructure or research environment. Then, five identifiable phases are iterated: (1) diagnosing, (2) action planning, (3) action taking, (4) evaluating and (5) specifying learning (Baskerville 1997).

Figure 5 is a graphical representation of action research.

The various components of action research are (Baskerville 1999):

- **Client-System Infrastructure:** the research environment, specifying scope, responsibilities, authority and sanctions. It is collaborative by nature, where scientists work closely with practitioners, and the latter provide the subject system knowledge and insight required for the study;
- **Diagnosing:** Identification of the primary problems that cause the organisation's desire for change. It includes a self-interpretation that should not reduce or simplify, but rather be holistic.
- **Action Planning:** Specify actions to relieve or improve problems, guided by a theoretical framework, target for change and approach;

- **Action Taking:** Collaborative implementation, by the researcher and practitioner, of the previous phase.
- **Evaluating:** Evaluation of the outcomes of implementing the actions.
- **Specifying Learning:** Specification of the knowledge acquired, successful or not, that is not necessarily done last, as it can be continuously undertaken throughout the other phases.

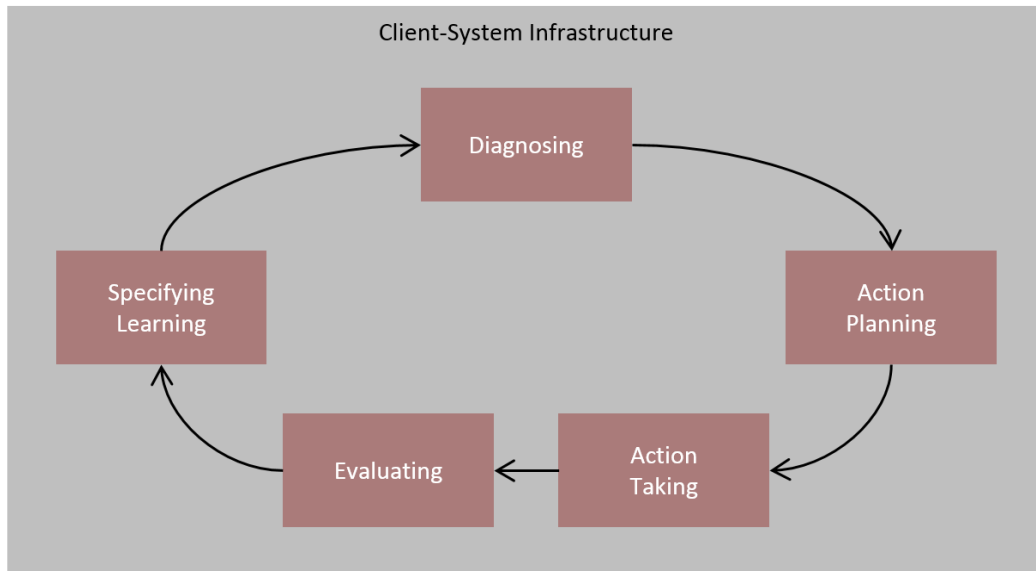


Figure 5 – Action Research process (Susman and Evered 1978)

Whether the result was successful or not, the study may continue due to the cyclical nature of action research and result in new knowledge once again.

There is some confusion that results from the failure to distinguish between action research and consulting activities (Baskerville 1997).

Table 1 shows the similarities between consulting and action research. It shows that the main building blocks, in terms of approach, are the same. There is a setting, a diagnosis is performed, actions are planned and executed, and there is an evaluation and generation of knowledge.

Table 1 – Similarities between consulting and action research (Baskerville 1997)

Action Research	Consulting
client-system infrastructure	well-defined, clear consulting contract
diagnosis	analysis of problem situation
action planning	alternatives formulation, presentation and client selection of most suitable
action taking	implementation -- client execution of consultant's recommendations
evaluation	follow-up meetings by consultant to capture client satisfaction or complaints
specifying learning	thorough consultant's internal project documentation

Although the approach, as shown in Table 1, is similar between consulting and action research, both approaches are quite distinct. Table 2 highlights the key differences between consulting and action research.

Table 2 – Key distinctions between consulting and action research (Baskerville 1997)

	Action Research	Consulting
Motivation	Scientific knowledge, publication	Profit, proprietary knowledge
Commitment	Dual: research community, client	Client only
Approach	Collaboration	External, independent study
Foundation for recommendations	Theoretical framework	Empirical tradition
Essential source of understanding	Experimentation	Critical analysis
Explanations	Idiographic solutions	Universal solutions
Client's side benefits	Contingent learning	Knowledge transfer

In summary, consultants are usually paid to dictate experienced, reliable solutions based on their independent review. Action researchers act out of scientific interest to help the organisation itself to learn by formulating a series of experimental solutions based on an evolving, untested theory. (Baskerville 1999).

Action research produces a knowledge which is contingent on the particular situation, and which develops the capacity of members of the organisation to solve their own problems (Susman and Evered 1978). The research addresses a specific social setting, although it will generate knowledge that enhances the development of general theory (Baskerville 1999).

1.4 Thesis Structure

This thesis is structured into six sections.

Section 1, Introduction, provides the context for the thesis, highlights the problem under study and defines the methodology used.

Section 2, State of the art, describes CMMI for Services (CMMI-SVC) and the relation with CMMI for Development (CMMI-DEV), how appraisals are conducted, and potential benefits from CMMI implementation.

The first two sections relate to the Diagnosing phase of the selected methodology.

Section 3, Proposal, identifies a solution for the given problem and relates to the Action Planning phase of the methodology.

Section 4, Implementation, corresponds to the Action Taking phase, and shows the implementation of the planned actions.

Section 5, Evaluation, expands on the results achieved on the previous section.

Section 6, Conclusion, includes lessons learnt, limitations of the proposal, and future work that can result from this thesis.

The last two sections correspond to the Evaluating and Specifying Learning from the methodology.

2 State of the art

The Managed Services area is more service oriented than the Delivery area. Although Delivery is providing software engineering services that often result on a turnkey solution for customers, the service component is more obvious in the Managed Services area.

In order to establish long term relationships with customers, a framework with best practices provides guidance on how this can be achieved. CSW already has in-house knowledge regarding CMMI-DEV hence the next step of studying if CMMI-SVC would provide additional value to CSW's operation, specifically to Managed Services, or if practices from CMMI-SVC may be useful on the Delivery area.

This subject is not something that is specific to CSW. Companies currently certified to CMMI-DEV may look at other models, such as CMMI-SVC or CMMI-ACQ, for best practices in areas not covered by the development model. This would enable companies to have a multi-model approach, adopting best practices from the different models. Certification or not is a different subject that will not be covered here. A company may choose to adopt the best practices described in the models, but not go for a certification because it bring in extra costs. Having certification on the other hand, works as a marketing strategy, where a company has been audited by an external organisation proving that in fact best practices are being followed. This has more value than simply stating that a certain model is being used, without having been verified by an external and independent organisation.

CSW operates according to processes defined on its Quality Management System (QMS). The current version of the QMS is version 6 and its processes have been certified according to CMMI-DEV Maturity Level 5, ISO 9001:2008 TickIT, AS 9100, NATO AQAP and NP 4457:2007.

The scope of this study is to understand the gap between what QMS defines and the best practices described in CMMI-SVC. This analysis will help to understand how far CSW's operation is from CMMI-SVC's best practices and how ultimately CSW can increase customer satisfaction.

2.1 CMMI-DEV and CMMI-SVC

CMMI models are guidelines, developed by product teams with members from the industry, government and the Software Engineering Institute, that help organisations implement best practices and so improve their processes.

Figure 6 shows the three critical dimensions that organisations focus on for process improvement:

- People;
- Procedures and methods;
- Tools and equipment.

What orchestrates these dimensions are processes. Processes allow organisations to address scalability and provide a way to incorporate knowledge of how to do things better. Processes leverage resources and allow for organisations to examine business trends.

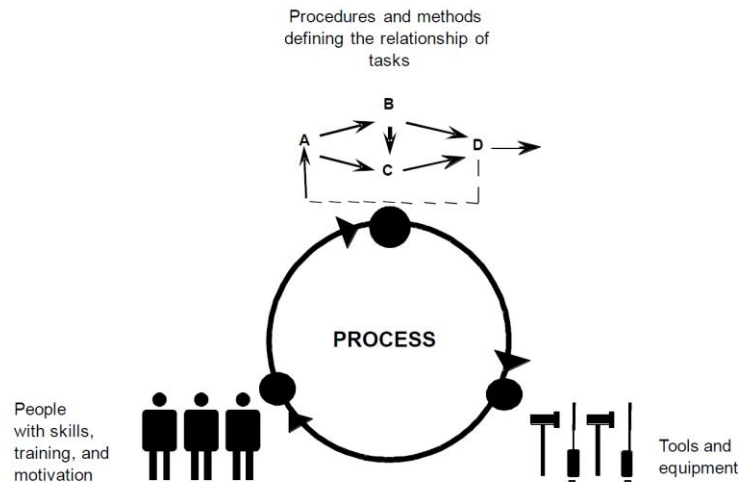


Figure 6 – The Three Critical Dimensions (CMMI Product Team 2010c)

CMMI publishes three models, all derived from a single Architecture and Framework:

- The CMMI-DEV model provides guidance for applying CMMI best practices in a development organisation. Best practices in the model focus on activities for developing quality products and services to meet the needs of customers and end users (CMMI Product Team 2010b).
- The CMMI-SVC model provides guidance for applying CMMI best practices in a service provider organisation. Best practices in the model focus on activities for providing quality services to customers and end users. CMMI-SVC integrates bodies of knowledge that are essential for a service provider (CMMI Product Team 2010c).
- The CMMI for Acquisition (CMMI-ACQ) model provides guidance for applying CMMI best practices in an acquiring organisation. Best practices in the model focus on activities for initiating and managing the acquisition of products and services to meet the needs of customers and end users. Although suppliers can provide artifacts useful to the processes addressed in CMMI-ACQ, the focus of the model is on the processes of the acquirer (CMMI Product Team 2010a).

CMMI components are organised into constellations and models.

A constellation is a collection of components that are used to construct models, training materials and appraisal related documents for a given area of interest.

Models are composed of Process Areas (PAs). A PA is a cluster of related practices in an area. These practices implement specific goals that, when implemented fully, are important for making improvements in that area. PAs are either core, shared, or specific. A core PA is common to all CMMI models. A shared PA is shared by at least two CMMI models, but not all of them. Specific PAs are applicable to a single model. Moreover, PAs can be categorized as Additions. Additions are components that contain information of interest to particular users. An addition can be informative material, a specific practice, a specific goal, or an entire process area that extends the scope of a model or emphasizes a particular aspect of its use.

In the scope of this thesis, the focus shall be CMMI-DEV and CMMI-SVC.

CMMI-DEV is composed of 22 PAs, from which 16 are core PAs, 1 is shared and 5 are specific to development.

Table 3 lists all PAs of the CMMI-DEV model, together with their type.

Table 3 – CMMI-DEV

Category	Process Area	Type
Engineering	Product Integration (PI)	Specific
	Requirements Development (RD)	Specific
	Technical Solution (TS)	Specific
	Validation (VAL)	Specific
	Verification (VER)	Specific
Project Management	Integrated Project Management (IPM)	Core
	Project Monitoring and Control (PMC)	Core
	Project Planning (PP)	Core
	Quantitative Project Management (QPM)	Core
	Requirements Management (REQM)	Core
	Risk Management (RSKM)	Core
	Supplier Agreement Management (SAM)	Shared
Support	Causal Analysis and Resolution (CAR)	Core
	Configuration Management (CM)	Core
	Decision Analysis and Resolution (DAR)	Core
	Measurement and Analysis (MA)	Core
	Process and Product Quality Assurance (PPQA)	Core
Process Management	Organizational Process Definition (OPD)	Core
	Organizational Process Focus (OPF)	Core
	Organizational Performance Management (OPM)	Core
	Organizational Process Performance (OPP)	Core
	Organizational Training (OT)	Core

Organisations may choose to improve:

1. Processes incrementally, by mapping them to individual PAs, or group of PAs, selected by the organisation;
2. A set of related processes by incrementally addressing successive sets of PAs.

These two options, or approaches, are called representations. They are called *continuous* and *staged*, respectively. By using the continuous representation, organisations achieve *capability levels*. The staged representation enables organisations to achieve *maturity levels*.

PAs are organised into levels. These levels are evolutionary paths recommended for organisations that want to improve their processes. The different capability and maturity levels are shown in Table 4.

Levels are used as the result from appraisal activities, as well. An organisation evolves throughout the levels as CMMI's goals and practices are met. When an organisation satisfies all goals, generic and specific, of a given PA or set of PAs that were selected for improvement, the organisation reaches a particular capability or maturity level. Detailed discussion regarding goals and practices can be found under 2.2 Goals and Practices.

Figure 7 shows CMMI-DEV's PAs grouped by category and maturity level.

Table 4 – Capability and Maturity Levels (CMMI Product Team 2010c)

Level	Continuous Representation Capability Levels	Staged Representation Maturity Levels
Level 0	Incomplete	-
Level 1	Performed	Initial
Level 2	Managed	Managed
Level 3	Defined	Defined
Level 4	-	Quantitatively Managed
Level 5	-	Optimizing

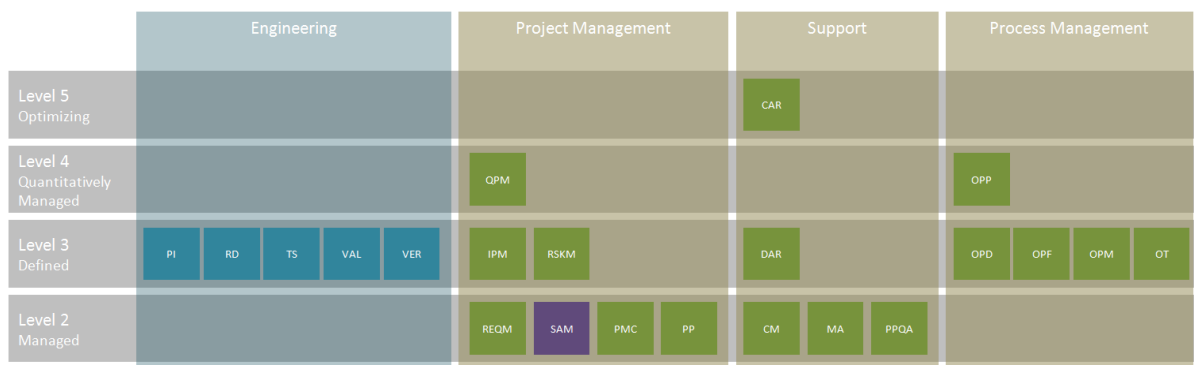


Figure 7 – CMMI-DEV

The three models, CMMI-DEV, CMMI-SVC and CMMI-ACQ, contain 16 core PAs. They cover basic concepts that are fundamental to improve any given process in an area of interest. For the case of CMMI-SVC, the content of these core PAs had to be adjusted for service provider organisations. The adjustments are due to the introduction of the concepts of work and work group, to distinguish from project that is not as service oriented. In a service concept, typically, one does not have a project that is time bound.

CMMI-SVC defines project as a managed set of interrelated activities and resources, including people, that delivers one or more products or services to a customer or end user. A project has an intended beginning (i.e., project beginning) and end.

CMMI-SVC replaces project with:

- Work Group, when referring to a managed set of people and other assigned resources that deliver one or more products or services to a customer or end user;
- Work, when referring to a collection of activities, or a collection of activities and associated resources.

The major distinction between project, and work group and work, is that work group and work have no intended beginning and end.

CMMI-SVC contains 24 PAs. Of those PAs, 16 are core, 1 is a shared PA, and 7 are service-specific PAs that include 1 addition.

Core PAs, apart from the change from project to work group or work, have the same Specific Goals and Specific Practices. The exception to this is Work Planning where the number, and content, of specific practices is different.

CMMI-SVC adds the Service Establishment and Delivery category and two PAs to Project and Work Management. Table 5 lists all PAs of the CMMI-SVC model, together with their type.

Table 5 – CMMI-SVC

Category	Process Area	Type
Project and Work Management	Capacity and Availability Management (CAM)	Specific
	Integrated Work Management (IWM)	Core
	Quantitative Work Management (QPM)	Core
	Requirements Management (REQM)	Core
	Risk Management (RSKM)	Core
	Service Continuity (SCON)	Specific
	Supplier Agreement Management (SAM)	Shared
	Work Monitoring and Control (WMC)	Core
	Work Planning (WP)	Core
Support	Causal Analysis and Resolution (CAR)	Core
	Configuration Management (CM)	Core
	Decision Analysis and Resolution (DAR)	Core
	Measurement and Analysis (MA)	Core
	Process and Product Quality Assurance (PPQA)	Core
Process Management	Organizational Process Definition (OPD)	Core
	Organizational Process Focus (OPF)	Core
	Organizational Performance Management (OPM)	Core
	Organizational Process Performance (OPP)	Core
	Organizational Training (OT)	Core
Service Establishment and Delivery	Incident Resolution and Prevention (IRP)	Specific
	Service System Development (SSD)	Specific, Addition
	Service System Transition (SST)	Specific
	Strategic Service Management (STSM)	Specific
	Service Delivery (SD)	Specific

CMMI-SVC specific PAs are (Forrester 2012):

- **Capacity and Availability Management:** making sure you have enough of the resources you need to deliver services and that they are available when needed – at an appropriate cost;
- **Incident Resolution and Prevention:** handling what goes wrong – and preventing it from going wrong if you can;
- **Service Continuity:** being ready to recover from a disaster and get back to delivering your service;
- **Service Delivery:** setting up agreements, taking care of service requests, and operating the service system;

- **Service System Development:** making sure you have everything you need to deliver services, including people, processes, consumables, and equipment;
- **Service System Transition:** getting new systems in place, changing existing systems, or retiring obsolete systems – all while making sure nothing goes terribly wrong with the service;
- **Strategic Service Management:** deciding what services you should be providing, making them standard, and letting people know about them;

Figure 8 shows CMMI-SVC’s PAs grouped by category and maturity level.

	Project and Work Management	Support	Process Management	Service Establishment and Delivery
Level 5 Optimizing		CAR		
Level 4 Quantitatively Managed	QWM (QPM)		OPP	
Level 3 Defined	CAM IWM RSKM SCON	DAR	OPD OPF OPM OT	IRP SSD* SST STSM
Level 2 Managed	REQM SAM WMC WP	CM MA PPOA		SD

Figure 8 – CMMI-SVC

When an organisation implements best practices from more than one model, it is operating in a multi-model configuration. Figure 9 shows a holistic view over PAs of both CMMI-SVC and CMMI-DEV.

	Engineering	Project and Work Management	Support	Process Management	Service Establishment and Delivery
Level 5 Optimizing			CAR		
Level 4 Quantitatively Managed		QWM (QPM)		OPP	
Level 3 Defined	PI RD TS VAL VER	CAM IWM (IFM) RSKM SCON	DAR	OPD OPF OPM OT	IRP SSD* SST STSM
Level 2 Managed		REQM SAM WMC (PML) WP (PF)	CM MA PPOA		SD

Figure 9 – Multi-model with CMMI-SVC and CMMI-DEV

It is expected that practices currently used in the Delivery area may be extended to Managed Services, and that Delivery may be enhanced with CMMI-SVC’s Process Areas, such as Capacity and Availability Management, for instance, to make sure that resources are available and used efficiently.

2.2 Goals and Practices

CMMI is structured into components that are categorized as required, expected, and informative.

To achieve process improvement, required components are essential. Required components are the specific and generic goals. In scope of an appraisal, whether these goals are satisfied or not, is the basis for deciding if a process area has been satisfied.

Activities that are important for achieving required components are expected components. Expected components are specific and generic practices.

In order to help understand the required and expected components, CMMI has informative components.

The relation between these components is depicted in Figure 10.

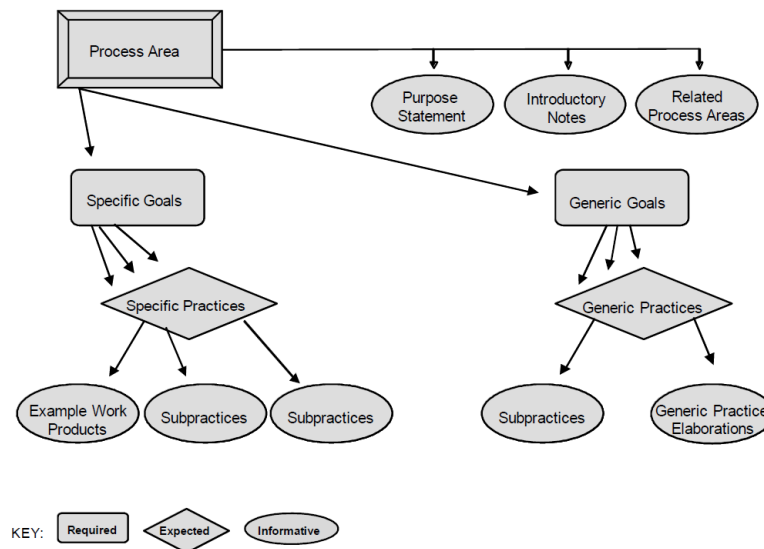


Figure 10 – Model components (CMMI Product Team 2010c)

Required and expected components are numbered sequentially and they begin with prefixes SG (Specific Goals), GG (Generic Goals), SP (Specific Practices) and GP (Generic Practices). Practices are numbered using the form $x.y$, where x is the goal to which the practice maps, and y is a sequential number for the practice under the goal, *GP 1.1* for instance.

Only the statements of each SG and GG are required components. Both the title and the number are informative components.

In a similar fashion to goals, only the statements of SP and GP are expected components. Title and number are informative components.

Some goals are called generic because they apply to multiple process areas in the same way, whereas specific goals are specific to a single PA.

Generic goals describe characteristics that must be present to institutionalize processes that implement a process area. Institutionalization of a process is the ingrained way of doing business that an organisation follows routinely as part of its corporate culture.

Generic Goals and Generic Practices are the same for CMMI-SVC and CMMI-DEV and they are shown in Table 6.

Achieving GG 1 for a PA means that the specific goals have been achieved.

For GG 2 and GG 3 it is important to understand the definitions of managed and defined process.

A managed process is a performed process that is planned and executed in accordance with policy; employs skilled people having adequate resources to produce controlled outputs; involves relevant stakeholders; is monitored, controlled, and reviewed; and is evaluated for adherence to its process description (CMMI Product Team 2010c).

Table 6 – Generic Goals and Generic Practices

Number	Title	Statement
GG 1	Achieve Specific Goals	The specific goals of the process area are supported by the process by transforming identifiable input work products into identifiable output work products.
GP 1.1	Perform Specific Practices	Perform the specific practices of the process area to develop work products and provide services to achieve the specific goals of the process area.
GG 2	Institutionalize a Managed Process	The process is institutionalized as a managed process.
GP 2.1	Establish an Organizational Policy	Establish and maintain an organizational policy for planning and performing the process.
GP 2.2	Plan the Process	Establish and maintain the plan for performing the process.
GP 2.3	Provide Resources	Provide adequate resources for performing the process, developing the work products, and providing the services of the process.
GP 2.4	Assign Responsibility	Assign responsibility and authority for performing the process, developing the work products, and providing the services of the process.
GP 2.5	Train People	Train the people performing or supporting the process as needed.
GP 2.6	Control Work Products	Place selected work products of the process under appropriate levels of control.
GP 2.7	Identify and Involve Relevant Stakeholders	Identify and involve the relevant stakeholders of the process as planned.
GP 2.8	Monitor and Control the Process	Monitor and control the process against the plan for performing the process and take appropriate corrective action.
GP 2.9	Objectively Evaluate Adherence	Objectively evaluate adherence of the process and selected work products against the process description, standards, and procedures, and address noncompliance.
GP 2.10	Review Status with Higher Level Management	Review the activities, status, and results of the process with higher level management and resolve issues.
GG 3	Institutionalize a Defined Process	The process is institutionalized as a defined process.
GP 3.1	Establish a Defined Process	Establish and maintain the description of a defined process.
GP 3.2	Collect Process Related Experiences	Collect process related experiences derived from planning and performing the process to support the future use and improvement of the organization's processes and process assets.

A performed process is a process that accomplishes the needed work to produce work products; the specific goals of the process area are satisfied (CMMI Product Team 2010c).

Achieving GG 2 for a PA is equivalent to saying you manage the execution of processes associated with the PA – the process is planned and monitored just like any work activity or support activity. There is/are:

- a policy that indicates you will perform the process;

- a plan for performing it;
- resources provided;
- responsibilities assigned;
- training on how to perform it;
- selected work products from performing the process are controlled.

A defined process is a managed process that is tailored from the organisation's set of standard processes according to the organisation's tailoring guidelines; has a maintained process description; and contributes process related experiences to the organisational process assets (CMMI Product Team 2010c).

Achieving GG 3 for a process area is equivalent to saying that an organisational standard process exists that can be tailored according to specific needs.

The generic goals that apply to each PA are also predetermined. GG 2 applies to maturity level 2 and GG 3 applies to maturity levels 3 through 5.

Looking at the service specific PAs, in particular at Service Delivery, as it is an area of maturity level 2, GG 1 and GG 2 are applicable, whereas for the remaining PAs, that are maturity level 3, all GGs are applicable.

Specific Goals and Specific Practices may be consulted within CMMI-SVC (CMMI Product Team 2010c). SGs and SPs of CMMI-SVC's specific PAs will be discussed in section 4.2 Gap Analysis.

SPs can be done informally without following a documented process description or plan. The rigor with which these practices are performed depends on the individuals managing and performing the work and can vary considerably (CMMI Product Team 2010c).

2.3 Standard CMMI Appraisal Method for Process Improvement

The tool used for appraisals is the Standard CMMI Appraisal Method for Process Improvement (SCAMPI) (Hayes 2005).

The SCAMPI may be applied to entire organisations, to a division, or to smaller business units that include work groups.

The structure for the appraisal is defined in the Appraisal Requirements for CMMI (ARC) (CMMI Product Team 2001). ARC defines the requirements for appraisal methods to use with CMMI, to keep appraisals consistent across constellations and models. By using a consistent set or requirements for appraisals, when organisations are being appraised for multiple CMMI constellations, the evidence collected may be used for more than one model.

Appraisal results can be used in multiple ways such as planning for strategy improvement, generation maturity or capability levels, support acquisitions or partnering decisions or to mitigate product acquisition, development and monitoring risks.

For CSW and for CMMI-SVC, CSW is looking to discover the gaps between current practices and the best practices in terms of service management.

SCAMPI is directed to three different actors: the internal change agent (ICA), the professional consultant, and the external auditor. In the scope of this thesis, the actor is the ICA.

SCAMPI has five core concepts:

- Family Architecture – Three different classes of appraisals. Class A (institutionalization), B (deployment), and C (approach) appraisals. Each class has a different set of requirements from the ARC. SCAMPI A is the most rigorous. SCAMPI B is not as rigorous as class A, as some requirements are not applicable or are optional. SCAMPI C is the more relaxed class of appraisal.
- Objective evidence – evidence is provided via direct artefacts, indirect artefacts, and affirmations. From the concept of objective evidence, we derive the concept of Practice Implementation Indicator (PII), that keeps the traceability between the evidence and the project or business unit that produced the evidence.
- Data sources – interviews with technical and managerial staff and review of documentation.
- Practice characterization – Characterization scales such as Low/Medium/High or Red/Yellow/Green for practice implementation. This characterization may be determined for the business unit, for individual projects or other organisational entities. In addition, there is an Out Of Scope characterization when no data was gathered to support the characterization of a given practice.
- Appraisal outputs - The generation of a findings statements. Using the characterization scale, detailed results are derived and mapped to each practice. This statement may be customized according to specific needs of the organisation, such as *anticipated return on investment from implementing the practice* or *estimated cost of implementing the practice*.

The results of several SCAMPI may be recorded into a database of PIIs so that the organisation can monitor its evolution in terms of implementation of best practices.

SCAMPI B and C are defined according to three major phases:

- Plan and prepare for appraisal;
- Conduct appraisal;
- Report results.

Each of these phases includes a set of processes towards planning, conducting and reporting a SCAMPI. These phases and processes are shown in Figure 11, Figure 12 and Figure 13.

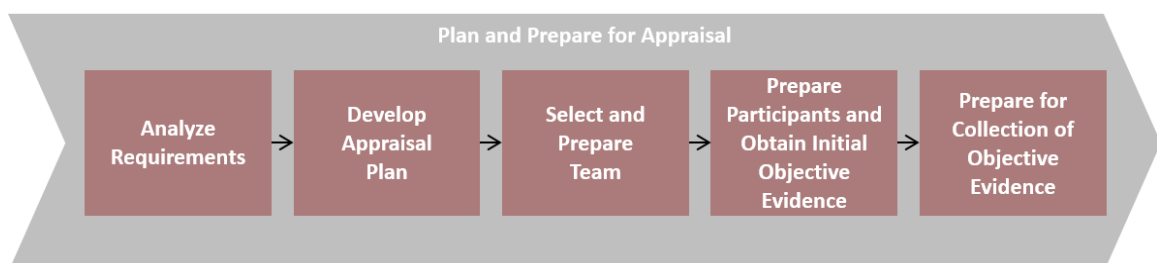


Figure 11 – Plan and Prepare for Appraisal

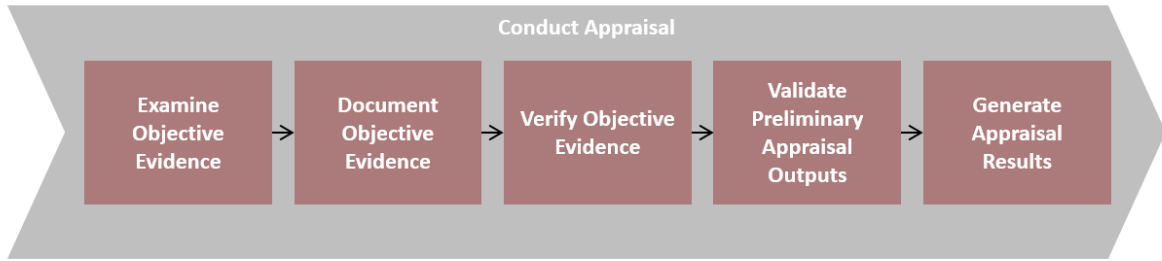


Figure 12 – Conduct Appraisal

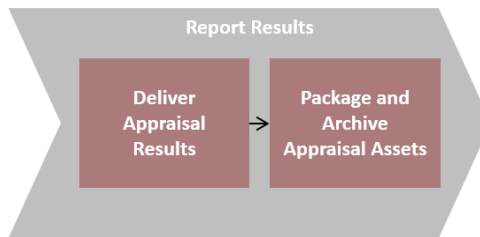


Figure 13 – Report Results

2.4 CMMI Benefits

The literature regarding benefits obtained from CMMI is quite thin. A report from CMMI (Gibson 2006) shows results from organisations implementing CMMI-DEV at different maturity levels.

There is no data available for multi-model organisations (CMMI-SVC/CMMI-DEV/CMMI-ACQ) or specific to CMMI-SVC.

The report provides quantitative data from 35 disparate organisations, as presented in Table 7, with results organised by dimensions as cost, schedule, productivity, quality, customer satisfaction, and return on investment (ROI).

Table 7 – CMMI Benefits (Gibson 2006)

	Lowest Improvement	Highest Improvement	Median Improvement	Number of Data Points
Cost	3%	87%	34%	29
Schedule	2%	95%	50%	22
Productivity	11%	329%	61%	20
Quality	2%	132%	48%	34
Customer Satisfaction	-4%	55%	14%	7
Return on Investment	1.7:1	27.7:1	4.0:1	22

The results are percentage change expressed from a baseline prior to the CMMI initiative or as ratios of return on investment.

Organisations report that they have achieved improvements across multiple dimensions simultaneously, such as in product quality and customer satisfaction together with higher productivity, cost performance, and schedule performance.

Each category is described as (Gibson 2006):

- **Cost** category covers instances where organisations report changes in the cost of final or intermediate work products, changes in the cost of the processes employed to produce the products, and general savings attributed to model-based process improvement. It also includes increased predictability of costs incurred and other measures of variation.
- **Schedule** covers improvements in schedule predictability and reductions in the time required to do the work.
- **Productivity** includes various measures based on the amount of work accomplished in a given period of time.
- **Quality** is most frequently measured by reductions in numbers of defects.
- **Customer Satisfaction** includes changes based on customer surveys.
- **Return on Investment**, on top of the benefit-to-cost includes as well measures of net present value, internal rate of return, payback periods, and break even points.

3 Proposal

A proposal for a solution to overcome the problem identified in section 1.2 Problem is described next.

This proposal builds on top of the best practices from CMMI-SVC, and the gaps identified on the Service Quality Model. These gaps are created within the service provider by Management Perceptions of Consumer Expectations, Translation of Perceptions in Service Quality Specifications, Service Delivery and External Communication to Consumers.

Since CMMI-SVC is a collection of best practices with focus on activities for providing quality services to customers and end users, it is expected that it helps closing the gaps of the Service Quality Model. Of course, the statement that we are closing the gaps by using the best practices defined by CMMI-SVC is equally valid. But is the entire CMMI-SVC equally important? Or are there key SPs that impact service quality and that are the drivers for the remaining SPs?

SPs' statements are expected components within each PA. They are then broke down into subpractices that are used to interpret and implement the practice. Organisations may choose to use them as prescriptive, but because they are actually informative component, they are useful to provide detail on what is expected in process improvement activities.

With this expectation, subpractices where analysed in order to identify which ones, and their containing SP, would impact the gaps from the Service Quality Model. The goal was to identify SPs as well, because they must be present in planned and implemented processes of the organisation, so that a goal may be considered satisfied – and goals are the key components for process improvement.

It is possible to further categorize the gaps from the Service Quality Model as being strategic, tactical and operational.

Gap 1 is a strategic gap, where management decides the strategy to market. Gap 2 is a tactical gap, where management decides how resources, products and services will be put in place to answer the strategic needs. Gap 3 and 4 are operational gaps, created when tactics are actually put in place by delivering and communicating products and services to the consumers.

SPs shown in Figure 14 are the ones that have an impact on the gaps created by the activities performed by the Service Provider.

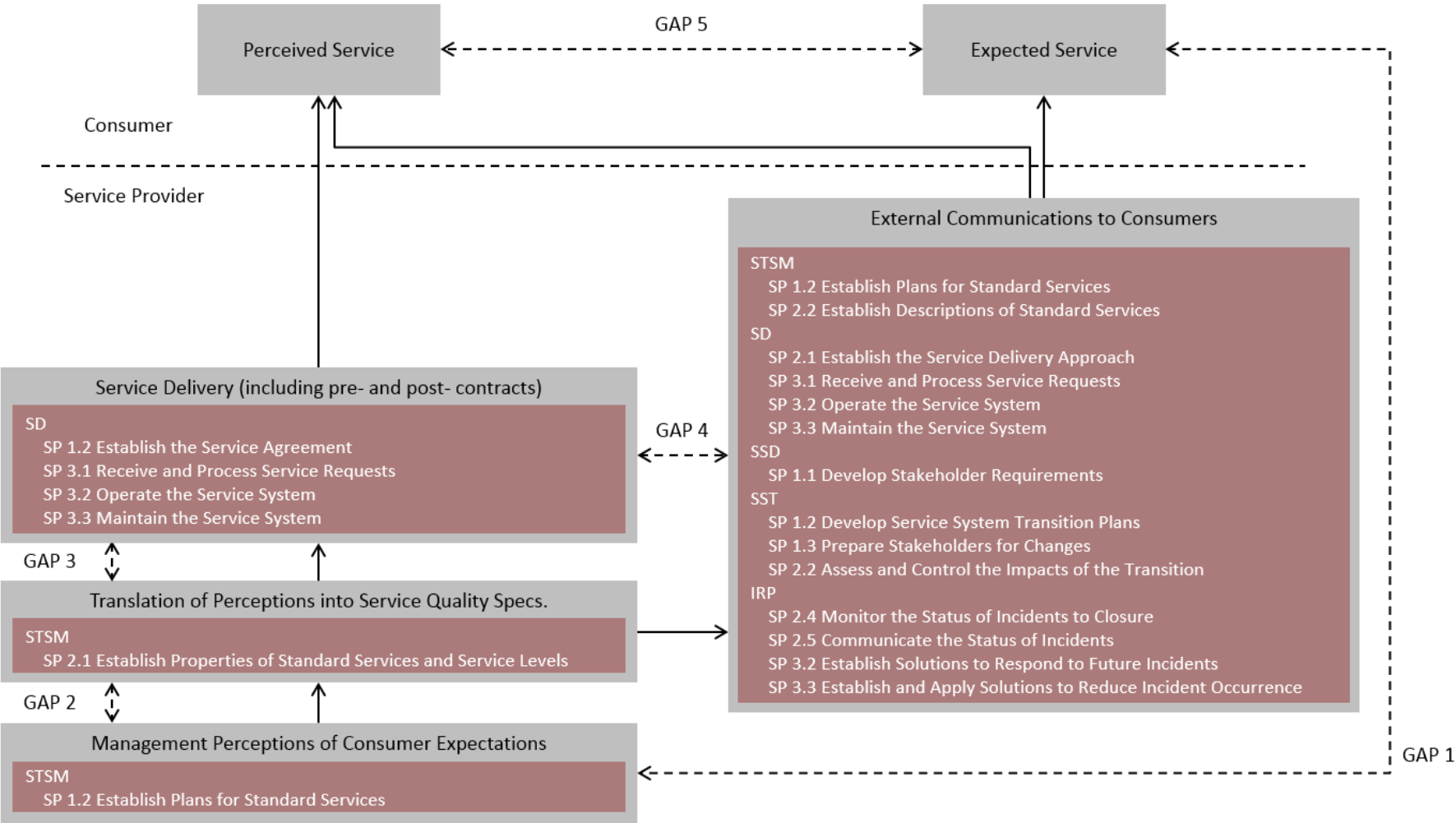


Figure 14 – CMMI-SVC Specific Practices and Service Quality Model

For instance, STSM’s SP 1.2 Establish Plans for Standard Services is where best practices regarding Management Perceptions of Consumer Expectations are modelled, and External Communications to Consumers are modelled across fourteen SPs, from five different PAs.

From this analysis of subpractices and SPs, the result was that CAM and SCON do not interfere directly with Service Quality Model. It is interesting to notice that these PAs are the ones that are located in the Project and Work Management category of CMMI-SVC.

All the PAs located on the Service Establishment and Delivery category – IRP, SD, SSD, SST and STSM, have direct impact on the gaps of the Service Quality Model.

This also links to the Key Process Area Relationships for Establishing and Delivering Services (Figure 15) that links IRP, SD, SSD, SST and STSM.

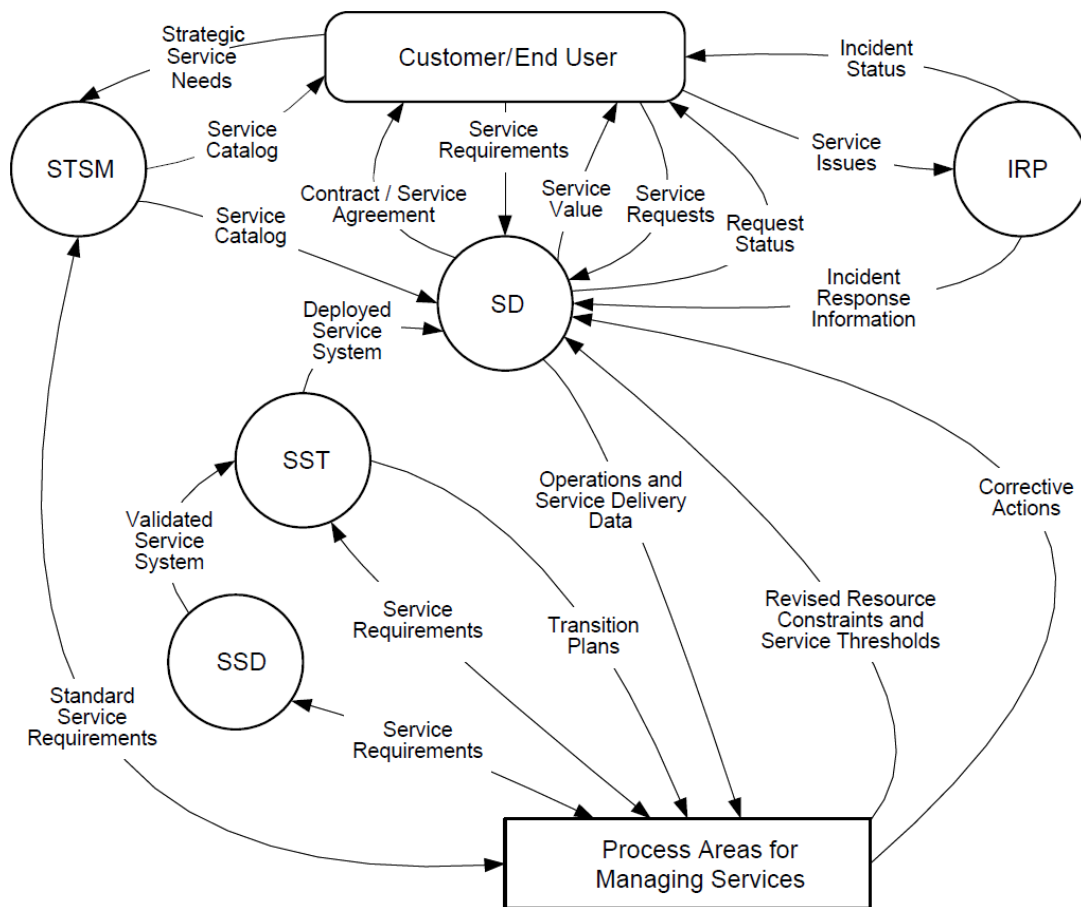


Figure 15 – Key Process Area Relationships for Establishing and Delivering Services (CMMI Product Team 2010c)

Service providers, when closing the gaps, should look in detail at what is being done on their internal processes regarding the contents and subpractices of SPs that impact each gap.

The following sections will highlight the subpractices of each SP that should be handled with particular care from the service providers’ viewpoint.

Notice that **gap 5** is a function of gaps 1 through 4 hence it is not mentioned in the following subsections as it cannot be influenced directly by any given activity.

3.1 Management Perceptions of Consumer Expectations practices

The CMMI-SVC’s PA that best fits the translation of consumer expectations into services is Strategic Service Management (STSM).

The SP where services are defined is within STSM’s SP 1.2 Establish Plans for Standard Services.

Applicable subpractices are presented in Table 8.

Table 8 – Management Perceptions of Consumer Expectations subpractices

PA	SP	Subpractice
STSM	SP 1.2 Establish Plans for Standard Services	Recommend requirements for standard services based on strategic business objectives, the organisation’s capabilities, and strategic needs; Identify needed actions on standard services; Review and get agreement from relevant stakeholders on the standard services to be established and maintained.

At this point, services have been planned, based on the organisation’s objectives, capabilities and needs, and in what management perceives as being required by consumers. These planned services will either close or extend **gap 1** of the model.

3.2 Translation of Perceptions in Service Quality Specifications practices

With the creation of plans towards the need of specific services, these plans must then be translated into actual service specifications. This translation is mapped in CMMI-SVC’s Strategic Service Management (STSM).

STSM specifies SP 2.1 as Establish Properties of Standard Services and Service Levels. All subpractices within this SP work towards the definition of service specifications.

Subpractices are identified in Table 9.

Table 9 – Translation of Perceptions in Service Quality Specifications subpractices

PA	SP	Subpractice
STSM	SP 2.1 Establish Properties of Standard Services and Service Levels	Select standard services; Specify the critical attributes of each service; Determine common and variable parts of standard services; Organize services into service lines as needed; Define service levels; Establish tailoring criteria as appropriate; Identify needs and expectations for service systems that deliver standard services as appropriate.

By establishing properties and service levels of services, an organisation is closing or extending **gap 2** of the model.

3.3 Service Delivery practices

The CMMI-SVC’s Service Delivery PA holds best practices in terms of service delivery. The service being delivered is the result of the properties and service levels established previously. This PA includes practices before the agreement for service delivery is established, during

delivery, and post-delivery of the service. This maps to what is expected on the Service Quality Model.

Activities that map to subpractices highlighted in the following subsections will have a positive or negative impact towards **gap 3**.

3.3.1 Pre-contract

Pre-contact practices are modelled in SD’s SP 1.2 Establish the Service Agreement.

Applicable subpractices are shown in Table 10.

Table 10 – Pre-Contract subpractices

PA	SP	Subpractice
SD	SP 1.2 Establish the Service Agreement	Define the structure and format of the service agreement. Define, negotiate, and obtain agreement on a draft service agreement. Publish the service agreement and make it available to service providers, customers, and end users as appropriate.

3.3.2 During contract

Practices during contract are modelled in SD’s SP 3.1 Receive and Process Service Requests and SP 3.2 Operate the Service System.

Applicable subpractices are shown in Table 11.

Table 11 – During Contract subpractices

PA	SP	Subpractice
SD	SP 3.1 Receive and Process Service Requests	Receive service requests and ensure each request is within the scope of the service agreement; Record information about the service request; Review service request status and resolution, and confirm results with relevant stakeholders;
SD	SP 3.2 Operate the Service System	Operate service system components according to service system procedures; Perform operations support activities (e.g., revise thresholds); Manage and control the security of service delivery; Manage and control other operationally oriented quality attributes associated with service delivery; As appropriate, perform the activities needed to fulfill service requests or resolve service incidents according to the service agreement; Collect customer satisfaction information immediately after services are delivered or service requests are fulfilled.

3.3.3 Post-contract

Post-contract practices are modelled in SD’s SP 3.3 Maintain the Service System.

Applicable subpractices are shown in Table 12.

Table 12 – Post-Contract subpractices

PA	SP	Subpractice
SD	SP 3.3 Maintain the Service System	Implement and test corrective or preventive maintenance according to the plan and operating procedures.

3.4 External Communication to Consumers practices

External communication to consumers is modelled across several PAs.

There is no PA specific to communication management within CMMI-SVC. There is no reference to how communication channels should be established and maintained or if points of contact should be established in order to put in place a filter for information that is not up to the required standards of the organisation or project.

STSM establishes communication with consumer in SP 1.2 Establish Plans for Standard Services and SP 2.2 Establish Descriptions of Standard Services.

SD also establishes communication with the consumer in SP 2.1 Establish the Service Delivery Approach, SP 3.1 Receive and Process Service Requests, SP 3.2 Operate the Service System and SP 3.3 Maintain the Service System.

SSD establishes that consumers should be engaged when developing requirements in SP 1.1 Develop Stakeholder Requirements.

There is also communication to consumers within SST in SP 1.2 Develop Service System Transition Plans, SP 1.3 Prepare Stakeholders for Changes and SP 2.2 Assess and Control the Impacts of the Transition.

IRP establishes communication with the consumer as well with SP 2.4 Monitor the Status of Incidents to Closure, SP 2.5 Communicate the Status of Incidents, SP 3.2 Establish Solutions to Respond to Future Incidents and SP 3.3 Establish and Apply Solutions to Reduce Incident Occurrence.

Subpractices are identified in Table 13.

Activities that map to the subpractices highlighted in Table 13 will have a positive or negative impact towards **gap 4**.

Table 13 – External Communication to Consumers subpractices

PA	SP	Subpractice
STSM	SP 1.2 Establish Plans for Standard Services	Review and get agreement from relevant stakeholders on the standard services to be established and maintained.
STSM	SP 2.2 Establish Descriptions of Standard Services	Conduct peer reviews on the descriptions with relevant stakeholders. Store the descriptions in a location and medium where all intended users have access.
SD	SP 2.1 Establish the Service Delivery Approach	Review, refine, or enhance stakeholder communication mechanisms (e.g., notices, status reports, dashboards) as necessary. Review and get agreement with relevant stakeholders on the approach for delivering each separately identifiable service.
SD	SP 3.1 Receive and Process Service Requests	Review service request status and resolution, and confirm results with relevant stakeholders.
SD	SP 3.2 Operate the Service System	Communicate the status of service requests until closed. Collect customer satisfaction information immediately after services are delivered or service requests are fulfilled.
SD	SP 3.3 Maintain the Service System	Release maintenance notifications to relevant stakeholders.
SSD	SP 1.1 Develop Stakeholder Requirements	Engage relevant stakeholders using methods for eliciting needs, expectations, constraints, and external interfaces.
SST	SP 1.2 Develop Service System Transition Plans	Obtain stakeholder commitment to the plan.
SST	SP 1.3 Prepare Stakeholders for Changes	Implement the notification strategy to keep relevant stakeholders informed about scheduled changes in services and service availability during the transition.
SST	SP 2.2 Assess and Control the Impacts of the Transition	Use data gathering methods to obtain input from relevant stakeholders about the deployment. Proactively communicate information about deployment impacts.
IRP	SP 2.4 Monitor the Status of Incidents to Closure	Review the resolution and confirm the results with relevant stakeholders.
IRP	SP 2.5 Communicate the Status of Incidents	-
IRP	SP 3.2 Establish Solutions to Respond to Future Incidents	Communicate the reusable solution to relevant stakeholders.
IRP	SP 3.3 Establish and Apply Solutions to Reduce Incident Occurrence	Communicate the action proposal to relevant stakeholders.

4 Implementation

A gap analysis highlights what is lacking in CSW's QMS to implement the best practices from CMMI-SVC. Section 4.1 Quality Management System describes the organisation and processes of the QMS.

The tool used to perform this gap analysis was the Standard CMMI Appraisal Method for Process Improvement (SCAMPI) class C (Hayes 2005), tailored to look at CMMI-SVC's service specific process areas. By using a structured method as SCAMPI, gaps may be identified from which CSW can draw an action plan to eventually correct and institutionalize current practices, or implement new ones, in the organisation.

The chapter Evaluation uses the result of the gap analysis shown in section 4.2 Gap Analysis for suggestions in terms of adoption, or not, of specific process areas.

As proposed by this thesis, practices that are critical in terms of closing the gaps on the Service Quality Model were highlighted and are detailed in section 4.3 CMMI-SVC and Service Quality Model.

4.1 Quality Management System

CSW operates according to processes defined on its Quality Management System (QMS). The current version of the QMS is version 6 and its processes have been certified according to CMMI-DEV Maturity Level 5, ISO 9001:2008 TickIT, AS 9100, NATO AQAP and NP 4457:2007.

This section details the organisation and processes of the QMS.

The process areas in CSW's Quality Management System (QMS) organise processes into:

- Primary Life Cycle Processes
- Supporting Processes
- Organisational Processes

Primary Life Cycle Processes are technical processes performed by projects and these comprise Customer (CUS) and Engineering (ENG) processes.

Supporting Processes are performed in more than one Life Cycle stage, Configuration Management for instance, and these comprise Support Processes (SUP).

Organisational Processes are typically management-related processes, e.g. Project Management, and these comprise Organisational (ORG) and Management (MAN) processes.

The following subsections have a brief description of each process area and the processes defined within.

4.1.1 Primary life cycle processes

This process area defines an overall set of processes for the initiation, development, delivery and support of CSW's products and services. These processes cover important aspects such as:

- Considering needed project resource including Commercial-off-the-Shelf (COTS) and Request-for-Quote quotations for commercial customers;

- Defining and controlling CSW’s products and services requirements to achieve customer needs and satisfy its expectations;
- Development of work products, from design specification through development to testing and maintenance phases;
- Controlling the release of products to enable their delivery to customers and dispatch and deployment of work products to customers.

These primary processes are divided into two major groups:

- Customer Support processes;
- Engineering processes.

The two following sections look in detail into these groups.

4.1.1.1 CUSTOMER SUPPORT

Customer Support processes define and describe a set of practices implemented by CSW to ensure the focus on meeting customers’ needs and expectations. These comprise the processes shown in Table 14.

Table 14 – Customer Processes

Id	Process	Description
CUS.1	Purchasing	The purpose of this process is to identify the activities someone has to undertake to purchase specific needs: for acquisition and choice of the more suitable supplier. Includes CUS1.1 Subcontracting.
CUS.2	Delivery	The main purpose of this process is to ensure that software products and/or services are delivered and deployed to the customer and that agreed requirements are met (including installation as applicable).
CUS.3	Contract Management	The purpose of this process is to ensure that a contract is produced, its execution during its lifetime is monitored and all changes to all written agreements (business, purchase, partnership) introduced throughout the development process until signing of the acceptance document is managed.

4.1.1.2 ENGINEERING

Engineering processes define and describe how projects are developed through their lifecycle phases, from requirements analysis and specification through design and construction, from validation through customer acceptance and product maintenance. Engineering processes are shown in Table 15.

4.1.2 Supporting processes

This process area includes Supporting Processes that may be employed by any of the other processes (including other supporting processes) at various points in the project life cycle. These processes complement the primary processes from Engineering to meet project objectives in different project environments such as different formality needs, safety and dependability needs, etc. Supporting processes are shown in Table 16.

Table 15 – Engineering Processes

Id	Process	Description
ENG.1	Requirements Analysis Process	The main objective of the Requirements Analysis Process is to ensure that high level customer requirements are analysed and detailed in a way that can efficiently be translated to the project.
ENG.2	Software Design	The overall goal of the Software Design Process is to ensure that a software design is produced with a high level of quality and that it is able to support the Software Construction process responding to all software requirements and promoting reuse and traceability.
ENG.3	Software Construction	The overall goal is to ensure that the software construction is conducted with a high level of quality and that it is able to respond to all software requirements, promote reuse and traceability. The construction process's purpose is to produce software units and to verify that they properly reflect software design.
ENG.4	Software Testing	The main purpose of this process is to ensure that software is verified to determine the product compliance with the defined requirements (system, software, user, or other).
ENG.5	Maintenance	The purpose of the Software and System Maintenance Process is to ensure a system/software product is modified after delivery to correct faults, improve performance or other attributes, or to adapt to a changed environment.

Table 16 – Supporting Processes

Id	Process	Description
SUP.1	Documentation	Documentation Process ensures that rules are defined to identify, create, accept, control and maintain all documents. These rules apply to any type of documents, such as, QMS documents (processes, procedures, template, guidebooks, etc.), project documents (deliverables and outputs) and external documents.
SUP.2	Configuration Management	The purpose of Configuration Management is to ensure that the integrity of the products of the software project, throughout the project's software life cycle, is established and maintained.
SUP.3	Verification	The process purpose is to ensure that each work product properly reflects the specified requirements and they are produced with a high quality level.
SUP.4	Audit	The objective of the Audit process is to provide an independent evaluation to ensure compliance to the QMS, of selected projects or processes, with specific requirements, plans, and contract, as appropriate.
SUP.5	Project Management Incident	The purpose of the Project Incident Management process is to ensure that all discovered incidents are analysed, classified and resolved, and that change requests are properly analysed in terms of impact and approved by a Change Control Board. This process also helps identifying trends and opportunities for improvement.
SUP.6	Safety and Dependability	Ensure the required degree of safety and dependability of the software product.
SUP.7	ISVV: Independent Software Verification and Validation	Ensure effective verification of SW products (source code and all documentation created during the SW life cycle) as well as validation by a team of experts that is independent from the SW development team.
SUP.8	Service Desk	The Service Desk process's main purpose is to ensure end users have support as they require assistance in using services present in the IT infrastructure, leading to the analysis of compliance with predetermined SLA's and escalate incidents in service delivery when they arise.
SUP.9	Estimation	The Estimation process ensures that specific estimation approaches are followed to increase the confidence on future commitments.

4.1.3 Organisational processes

Organisational Processes assure the same level of basic procedures to all projects developed within the organisation. These processes are divided into two major groups:

- Management processes.
- Organisational processes.

The following subsections look in detail into these groups.

4.1.3.1 MANAGEMENT

Management processes include practices of a generic nature that may be used by anyone who manages any type of project or process within a software life cycle. This group’s processes are shown in Table 17

Table 17 – Management Processes

Id	Process	Description
MAN.1	Project Management Process	The purpose of this process is to ensure that specified requirements are met by identifying, establishing, coordinating, and monitoring activities, tasks, and resources necessary for the management of a project. The PMP includes MAN1.1 Project Scope, MAN.1.2 Project Planning, MAN.1.3 Project Monitoring and Control and MAN.1.4 Cost Management.
MAN.2	Quality Management	The purpose of the Quality Management process is to ensure customers’ satisfaction and fulfilment of expectations, while providing continuous improvement in terms of effectiveness, efficiency and competitiveness to our projects and processes;
MAN.3	Risk Management	The Risk Management process is to ensure appropriate risk management strategies are defined and implemented across the company, project risks are identified and analysed in a risks item list, threats are mitigated and opportunities are increased as they evolve during the conduct of the project, and appropriate actions are taken to correct, minimise or avoid the impact of negative risks (e.g. financial loss, poor quality).
MAN.4	Business Development	The Business Development process is to ensure CSW customers are retained by feeding back to the creation of new opportunities and by promoting new proposals;
MAN.5	Outsourcing Management	The Outsourcing Management process is to ensure effective methods and practices are defined to be used by CSW to manage the individual members and project teams that are providing services at the Customer premises and hence provide confidence to Customers that the services provided will achieve the best results.
MAN.6	Decision Analysis and Resolution	Decision Analysis and Resolution Process is to ensure decisions are made by using a structured approach that evaluates identified alternatives against established criteria within the project scope.
MAN.7	Lessons Learned	Lessons Learned process is to ensure that unsuccessful outcomes are not recurrent and that successful outcomes are promoted to ensure recurrence.
MAN.8	Software Product Assurance Process	Software Product Assurance Process to ensure the adequate follow up of the project’s development.
MAN.9	Innovation Management Process	Process to ensure creativity is promoted and stimulated, ensure production of Knowledge and its transformation into economic development.
MAN.10	Knowledge Management	The objective of the Knowledge Management process is to ensure information is provided to the organisation showing the levels of knowledge available within the business at any given time.

4.1.3.2 ORGANISATIONAL

Organisational processes establish the organisation’s business goals and develop process, product, and resource assets that, when used by projects will help the organisation achieve its business goals. This group’s processes are shown in Table 18.

Table 18 – Organisational Processes

Id	Process	Description
ORG.1	Process Improvement	Process to ensure continual process improvement throughout the organisation.
ORG.2	Human Resources Management	<p>Process to ensure that human resources are recruited, cared for, and monitored and analysed according to corporate policies.</p> <p>This process includes ORG.2.1 Recruitment, ORG.2.3 Individual Performance Analysis, ORG.2.4 Bottom-Up Performance Analysis Process, ORG.2.5 Premio de Desempenho (PT), ORG.2.6 Reuniões Individuais com Colaboradores (PT), ORG.2.7 Gestão de Contratos (PT), ORG.2.8 Análise de Desempenho das Áreas de Suporte (PT), ORG.2.9 Hiring & Welcoming Process e ORG.2.10 Training Management</p>
ORG.3	Infrastructure	Process to ensure a stable and reliable infrastructure is maintained that is needed to support the performance of any project. The infrastructure may include hardware, software, methods, tools, techniques, standards, and facilities for development, operation, or maintenance.
ORG.4	Measurement and Analysis	To ensure that data relating to the products developed, processes implemented, organisation and business, is collected and analysed to objectively measure quality, effectiveness and efficiency levels at CSW.
ORG.5	Reuse	Reuse process is to ensure that a reuse strategy is implemented and deployed and that it is followed by entire CSW.
ORG.6	Tendering	The Tendering Process ensures that all the information needed to prepare a proposal is available, according to CSW’s standards of quality and excellence, aiming at maximising its success possibilities, from opportunity search and identification to lessons learned from the process results.
ORG.7	Financial Management	<p>This process ensures there is a correct and efficient management of financial issues.</p> <p>Includes ORG 7.1 Travel Management; ORG 7.2 Financial Documentation Management and ORG 7.3 Correspondence Management.</p>
ORG.8	R&D Management	This process ensures that research and development is internally managed and how decisions are made.
ORG.9	Causal Analysis and Resolution	This process ensures that all relevant defects are analysed and actions are identified to remove the validated causes.
ORG.10	Organisational Process Performance	The Organisational Process Performance Process ensures a quantitative understanding of the performance of the organisation’s processes is established and maintained.
ORG.11	Security	The purpose of the Security Process is to ensure security issues are address, by analysing physical and information security, stating the overarching principles for existing security systems.

4.2 Gap Analysis

To perform the SCAMPI C, service specific PAs were organised into an Excel workbook, including SGs, SPs and subpractices (see ANNEX A: Appraisal Workbook).

An initial workbook, configured for CMMI-DEV, was provided by CSW. A CMMI-SVC workbook was created, improved with bidirectional links between SPs/subpractices. Links

from/to components of other PAs are marked accordingly to identify interfaces to other PAs outside CMMI-SVC specific PAs. Percentage coverage per SP and SG was also included as an improvement. An improvement related with this thesis’s proposal is discussed in 4.3 CMMI-SVC and Service Quality Model.

Figure 16 shows, as example, IRP’s SP 1.1 Establish an Approach to Incident Resolution and Prevention, part of SG 1 Prepare for Incident Resolution and Prevention.

For each PA, subpractices were marked has implemented or not, depending on the existence of evidence of implementation. If implemented, column *Y* is populated, otherwise column *N* is populated. A reference to the evidence found was introduced within the *Notes* column. Column *IS* stands for Improvement Suggestion and column *O* stands for Observation.

PRACTICES	PRACTICE TEXT	RELATED COMPONENTS	SAMPLE APPRAISAL QUESTIONS					NOTES	
			Y	N	N/A	IS	O	Gap	
INCIDENT RESOLUTION AND PREVENTION									
irp	<i>The purpose of Incident Resolution and Prevention (IRP) is to ensure timely and effective resolution of service incidents and prevention of service incidents as appropriate.</i>	From sst.sp2.2							
SG 1 Prepare for Incident Resolution and Prevention 62%									
irp.sg1	<i>Preparation for incident resolution and prevention is conducted.</i>	From lwm.sp1.4'							
SP 1.1 Establish an Approach to Incident Resolution and Prevention 67%									
irp.sp1.1	<i>Establish and maintain an approach to incident resolution and prevention.</i>	Link to sd.sg1							
irp.sp1.1a	Define criteria for determining what an incident is.		1						"Project Incidents (PINC) are all the occurrences that happen during the development cycle of a project that need to be analysed and classified." Defect Types Guidebook
irp.sp1.1b	Define categories for incidents and criteria for determining which categories an incident belongs to.		1						JIRA Workflow Guidebook is not clear on roles and responsibilities
irp.sp1.1c	Describe how responsibility for processing incidents is assigned and transferred.			1					SUP.5 Project Incident Management - A1 Identification
irp.sp1.1d	Identify one or more mechanisms that customers and end users can use to report incidents.		1						SUP.5 Project Incident Management
irp.sp1.1e	Define methods and acquire tools to use for incident management.		1						No notification or communication strategy found on SUP.5 Project Incident Management
irp.sp1.1f	Describe how to notify all relevant customers and end users who may be affected by a reported incident.			1					Missing "categories of actions and responses to be taken based on severity and priority levels." Build knowledge base and reuse - lessons learnt.
irp.sp1.1g	Define criteria for determining severity and priority levels and categories of actions and responses to be taken based on severity and priority levels.			1					SLAa defined on Tendering process ORIG.6 Tendering Process - A2 Proposal Preparation ORIG.6 Tendering Process - A3 Proposal Coordination, Content Alignment and Coherency Assurance
irp.sp1.1h	Identify requirements on the amount of time defined for the resolution of incidents in the service agreement.	Link to sd.sg1	1						SUP.5 Project Incident Management - A4 Resolution Activity SUP.5 Project Incident Management- A5 Close-Down Activity
irp.sp1.1i	Document criteria that define when an incident should be closed.		1						

Figure 16 – Example from appraisal workbook

Service System Development (SSD), which is an addition, was excluded from the analysis. SSD offers an alternative to the Engineering category of CMMI-DEV, which is already implemented and appraised at CSW. It included requirements development, service system development, integration, verification, and validation in a single process area. As specified in CMMI-SVC, SSD may be preferred by service provider organisations that are new to CMMI, especially those service providers that are developing simple services with relatively few components and interfaces, which is not the case for CSW. CSW has experience with CMMI and is not developing new services – the Managed Services area already has a set of services

established. New services that need developing can go through the established engineering activities.

The first stage on the gap analysis was to verify if CSW’s QMS implemented the SGs, SPs and subpractices of the different PAs. For each component, the QMS was inspected to find evidence of implementation, or intent/approach for implementation.

With the conclusion of the first stage, a meeting was held with the responsible for the Quality Department, which owns the QMS. As specific practices can be done informally, without following a documented process description or plan, the meeting’s objective was to verify the results of analysing the QMS and its coverage.

Some practices were then amended to reflect either practices that are being performed but are not on the QMS, or practices specified on the QMS that are not being performed.

The appraisal workbook contains a summary worksheet (Summary) with the result in terms of coverage for the different PAs. To each PA, a percentage value is attributed in terms of implemented subpractices. A consolidated radar chart is drawn with these data. A score is given based on the average of the appraised PAs.

Figure 17 shows the results after phase one.

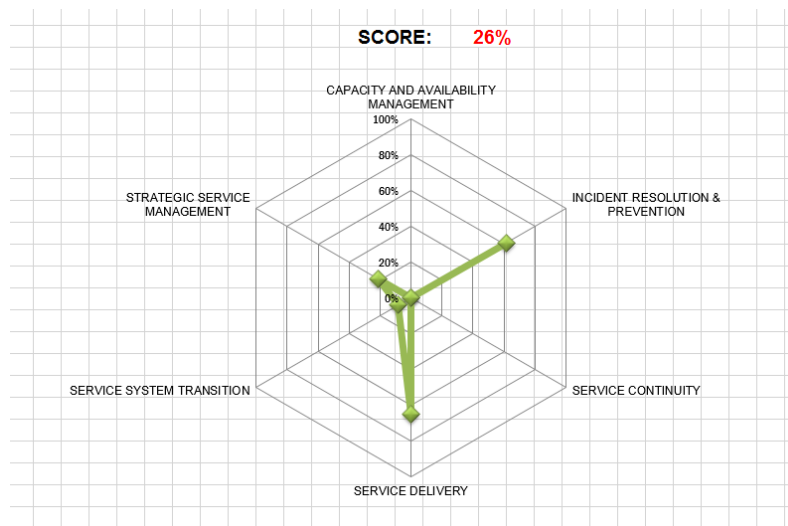


Figure 17 – Phase one, mapping to QMS

Analysis of Figure 17 indicates a low coverage by the QMS – a score of 26%.

Figure 18 shows the results after phase two.

Analysis of Figure 18 – a score of 69%, and comparing to the results from QMS, indicates that most practices are done informally.

Table 19 has a comparison by PA, with percentage coverage of subpractices within each PA, with the indication of a trend between the two phases. Regarding the indicator, if, after meeting:

- There was an increase in coverage: ▲;
- There was a decrease in coverage: ▼;
- Same coverage: =.

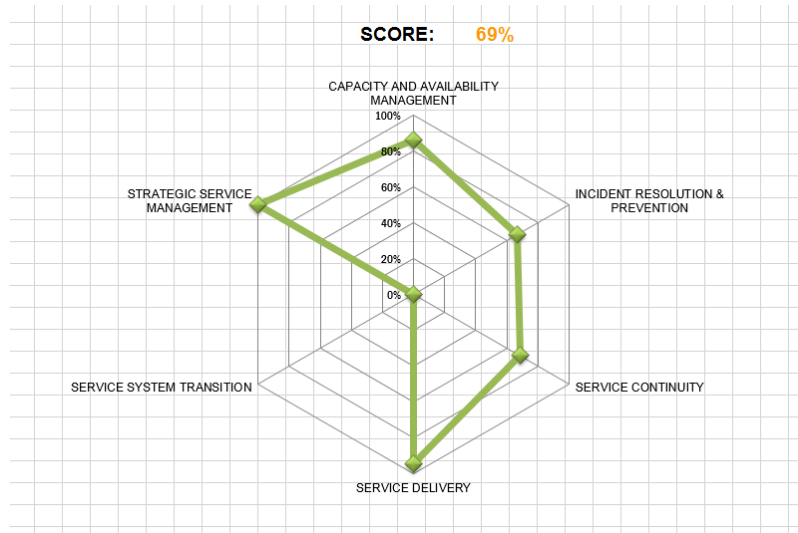


Figure 18 – Phase two, meeting

Table 19 – Coverage comparison

PA	QMS (%)	Mtg. (%)
Capacity and Availability Management	0	86 ▲
Incident Resolution and Prevention	62	67 ▲
Service Continuity	0	68 ▲
Service Delivery	65	95 ▲
Service System Transition	8	0 ▼
Strategic Service Management	21	100 ▲

The SCAMPI C was performed with the scope of GG 1 Achieve Specific Goals. An indication in terms of GG 2 Institutionalize a Managed Process and GG 3 Institutionalize a Defined Process, may be obtained by looking at the difference between the two phases. However, because practices may be performed informally, it would not be a complete picture in terms of GG 2 and GG 3.

The following subsections have details for each PA and highlight subpractices that link to the Service Quality Model. The link is provided via the Gaps column of each table that have as well an indicator as specified previously for the trending.

Section 4.3 CMMI-SVC and Service Quality Model, drills-down on the details of SPs that impact the Service Quality Model.

4.2.1 Capacity and Availability Management

This PA holds practices to make sure an organisation has enough resources to deliver services and that they are available when needed, at an appropriate cost.

Coverage of this PA was accessed using the CAM worksheet from the appraisal workbook.

Coverage for the specific goals and practices is shown in Table 20.

Table 20 – CAM goals and practices

Specific Practices	Goals and Statement	QMS (%)	Mtg. (%)	Gaps
SG 1 Prepare for Capacity and Availability Management	Preparation for capacity and availability management is conducted.	0	73 ▲	-
SP 1.1 Establish a Capacity and Availability Management Strategy	Establish and maintain a strategy for capacity and availability management.	0	100 ▲	-
SP 1.2 Select Measures and Analytic Techniques	Select measures and analytic techniques to be used in managing the capacity and availability of the service system.	0	100 ▲	-
SP 1.3 Establish Service System Representations	Establish and maintain service system representations to support capacity and availability management.	0	33 ▲	-
SG 2 Monitor and Analyze Capacity and Availability	Capacity and availability are monitored and analyzed to manage resources and demand.	0	100 ▲	-
SP 2.1 Monitor and Analyze Capacity	Monitor and analyze capacity against thresholds.	0	100 ▲	-
SP 2.2 Monitor and Analyze Availability	Monitor and analyze availability against targets.	0	100 ▲	-
SP 2.3 Report Capacity and Availability Management Data	Report capacity and availability management data to relevant stakeholders.	0	100 ▲	-

All the specific goals and practices from Table 20 are important regardless of the type of work being carried out. Independently of an on-site or off-site project, or if it is a project being executed on the Delivery area or in the Managed Services area, capacity and availability must be monitored and analysed. These specific goals and practices have no direct impact on the Service Quality Model – Figure 14.

Current practices within CSW may be used for the Managed Services area without any tailoring.

Although there are CAM practices within CSW, they are not specified as a process, as we can see by the coverage percentage of column QMS. There is no documented description or plan in terms of performing these practices. They may be verified via evidence, such as documentation and models, but they are not linked to any formally established process.

Some services require flexible allocation of capacity to cope with demand variability, hence the importance of this PA.

4.2.2 Incident Resolution and Prevention

This PA is related to practices in terms of handling what goes wrong and, if possible, preventing it from going wrong.

Coverage of this PA was accessed using the IRP worksheet from the appraisal workbook.

Table 21 shows coverage of IRP’s specific goals and practices.

Table 21 – IRP goals and practices

Specific Practices	Goals and Statement	QMS (%)	Mtg. (%)	Gaps
SG 1 Prepare for Incident Resolution and Prevention	Preparation for incident resolution and prevention is conducted.	62	85 ▲	-
SP 1.1 Establish an Approach to Incident Resolution and Prevention	Establish and maintain an approach to incident resolution and prevention.	67	89 ▲	-
SP 1.2 Establish an Incident Management System	Establish and maintain an incident management system for processing and tracking incident information.	50	75 ▲	-
SG 2 Identify, Control, and Address Individual Incidents	Individual incidents are identified, controlled, and addressed.	69	94 ▲	-
SP 2.1 Identify and Record Incidents	Identify incidents and record information about them.	100	100 =	-
SP 2.2 Analyze Individual Incident Data	Analyze individual incident data to determine a course of action.	75	100 ▲	-
SP 2.3 Resolve Incidents	Resolve incidents.	75	75 =	-
SP 2.4 Monitor the Status of Incidents to Closure	Monitor the status of incidents to closure.	50	100 ▲	4
SP 2.5 Communicate the Status of Incidents	Communicate the status of incidents.	0	100 ▲	4
SG 3 Analyze and Address Causes and Impacts of Selected Incidents	Causes and impacts of selected incidents are analyzed and addressed.	56	25 ▼	-
SP 3.1 Analyze Selected Incidents	Analyze the underlying causes of selected incidents.	75	75 =	-
SP 3.2 Establish Solutions to Respond to Future Incidents	Establish and maintain solutions to respond to future incidents.	0	0 =	4
SP 3.3 Establish and Apply Solutions to Reduce Incident Occurrence	Establish and apply solutions to reduce the occurrence of selected incidents.	75	13 ▼	4

This PA impact directly the Service Quality Model regarding External Communications to Consumers. Details regarding this subject will be expanded in 4.3 CMMI-SVC and Service Quality Model.

All of IRP’s practices are important regardless of the type of project within Managed Services. Some practices are embedded in the QMS, but others are lacking. Current practices from the Delivery area may be used in Managed Services, but some improvements are required.

4.2.3 Service Continuity

With this PA, organisations will be ready to recover from a disaster and get back to service delivery.

Coverage of this PA was accessed using the SCON worksheet from the appraisal workbook.

Coverage of SCON’s specific goals and practices is shown in Table 22.

Table 22 – SCON goals and practices

Specific Practices	Goals and Statement	QMS (%)	Mtg. (%)	Gaps
SG 1 Identify Service Dependencies	Essential The essential functions and resources on which services depend are identified and documented.	0	82 ▲	-
SP 1.1 Identify and Prioritize Functions	Essential Identify and prioritize the essential functions that must be performed to ensure service continuity.	0	75 ▲	-
SP 1.2 Identify and Prioritize Resources	Essential Identify and prioritize the essential resources required to ensure service continuity.	0	86 ▲	-
SG 2 Prepare for Service Continuity	Preparations are made for service continuity.	0	47 ▲	-
SP 2.1 Establish Service Continuity Plans	Establish and maintain service continuity plans that enable the organization to resume performing essential functions.	0	89 ▲	-
SP 2.2 Establish Service Continuity Training	Establish and maintain training for service continuity.	0	0 =	-
SP 2.3 Provide and Evaluate Service Continuity Training	Provide and evaluate training in the execution of the service continuity plan.	0	0 =	-
SG 3 Verify and Validate the Service Continuity Plan	The service continuity plan is verified and validated.	0	85 ▲	-
SP 3.1 Prepare for the Verification and Validation of the Service Continuity Plan	Prepare for the verification and validation of the service continuity plan.	0	75 ▲	-
SP 3.2 Verify and Validate the Service Continuity Plan	Verify and validate the service continuity plan.	0	100 ▲	-
SP 3.3 Analyze Results of Verification and Validation of the Service Continuity Plan	Analyze the results of verifying and validating the service continuity plan.	0	83 ▲	-

This PA is more corporate oriented than Delivery or Managed Services specific. Regardless of products or services, business continuity must be assured in case of disaster.

4.2.4 Service Delivery

This PA models setting up agreements, taking care of service requests, and operating the service system.

Coverage of this PA was accessed using the SD worksheet from the appraisal workbook.

Table 23 shows coverage of SD’s goals and practices.

Table 23 – SD goals and practices

Specific Practices	Goals and Statement	QMS (%)	Mtg. (%)	Gaps
SG 1 Establish Service Agreements	Service agreements are established and maintained.	89	100 ▲	-
SP 1.1 Analyze Existing Agreements and Service Data	Analyze existing service agreements and service data to prepare for expected new agreements.	80	100 ▲	-
SP 1.2 Establish the Service Agreement	Establish and maintain the service agreement.	100	100 =	3
SG 2 Prepare for Service Delivery	Preparation for service delivery is conducted.	56	96 ▲	-
SP 2.1 Establish the Service Delivery Approach	Establish and maintain the approach to be used for service delivery and service system operations.	90	100 ▲	4
SP 2.2 Prepare for Service System Operations	Confirm the readiness of the service system to enable the delivery of services.	13	88 ▲	-
SP 2.3 Establish a Request Management System	Establish and maintain a request management system for processing and tracking request information.	-	100	-
SG 3 Deliver Services	Services are delivered in accordance with service agreements.	62	92 ▲	-
SP 3.1 Receive and Process Service Requests	Receive and process service requests in accordance with service agreements.	-	100	3 and 4
SP 3.2 Operate the Service System	Operate the service system to deliver services in accordance with service agreements.	50	89 ▲	3 and 4
SP 3.3 Maintain the Service System	Maintain the service system to ensure the continuation of service delivery.	80	86 ▲	3 and 4

This PA impact directly the Service Quality Model regarding Service Delivery and External Communications to Consumers. Details regarding this subject will be expanded in 4.3 CMMI-SVC and Service Quality Model.

Depending on the type of contract, some SP may not apply to Managed Services. If the contract is a staff augmentation or manpower acquisition, then there is no service request as such. The service is set when the service agreement is established and the service is delivered continuously. In a setting as this, SP 2.3 and SP 3.1 are not applicable. If there is, e.g., a helpdesk or ticketing system to manage, then these SPs are applicable.

4.2.5 Service System Transition

This PA relates to getting new systems in place, changing existing systems, or retiring obsolete systems, while making sure nothing goes terribly wrong with the service.

Coverage of this PA was accessed using the SST worksheet from the appraisal workbook.

Table 24 shows coverage for SST’s goals and practices.

Table 24 – SST goals and practices

Specific Goals and Practices	Statement	QMS (%)	Mtg. (%)	Gaps
SG 1 Prepare for Service System Transition	Preparation for service system transition is conducted.	13	0 ▼	-
SP 1.1 Analyze Service System Transition Needs	Analyze the functionality, quality attributes, and compatibility of the current and future service systems to minimize impact on service delivery.	50	0 ▼	-
SP 1.2 Develop Service System Transition Plans	Establish and maintain plans for specific transitions of the service system.	0	0 =	4
SP 1.3 Prepare Stakeholders for Changes	Prepare relevant stakeholders for changes in services and service systems.	0	0 =	4
SG 2 Deploy the Service System	The service system is deployed to the delivery environment.	0	0 =	-
SP 2.1 Deploy Service System Components	Systematically deploy service system components into the delivery environment based on transition planning.	0	0 =	-
SP 2.2 Assess and Control the Impacts of the Transition	Assess the impacts of the transition on stakeholders and service delivery, and take appropriate corrective action.	0	0 =	4

This PA has an impact on the Service Quality Model regarding External Communications to Consumers. Details regarding this subject will be expanded in 4.3 CMMI-SVC and Service Quality Model.

This is a PA that is relevant for Managed Services. If the service agreement is altered during service delivery, organisations must guarantee the transition, and they must as well put in place service system when a new service agreement is established.

4.2.6 Strategic Service Management

Within this PA, organisations decide what services should be provided, make them standard, and let people know about them.

Coverage of this PA was accessed using the STSM worksheet from the appraisal workbook.

Table 25 shows coverage for STSM’s goals and practices.

This PA impact directly the Service Quality Model regarding Management Perceptions of Consumer Expectations, Translation of Perceptions in Service Quality Specifications and External Communications to Consumers.

This is the PA that affect the Service Quality Model the most, across three different type of activities. Details regarding this subject will be expanded in 4.3 CMMI-SVC and Service Quality Model.

Managed Services should look carefully at this PA to align the offering to market requirements and corporate objectives. This PA drives all the remaining by the translation of management perceptions into which services the organisation should be offering.

Table 25 – STSM goals and practices

Specific Practices	Goals and Statement		QMS (%)	Mtg. (%)	Gaps
SG 1	Establish Strategic Needs and Plans for Standard Services	Strategic needs and plans for standard services are established and maintained.	50	100 ▲	-
SP 1.1	Gather and Analyze Data	Gather and analyze data about the strategic needs and capabilities of the organization.	100	100 =	-
SP 1.2	Establish Plans for Standard Services	Establish and maintain plans for standard services.	0	100 ▲	1 and 4
SG 2	Establish Standard Services	A set of standard services is established and maintained.	0	100 ▲	-
SP 2.1	Establish Properties of Standard Services and Service Levels	Establish and maintain properties of the organization’s set of standard services and service levels.	0	100 ▲	2
SP 2.2	Establish Descriptions of Standard Services	Establish and maintain descriptions of the organization’s defined standard services.	0	100 ▲	4

4.3 CMMI-SVC and Service Quality Model

Section 4.2 Gap Analysis has an analysis from a SCAMPI C viewpoint, enhanced with indications of which SPs have impact on the Service Quality Model gaps. This section has an analysis from a Service Quality Model viewpoint as proposed by this thesis.

The appraisal Excel workbook was also enhanced with references to the Service Quality Model whenever a subpractice has an impact on a given gap.

We look at the SPs’ statements which are the expected components within each PA. We then breakdown the specific practices into subpractices that are used to interpret and implement the practice. Organisations may choose to use them as prescriptive, but because they are actually informative component, they are useful to provide detail on what is expected in process improvement activities.

Table 26, Table 27, Table 28 and Table 29, from the following subsections, hold details per gap and per subpractice within each SP, on the two phases of analysis – QMS and meeting.

Each table hold indicators to signal the evidence, or not, of subpractice implementation:

- Evidence of subpractice implementation: ✓;
- No evidence of subpractice implementation: ✕;
- Not evaluated: -.

4.3.1 Gap 1 – Management Perceptions of Consumer Expectations

Table 26 shows coverage in terms of subpractices that impact gap 1.

Table 26 – Gap 1 subpractices (Management Perceptions of Consumer Expectations)

PA	Statement	Subpractice	QMS	Mtg.
STSM	Establish and maintain plans for standard services (SP 1.2)	Recommend requirements for standard services based on strategic business objectives, the organization’s capabilities, and strategic needs;	x	✓
		Identify needed actions on standard services;	x	✓
		Review and get agreement from relevant stakeholders on the standard services to be established and maintained.	x	✓

All subpractices are performed informally as they are not specified within any process of the QMS.

4.3.2 Gap 2 – Translation of Perceptions in Service Quality Specifications

Table 27 shows coverage for subpractices that impact gap 2.

Table 27 – Gap 2 subpractices (Translation of Perceptions in Service Quality Specifications)

PA	Statement	Subpractice	QMS	Mtg.
STSM	Establish and maintain properties of the organization’s set of standard services and service levels (SP 2.1)	Select standard services;	x	✓
		Specify the critical attributes of each service;	x	✓
		Determine common and variable parts of standard services;	x	✓
		Organize services into service lines as needed;	x	✓
		Define service levels;	x	✓
		Establish tailoring criteria as appropriate;	x	✓
		Identify needs and expectations for service systems that deliver standard services as appropriate.	x	✓

Again, all subpractices are performed informally.

4.3.3 Gap 3 – Service Delivery

Table 28 has the coverage of subpractices for gap 3.

The rationale for not assessing SD’s SP 3.1 on the first phase is that this SP is not applicable to typical projects within the Delivery area. SD’s SP 3.1 is applicable when the service being delivered requires a service request management system, such as a helpdesk or ticketing system. When the service is acquisition of manpower for instance, then there is no request apart from the service agreement.

In terms of coverage by the QMS, it has subpractices that are indeed implemented, and others that are lacking.

Table 28 – Gap 3 subpractices (Service Delivery)

PA	Statement	Subpractice	QMS	Mtg.
SD	Establish and maintain the service agreement (SP 1.2)	Define the structure and format of the service agreement.	✓	✓
		Define, negotiate, and obtain agreement on a draft service agreement.	✓	✓
		Publish the service agreement and make it available to service providers, customers, and end users as appropriate.	✓	✓
SD	Receive and process service requests in accordance with service agreements (SP 3.1)	Receive service requests and ensure each request is within the scope of the service agreement;	-	✓
		Record information about the service request;	-	✓
		Review service request status and resolution, and confirm results with relevant stakeholders;	-	✓
SD	Operate the service system to deliver services in accordance with service agreements (SP 3.2)	Operate service system components according to service system procedures;	✓	✓
		Perform operations support activities (e.g., revise thresholds);	✗	✓
		Manage and control the security of service delivery;	✗	✓
		Manage and control other operationally oriented quality attributes associated with service delivery;	✓	✓
		As appropriate, perform the activities needed to fulfill service requests or resolve service incidents according to the service agreement;	✓	✓
		Collect customer satisfaction information immediately after services are delivered or service requests are fulfilled.	✓	✓
SD	Maintain the service system to ensure the continuation of service delivery (SP 3.3)	Implement and test corrective or preventive maintenance according to the plan and operating procedures.	✓	✓

4.3.4 Gap 4 – External Communication To Consumers

Table 29 shows coverage in terms of subpractices that impact gap 4.

Again, SD’s SP 3.1 is applicable when the service being delivered requires a service request management system.

SSD is an addition, which was excluded from this analysis, so SP 1.1 is not always applicable.

In terms of coverage, the majority is not implemented by the QMS, and some are not even done informally.

Table 29 – Gap 4 subpractices (External Communication to Consumers)

PA	Statement	Subpractice	QMS	Mtg.
STSM	Establish and maintain plans for standard services (SP 1.2)	Review and get agreement from relevant stakeholders on the standard services to be established and maintained.	✗	✓
STSM	Establish and maintain descriptions of the organization's defined standard services (SP 2.2)	Conduct peer reviews on the descriptions with relevant stakeholders.	✗	✓
		Store the descriptions in a location and medium where all intended users have access.	✗	✓
SD	Establish and maintain the approach to be used for service delivery and service system operations (SP 2.1)	Review, refine, or enhance stakeholder communication mechanisms (e.g., notices, status reports, dashboards) as necessary.	✓	✓
		Review and get agreement with relevant stakeholders on the approach for delivering each separately identifiable service.	✓	✓
SD	Receive and process service requests in accordance with service agreements (SP 3.1)	Review service request status and resolution, and confirm results with relevant stakeholders.	-	✓
SD	Operate the service system to deliver services in accordance with service agreements (SP 3.2)	Communicate the status of service requests until closed.	✗	✓
		Collect customer satisfaction information immediately after services are delivered or service requests are fulfilled.	✓	✓
SD	Maintain the service system to ensure the continuation of service delivery (SP 3.3)	Release maintenance notifications to relevant stakeholders.	✗	✗
SSD	Collect and transform stakeholder needs, expectations, constraints, and interfaces into prioritized stakeholder requirements (SP 1.1)	Engage relevant stakeholders using methods for eliciting needs, expectations, constraints, and external interfaces.	-	-
SST	Establish and maintain plans for specific transitions of the service system (SP 1.2)	Obtain stakeholder commitment to the plan.	✗	✗
SST	Prepare relevant stakeholders for changes in services and service systems (SP 1.3)	Implement the notification strategy to keep relevant stakeholders informed about scheduled changes in services and service availability during the transition.	✗	✗
SST	Assess the impacts of the transition on stakeholders and service delivery, and take appropriate corrective action (SP 2.2)	Use data gathering methods to obtain input from relevant stakeholders about the deployment.	✗	✗
		Proactively communicate information about deployment impacts.	✗	✗
IRP	Monitor the status of incidents to closure (SP 2.4)	Review the resolution and confirm the results with relevant stakeholders.	✗	✓
IRP	Communicate the status of incidents (SP 2.5)	-	✗	✓
IRP	Establish and maintain solutions to respond to future incidents (SP 3.2)	Communicate the reusable solution to relevant stakeholders.	✗	✗
IRP	Establish and apply solutions to reduce the occurrence of selected incidents (SP 3.3)	Communicate the action proposal to relevant stakeholders.	✗	✗

4.4 Summary

Section 4.1 Quality Management System describes the organisation and processes of the QMS that was used on phase one of the gap analysis. The gap analysis is described in section 4.2 Gap Analysis that consists of two phases. One phase looking at the information from the QMS and a second phase that included a meeting with the responsible for the QMS.

Section 4.3 CMMI-SVC and Service Quality Model contains information regarding this thesis's proposal. Key subpractices are identified, highlighting the coverage, or not, of these subpractices, that have a direct influence over activities that will either close or expand the Service Quality Model's gaps.

The next chapter, Evaluation, uses the result of the gap analysis and from the thesis's proposal to provide a way forward in terms of solving the problem identified.

5 Evaluation

This section establishes if the proposal has worked towards the solution of the problem. Recalling the objective of the thesis, it is to answer how a software company, certified to CMMI Maturity Level 5, can increase customer satisfaction in its Managed Services area.

The first pillar is looking for best practices in a service provider organisation, to provide quality services to customers and end users. CMMI-SVC delivers these best practices.

The second pillar is to use the Service Quality Model to enhance CMMI-SVC with a different viewpoint in terms of service quality.

5.1 Gap Analysis

A SCAMPI C tested for compliance with CMMI-SVC and highlighted the gaps between the QMS and CMMI-SVC, as well as what is specified in the QMS and what is actually being performed by the organisation.

The result of the appraisal helps understand which CSW's practices are available for the Managed Services area, and which practices should be implemented by Managed Services.

It is possible to adopt practices from specific PAs without incurring in appraisal costs, although these costs could then have a return on investment via marketing campaigns due to the fact that CSW would be a multi-model company, certified to both CMMI-DEV and CMMI-SVC.

The appraisal is summarised in Table 19. Details per PA are available in Table 20, Table 21, Table 22, Table 23, Table 24 and Table 25 and the following paragraphs try to expand on these details and provide a way forward.

CAM (Table 20), a PA from the Project and Work Management category, is currently implemented at CSW. Although CAM best practices are being followed at CSW, there is no formal process put in place on the QMS. This PA is particularly important as some services require flexible allocation of capacity to cope with demand variability. By establishing a process, these activities would be less dependent on the people that are actually executing the activities, latent knowledge would be recorded, and tools could be used to automate this process and monitor it.

In terms of IRP (Table 21), although there is a process that largely implements all CMMI-SVC's best practices, some improvements should be considered. A communication strategy should be established. There is also no mention of building a knowledge base as incidents are resolved. Creation of roles and responsibilities, categories, and actions and responses based on severity and priority. Escalation and transfer, although possible, is not explicitly mentioned. In line with the knowledge base creation, after analysing the causes of incidents, actions should be sought to respond to future incidents, and these actions should be put in place to reduce the occurrence of future incidents.

SCON (Table 22), is not as service specific as the remaining – same applies to CAM, hence falling in the scope of the Project and Work Management category of CMMI-SVC. It is important to guarantee service continuity not only on Managed Services, but throughout the areas of CSW. Projects being executed in Delivery should not be affected by problems in infrastructure for instance. Formal processes should be put in place in the QMS to guarantee

the least disruption possible whenever there is major event that puts the organisation in difficulty.

SD (Table 23) is the PA where most subpractices have been implemented in the QMS and are being carried out by CSW. It is not surprising as even the Delivery area is providing software development services, and this is CSW's core business.

SST (Table 24) is the PA where more work would be required to implement all subpractices. No subpractice is currently in place. Whenever there is a change to a contract or service it is down to the project to define how this is handled. Managed Services should devise a strategy to handle change to the service system or service arrangements to guarantee that delivery is not affected.

STSM (Table 25) can be seen as a PA with a corporate scope. Regardless of product or service, offering should be placed strategically and answer to a market need. CMMI-SVC defines STSM within the Service Establishment and Delivery category. Even for organisation only implementing CMMI-DEV, having a defined set of practices to strategically manage their offering is of added value. Most of the best practices are currently not covered by the QMS.

CSW as a whole, and not only Managed Services, would benefit from improved CAM, SCOM and STSM. Processes that implement IRP would need improvements and the same applies to SD. Some subpractices would need to be introduced in the QMS so that Managed Services could take advantage of that, or informal practices could be introduced but that is not ideal. SST is an area that would need to be implemented as no subpractice is currently covered by the QMS or any practice outside its scope.

5.2 CMMI-SVC and Service Quality Model

The thesis's proposal highlights the SPs and subpractices that link to the Service Quality Model so that CSW can understand what drives the perceived and expected service.

Table 26, Table 27, Table 28 and Table 29 show the coverage per gap of each subpractice, and the following paragraphs build on top of these results.

Now that CSW is able to identify which activities have a direct impact on the gaps of the Service Quality Model, it is possible to actually understand what is being done on each one of the subpractices, and not simply doing them for the sake of a certification against a standard. How CSW is actually performing these subpractices will impact directly on customer satisfaction, and in the medium to long term on business performance.

Gap 1 (Table 26) shows that requirements and actions for products and services are being set, and that they are being reviewed. Despite this, there is no defined process to perform this review, say, quarterly, with an established procedure.

From analysis of gap 2 (Table 27) we have that all subpractices are performed without the existence of a formal process. Based on the requirements previously set by subpractices linked to gap 1, services are defined to respond to the established requirements.

Most of subpractices that relate to gap 3 (Table 28) are formally covered by the QMS, which reflects the nature of CSW's business – providing software engineering services. We can then say that the operational nature of the business is defined by the QMS.

On the other hand, in terms of gap 4 (Table 29), which relates to communication, a key operational aspect, we find that some subpractices are not being performed. This is the gap with the least coverage and where more work is required. As previously shown in Figure 6, people are a key dimension for process improvement, and ultimately communication is performed by CSW's collaborators. Communication guidelines and training would provide consistency to CSW's operation and help closing this gap.

Both the strategic and tactical aspects are being performed, although not with an established process. The operational side requires work to implement specific subpractices and a deeper analysis on how CSW is communicating to consumers is required.

6 Conclusion

Knowledge was acquired across two different dimensions – CMMI-SVC and Service Quality Model.

CSW now knows the gap between current practices, either implemented on the QMS or done outside of its current scope, and the best practices specified by CMMI-SVC.

CSW is now able to identify its practices that influence directly each gap of the Service Quality Model and ultimately customer satisfaction. The first step identified if best practices are being covered, and the next step would be to identify what is the actual procedure linked to these practices – how efficient and effective are these practices in reality.

CSW as a whole, and not only Managed Services, would benefit from CAM, SCOM and STSM.

For Managed Services, processes that implement IRP would need improvements.

Same applies to SD, where some subpractices would need to be introduced in the QMS.

SST is an area that would need to be implemented as no subpractice is currently covered by the QMS or any practice outside its scope.

From the viewpoint of the Service Quality Model, introduction of a process to control the strategic and tactical gaps could be discussed, but on the operational aspect, care should be taken with communication to consumers.

Certification, or not, to CMMI-SVC will need further study. In terms of benefits, the expectation is that some benefits were already obtained with the implementation of CMMI-DEV. A potential benefit would be in terms of marketing as CSW would be a multi-model company, certified for both CMMI-DEV and CMMI-SVC in two distinct areas.

6.1 Lessons Learnt

Looking at this thesis's proposal and at the different SPs within each activity from the service provider, we find that the External Communication to Customers is affected in many different situations. CMMI-SVC would benefit from a PA specific to communication management.

The Software Engineering Institute should publish an update to the report of performance results of CMMI. The report should include successful, and unsuccessful, case studies, so that new implementations can learn from past experiences.

Organisations currently certified against CMMI-DEV could benefit from PAs specific to CMMI-SVC– specifically CAM, SCOM and STSM.

CAM and SCOM do not interfere directly with the Service Quality Model and are the ones located in the Project and Work Management category. PAs from the Service Establishment and Delivery category all have some sort of direct impact on the gaps of the Service Quality Model.

This thesis's research question can be applied to other organisations. Knowledge acquired is applicable to all service organisations that are CMMI-DEV certified and wish to improve customer satisfaction.

6.2 Limitations

This section contains limitations of the proposal.

The proposal is based on CMMI-SVC and the Service Quality Model. Other activities, not modelled in CMMI-SVC, could have impact on service quality. In order to mitigate this limitation, organisations could look to other service related models or standards, such as Information Technology Infrastructure Library (ITIL), ISO/IEC 20000 Information Technology – Service Management, or Control Objectives for Information and related Technology (CobiT), for other practices that could impact the gaps of the Service Quality Model.

The PAs that were analysed were the service specific ones. It is expectable to find other subpractices and SPs that include communication to external consumers. WMC's SP 1.6 Conduct Progress Reviews, for instance, also includes external communication.

CMMI-SVC's subpractices are informative components that organisations can use as prescriptive. If organisations are not using subpractices as prescriptive, they will need to identify the activities, within the SPs (which are expected components) that influence service quality. The proposal expects organisations to use subpractices as prescriptive.

The proposal checks if organisations are doing some internal activity to fulfil a subpractice. Focus should be placed on analysing what is actually being done by the organisation on each subpractice that influences the Service Quality Model. Knowing that organisations are doing something is just a starting point to ensure service quality.

Organisations that implement the proposal will require knowledge in CMMI and willingness to implement such a model, or part of it. Certification is not required as organisations may wish to follow the model but not to incur in the cost of certification. Likewise, knowledge in terms of the Service Quality Model and what it represents is also required to take full advantage of the proposed solution.

6.3 Future Work

In terms of future work, guidelines and best practices in terms of communication management should be created as people are a critical dimension in process improvement, and the impact of External Communication to Consumers is spread across many different PAs and SPs, including PAs that are not service specific.

Work should be developed to analyse the impact on gap 5, the gap between the Expected Service and Perceived Service. This gap is described across five different dimensions – Reliability, Assurance, Tangibles, Empathy and Responsiveness. The service should be described using these dimensions, so that organisations have a baseline. Then, work towards improving the internal activities, that impact gaps 1 through 4, should be carried out, and then analyse gap 5 once again, in order to compare the pre- and post-implementation of the internal improvements.

Knowing that organisations are doing something is just a starting point to ensure service quality. Guidelines per service provider activity that influences service quality should be created, and a starting could be the analysis of ITIL, ISO/IEC 20000 and CobiT for instance. The proposal can be improved with guidelines on how to perform the SPs and subpractices provided by CMMI-SVC. It should be possible to create a viewpoint in terms of the Service Quality that groups together the best from different models and standards.

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ANNEX A: Appraisal Workbook

The appraisal workbook contains a cover worksheet with the revision history, a worksheet with the summary of the appraisal, and a worksheet per Process Area assessed.

The following sections provide detail on these worksheets.


REVISION HISTORY

Cover worksheet of the appraisal workbook, with placeholders for metadata and auditing data.

		DEPENDABLE TECHNOLOGIES FOR CRITICAL SYSTEMS	
<h1>CRITICAL SOFTWARE S.A.</h1> <h1>APPRAISAL REPORT</h1> <p><PROJECT NAME></p>			
DATE:	<YYYY-MM-DD>		
DOC. REF.:	<CSW-PPPP-2010-TTT-NNNN>		
STATUS:	<DRAFT / APPROVED>		
SHEETS:	XX		
ACCESS:	<PUBLIC / CONFIDENTIAL PROJECT / CONFIDENTIAL CRITICAL SOF		
VERSION:	VV		
<p>DISCLAIMER <THE CUSTOMER NAME> CONTRACT REPORT</p> <p>The work described in this report was performed under <The Customer Name> contract. Responsibility for the contents resides in the author or organization that prepared it.</p>			
PARTNERS:			
APPROVAL			
VERSION NAME	FUNCTION	SIGNATURE	DATE
VV			
AUTHORS AND CONTRIBUTORS			
NAME	CONTACT	DESCRIPTION	DATE
ACCESS LIST			
INTERNAL ACCESS:			
Project Team, Quality Department, Directors Board			
EXTERNAL ACCESS:			
TBD			
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REVISION			
VERSION	DATE	DESCRIPTION	AUTHOR
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SUMMARY

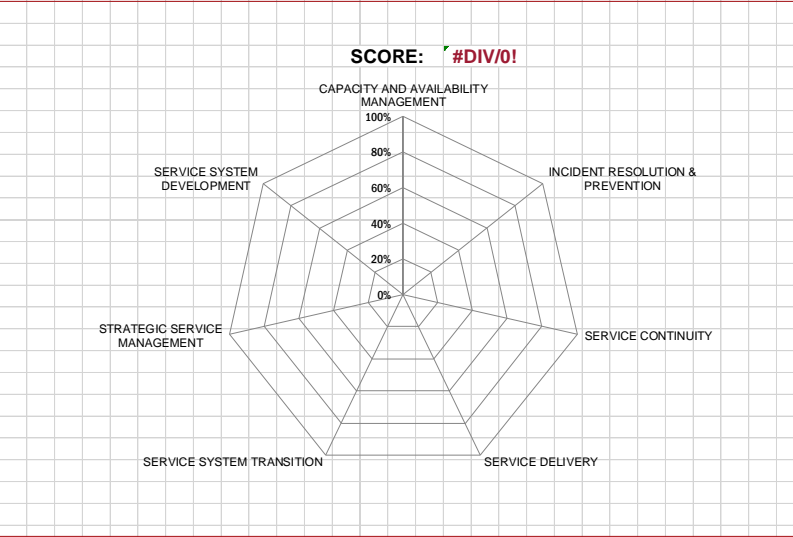
Appraisal workbook’s summary worksheet that contains aggregated values from the different PAs and provides a general view of the appraisal with an overall score and a radar chart.



DEPENDABLE TECHNOLOGIES
FOR CRITICAL SYSTEMS

APPRAISAL REPORT

OBJECTIVE	
	The objective of this audit is to evaluate the conformance of the project or function to the requirements defined in <standards>.
AUDIT INFORMATION	
DATE	<YYYY-MM-DD>
AUDIT SCOPE	
AUDIT TYPE	
LEAD AUDITOR	
AUDITOR	
EXECUTIVE SUMMARY	
SUMMARY	<summary>
STRONG POINTS	<strong points>
IMPROVEMENT OPPORTUNITIES	<improvement opportunities>




SCORE: #DIV/0!

CHART ID	CHECKLIST	SCORE
CAM	CAPACITY AND AVAILABILITY MANAGEMENT	#DIV/0!
IRP	INCIDENT RESOLUTION & PREVENTION	#DIV/0!
SCON	SERVICE CONTINUITY	#DIV/0!
SD	SERVICE DELIVERY	#DIV/0!
SST	SERVICE SYSTEM TRANSITION	#DIV/0!
STSM	STRATEGIC SERVICE MANAGEMENT	#DIV/0!
SSD	SERVICE SYSTEM DEVELOPMENT	#DIV/0!

CAM

Worksheet used to assess CAM's coverage. Contains Specific Goals, Specific Practices and subpractices, used to obtain the results shown in section Capacity and Availability Management of 4.2 Gap Analysis.



 DEPENDABLE TECHNOLOGIES FOR CRITICAL SYSTEMS		APPRAISAL REPORT												
PRACTICES	PRACTICE TEXT	RELATED COMPONENTS	SAMPLE APPRAISAL QUESTIONS					Y	N	N/A	IS	O	GAP	NOTES
CAPACITY AND AVAILABILITY MANAGEMENT														
cam	<i>The purpose of Capacity and Availability Management (CAM) is to ensure effective service system performance and ensure that resources are provided and used effectively to support service requirements.</i>	From sd.sp1.1e From sd.sp2.1 From sd.sp2.1f From wp.sp1.1d* From wp.sp2.4c*												
SG 1 Prepare for Capacity and Availability Management #DIV/0!														
cam.sg1	<i>Preparation for capacity and availability management is conducted.</i>	From iwm.sp1.4*												
SP 1.1 Establish a Capacity and Availability Management Strategy #DIV/0!														
cam.sp1.1	<i>Establish and maintain a strategy for capacity and availability management.</i>	Link to sd.sg1 Link to sst.sg1 Link to stsm.sg2												
cam.sp1.1a	Document resource and service use, performance, and availability.													
cam.sp1.1b	Estimate future resource and service capacity and availability requirements.													
cam.sp1.1c	Develop a capacity strategy that meets service requirements, meets the demand for resources and services, and addresses how resources are provided, used, and allocated.													
cam.sp1.1d	Develop an availability strategy that meets service requirements and addresses delivering a sustained level of availability.	Link to scon.sg2 Link to sd.sp3.3 Link to sst.sg1												
cam.sp1.1e	Document monetized costs and benefits of the strategy and any assumptions.													
cam.sp1.1f	Periodically revise the strategy.													
SP 1.2 Select Measures and Analytic Techniques #DIV/0!														
cam.sp1.2	<i>Select measures and analytic techniques to be used in managing the capacity and availability of the service system.</i>	Link to sd.sg1 Link to ma.sg1* Link to sam.sg1*												
cam.sp1.2a	Identify measures from organizational process assets that support capacity and availability management objectives.													
cam.sp1.2b	Identify and specify additional measures that may be needed to support achieving capacity and availability management objectives for the service.													
cam.sp1.2c	Analyze the relationship between identified measures and service requirements, and derive objectives that state specific target measures or ranges to be met for each measured attribute.	Link to stsm.sg2												
SP 1.3 Establish Service System Representations #DIV/0!														
cam.sp1.3	<i>Establish and maintain service system representations to support capacity and availability management.</i>	Link to ma.sp1.1* Link to ma.sp1.4* Link to sd.sg1 Link to stsm.sg2 Link to ssd.sg2 Link to opp.sg1* Link to qwm*												
cam.sp1.3a	Collect measurements on the use of resources and services and the current service levels delivered.													
cam.sp1.3b	Establish and maintain descriptions of the normal use of service resources and service system performance.													
cam.sp1.3c	Establish and maintain service system representations from collected measurements and analyses.													
cam.sp1.3d	Review and get agreement with relevant stakeholders about the descriptions of the normal use of service resources, service system performance, and service system representations.													
cam.sp1.3e	Make available the descriptions of the normal use of service resources, service system performance, and service system representations.													
cam.sp1.3f	Establish and maintain thresholds associated with demand, workload, use of service resources, and service system performance to define exception conditions in the service system and breaches or near breaches of service requirements.													

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SG 2 Monitor and Analyze Capacity and Availability															#DIV/0!								
cam.sg2	Capacity and availability are monitored and analyzed to manage resources and demand.	From irp.sp2.1 From sd.sp1.1d From sd.sp1.1e From sd.sp3.2e From wmc.sp1.1d*													#DIV/0!								
SP 2.1 Monitor and Analyze Capacity															#DIV/0!								
cam.sp2.1	Monitor and analyze capacity against thresholds.	Link to ma.sp1.3*													#DIV/0!								
cam.sp2.1a	Monitor the use of service resources against thresholds, descriptions of normal use, and service system performance.	Link to wmc.sp1.1*																					
cam.sp2.1b	Monitor service response times.																						
cam.sp2.1c	Identify breaches of thresholds and exception conditions.	Link to irp.sg2 Link to sd.sp3.2																					
cam.sp2.1d	Determine the corrective action to be taken.	Link to ssd.sg2 Link to wmc.sg2*																					
cam.sp2.1e	Estimate future changes (either growth or reduction) in the use of resources and services.																						
cam.sp2.1f	Store capacity and availability data, specifications, analysis results, and monitoring data.																						
SP 2.2 Monitor and Analyze Availability															#DIV/0!								
cam.sp2.2	Monitor and analyze availability against targets.														#DIV/0!								
cam.sp2.2a	Monitor availability, reliability, and maintainability against their requirements.																						
cam.sp2.2b	Analyze trends in availability, reliability, and maintainability.																						
cam.sp2.2c	Identify breaches of availability, reliability, and maintainability requirements.	Link to irp.sg2																					
cam.sp2.2d	Determine the corrective actions to be taken.	Link to sd.sp3.3 Link to wmc.sg2*																					
SP 2.3 Report Capacity and Availability Management Data															#DIV/0!								
cam.sp2.3	Report capacity and availability management data to relevant stakeholders.	Link to wmc.sg1* Link to sd.sg1 Link to opd.sp1.1* Link to sam.sg1*													#DIV/0!								
cam.sp2.3a	Report the performance and use of resources and services.																						
cam.sp2.3b	Report exception conditions in the service system and breaches of service requirements.																						
cam.sp2.3c	Report data from monitoring against growth estimates in resource and service use.																						
cam.sp2.3d	Report the availability, reliability, and maintainability of resources and services.																						
			COMPLIANCE SCORE	0	0	0																	
			CHECKLIST SCORE	#DIV/0!																			

IRP

Worksheet used to assess IRP’s coverage. Contains Specific Goals, Specific Practices and subpractices, used to obtain the results shown in section Incident Resolution and Prevention of 4.2 Gap Analysis and in 4.3 CMMI-SVC and Service Quality Model.

 		APPRAISAL REPORT									
PRACTICES	PRACTICE TEXT	RELATED COMPONENTS	SAMPLE APPRAISAL QUESTIONS	Y	N	N/A	IS	O	GAP	NOTES	
INCIDENT RESOLUTION AND PREVENTION											
irp	<i>The purpose of Incident Resolution and Prevention (IRP) is to ensure timely and effective resolution of service incidents and prevention of service incidents as appropriate.</i>	From sst.sp2.2									
SG 1 Prepare for Incident Resolution and Prevention #DIV/0!											
irp.sg1	<i>Preparation for incident resolution and prevention is conducted.</i>	From iwm.sp1.4*									
SP 1.1 Establish an Approach to Incident Resolution and Prevention #DIV/0!											
irp.sp1.1	<i>Establish and maintain an approach to incident resolution and prevention.</i>	Link to sd.sg1									
irp.sp1.1a	Define criteria for determining what an incident is.										
irp.sp1.1b	Define categories for incidents and criteria for determining which categories an incident belongs to.										
irp.sp1.1c	Describe how responsibility for processing incidents is assigned and transferred.										
irp.sp1.1d	Identify one or more mechanisms that customers and end users can use to report incidents.										
irp.sp1.1e	Define methods and acquire tools to use for incident management.										
irp.sp1.1f	Describe how to notify all relevant customers and end users who may be affected by a reported incident.										
irp.sp1.1g	Define criteria for determining severity and priority levels and categories of actions and responses to be taken based on severity and priority levels.										
irp.sp1.1h	Identify requirements on the amount of time defined for the resolution of incidents in the service agreement.	Link to sd.sg1									
irp.sp1.1i	Document criteria that define when an incident should be closed.										
SP 1.2 Establish an Incident Management System #DIV/0!											
irp.sp1.2	<i>Establish and maintain an incident management system for processing and tracking incident information.</i>										
irp.sp1.2a	Ensure that the incident management system allows the escalation and transfer of incidents among groups.										
irp.sp1.2b	Ensure that the incident management system allows the storage, update, retrieval, and reporting of incident information that is useful to the resolution and prevention of incidents.										
irp.sp1.2c	Maintain the integrity of the incident management system and its contents.										
irp.sp1.2d	Maintain the incident management system as necessary.										
SG 2 Identify, Control, and Address Individual Incidents #DIV/0!											
irp.sg2	<i>Individual incidents are identified, controlled, and addressed.</i>	Link to cm.sg2* From cam.sp2.1c From cam.sp2.2c From sd.sp1.1d From sd.sp2.2b From sd.sg3 From sd.sp3.2g									
SP 2.1 Identify and Record Incidents #DIV/0!											
irp.sp2.1	<i>Identify incidents and record information about them.</i>	Link to cam.sg2									
irp.sp2.1a	Identify incidents that are in scope.										
irp.sp2.1b	Record information about the incident.										
irp.sp2.1c	Categorize the incident.										

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SP 2.2 Analyze Individual Incident Data		#DIV/0!
irp.sp2.2	Analyze individual incident data to determine a course of action.	
irp.sp2.2a	Analyze incident data.	
irp.sp2.2b	Determine which group is best suited to take action to address the incident.	
irp.sp2.2c	Determine actions that should be taken to address the incident.	
irp.sp2.2d	Plan the actions to be taken.	
SP 2.3 Resolve Incidents		#DIV/0!
irp.sp2.3	Resolve incidents.	
irp.sp2.3a	Address the incident using the best course of action.	
irp.sp2.3b	Manage the actions until the impact of the incident is at an acceptable level.	
irp.sp2.3c	Record the actions and result.	
irp.sp2.3d	Review actions taken that resulted in service system changes to determine if further actions are needed to ensure traceability to requirements.	
SP 2.4 Monitor the Status of Incidents to Closure		#DIV/0!
irp.sp2.4	Monitor the status of incidents to closure. Link to wmc* From wmc.sp2.3a*	4
irp.sp2.4a	Document actions and monitor and track the incidents until they meet the terms of the service agreement and satisfy the incident submitter as appropriate.	
irp.sp2.4b	Escalate incidents as necessary.	
irp.sp2.4c	Review the resolution and confirm the results with relevant stakeholders.	4
irp.sp2.4d	Close incidents that meet the criteria for closure.	
SP 2.5 Communicate the Status of Incidents		#DIV/0!
irp.sp2.5	Communicate the status of incidents.	4
irp.sp2.5a	-	
SG 3 Analyze and Address Causes and Impacts of Selected Incidents		#DIV/0!
irp.sg3	Causes and impacts of selected incidents are analyzed and addressed. Link to car.sg1*	
SP 3.1 Analyze Selected Incidents		#DIV/0!
irp.sp3.1	Analyze the underlying causes of selected incidents. Link to cm.sg2*	
irp.sp3.1a	Identify underlying causes of incidents.	
irp.sp3.1b	Record information about the underlying causes of an incident or group of incidents.	
irp.sp3.1c	Conduct causal analysis with the people who are responsible for performing related tasks.	
irp.sp3.1d	Determine the best overall approach for dealing with selected incidents in the future.	
SP 3.2 Establish Solutions to Respond to Future Incidents		#DIV/0!
irp.sp3.2	Establish and maintain solutions to respond to future incidents.	4
irp.sp3.2a	Determine which group is best suited to establish and maintain a reusable solution.	
irp.sp3.2b	Plan and document the reusable solution.	
irp.sp3.2c	Verify and validate the reusable solution to ensure that it effectively addresses the incident.	
irp.sp3.2d	Communicate the reusable solution to relevant stakeholders.	4

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SP 3.3 Establish and Apply Solutions to Reduce Incident Occurrence										#DIV/0!
irp.sp3.3 Establish and apply solutions to reduce the occurrence of selected incidents.										4
irp.sp3.3a	Determine which group is best suited to address the underlying cause.									
irp.sp3.3b	Determine the actions to be taken to address the underlying cause.	Link to dar*								
irp.sp3.3c	Document the actions to be taken in an action proposal.									
irp.sp3.3d	Verify and validate the action proposal to ensure that it effectively addresses the underlying cause.									
irp.sp3.3e	Communicate the action proposal to relevant stakeholders.								4	
irp.sp3.3f	Address the underlying cause by implementing the action proposal that resulted from the analysis of the incidents' underlying causes.	Link to sd.sp3.3 Link to ssd.sg2								
irp.sp3.3g	Manage the actions until the underlying cause is addressed.									
irp.sp3.3h	Record the actions and result.									
COMPLIANCE SCORE										0 0 0
CHECKLIST SCORE										#DIV/0!

SCON

Worksheet used to assess SCON’s coverage. Contains Specific Goals, Specific Practices and subpractices, used to obtain the results shown in section Service Continuity of 4.2 Gap Analysis.


 		APPRAISAL REPORT												
PRACTICES	PRACTICE TEXT	RELATED COMPONENTS	SAMPLE APPRAISAL QUESTIONS					Y	N	N/A	IS	O	GAP	NOTES
SERVICE CONTINUITY														
scon	<i>The purpose of Service Continuity (SCON) is to establish and maintain plans to ensure continuity of services during and following any significant disruption of normal operations.</i>													
SG 1 Identify Essential Service Dependencies #DIV/0!														
scon.sg1	<i>The essential functions and resources on which services depend are identified and documented.</i>	Link to reqm*												
SP 1.1 Identify and Prioritize Essential Functions #DIV/0!														
scon.sp1.1	<i>Identify and prioritize the essential functions that must be performed to ensure service continuity.</i>	Link to iwm.sg2*												
scon.sp1.1a	Identify and prioritize the essential services of the organization.													
scon.sp1.1b	Identify the essential functions on which services rely.													
scon.sp1.1c	Analyze the criticality of providing those functions and the impact to services if the essential functions cannot be performed.	Link to dar*												
scon.sp1.1d	Prioritize the list of essential functions that must be provided despite a significant disruption.													
SP 1.2 Identify and Prioritize Essential Resources #DIV/0!														
scon.sp1.2	<i>Identify and prioritize the essential resources required to ensure service continuity.</i>	Link to iwm.sg2* Link to wp.sp2.3*												
scon.sp1.2a	Identify and document internal and external dependencies.													
scon.sp1.2b	Identify and document key staff and their roles in relation to service delivery.													
scon.sp1.2c	Identify and document organizational and relevant stakeholder responsibilities.													
scon.sp1.2d	Identify and document resources required by essential functions to ensure continuity.													
scon.sp1.2e	Prioritize resources based on an evaluation of impact from their loss or from lack of access.													
scon.sp1.2f	Ensure that safety provisions are made for staff, both internal and external, within the delivery environment and for organizational supporting functions.													
scon.sp1.2g	Ensure that records and databases are protected, accessible, and usable in an emergency.													
SG 2 Prepare for Service Continuity #DIV/0!														
scon.sg2	<i>Preparations are made for service continuity.</i>	Link to iwm.sp1.4* Link to wp.sg2* From cam.sp1.1d												
SP 2.1 Establish Service Continuity Plans #DIV/0!														
scon.sp2.1	<i>Establish and maintain service continuity plans that enable the organization to resume performing essential functions.</i>	From sst.sp1.2g From iwm.sp1.4*												
scon.sp2.1a	Identify and document threats and vulnerabilities to ongoing service delivery.	Link to rskm.sg2* Link to rskm.sg3*												
scon.sp2.1b	Document the service continuity plan.													
scon.sp2.1c	Review the service continuity plan with relevant stakeholders.	Link to ssd.sp3.2												
scon.sp2.1d	Ensure that secure storage and access methods exist for the service continuity plan and critical information and functions needed to implement the plan.													
scon.sp2.1e	Ensure that vital data and systems are adequately protected.	Link to ssd.sg2												
scon.sp2.1f	Document the acceptable service level agreed to by the customer for when a shift between the normal delivery environment and the recovery environment (e.g., site affected by disruption).													
scon.sp2.1g	Plan for returning to normal working conditions.													
scon.sp2.1h	Develop procedures for implementing the service continuity plan.													
scon.sp2.1i	Revise the service continuity plan as necessary.													

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SP 2.2 Establish Service Continuity Training		#DIV/0!
scon.sp2.2	Establish and maintain training for service continuity.	
scon.sp2.2a	Develop a strategy for conducting service continuity training.	
scon.sp2.2b	Develop and document service continuity training for each category of threat and vulnerability to service delivery.	
scon.sp2.2c	Review service continuity training material with relevant stakeholders. Link to ssd.sp3.2	
scon.sp2.2d	Revise the training material as needed to reflect changes in the service continuity plan and feedback on training effectiveness.	
SP 2.3 Provide and Evaluate Service Continuity Training		#DIV/0!
scon.sp2.3	Provide and evaluate training in the execution of the service continuity plan. Link to ot.sg2*	
scon.sp2.3a	Deliver training that covers the execution of the service continuity plan to appropriate staff.	
scon.sp2.3b	Maintain records of those who successfully complete service continuity training.	
scon.sp2.3c	Solicit feedback on how well service continuity training prepared those who will execute the service continuity plan.	
scon.sp2.3d	Analyze training feedback and document suggested improvements to the service continuity plan and service continuity training.	
SG 3 Verify and Validate the Service Continuity Plan		#DIV/0!
scon.sg3	The service continuity plan is verified and validated. Link to ssd.sp3.3	
SP 3.1 Prepare for the Verification and Validation of the Service Continuity Plan		#DIV/0!
scon.sp3.1	Prepare for the verification and validation of the service continuity plan.	
scon.sp3.1a	Develop a plan for conducting service continuity verification and validation.	
scon.sp3.1b	Review with relevant stakeholders the verification and validation plan, including evaluation methods and the environments and other resources that will be needed.	
scon.sp3.1c	Determine the procedures and criteria for verification and validation of the service continuity plan.	
scon.sp3.1d	Identify changes to the service continuity plan from the preparation for verification and validation.	
SP 3.2 Verify and Validate the Service Continuity Plan		#DIV/0!
scon.sp3.2	Verify and validate the service continuity plan.	
scon.sp3.2a	Prepare the environment to conduct verification and validation.	
scon.sp3.2b	Conduct verification and validation of the service continuity plan.	
scon.sp3.2c	Record the results of verification and validation activities.	
SP 3.3 Analyze Results of Verification and Validation of the Service Continuity Plan		#DIV/0!
scon.sp3.3	Analyze the results of verifying and validating the service continuity plan.	
scon.sp3.3a	Compare actual to expected results of service continuity plan verification and validation.	
scon.sp3.3b	Evaluate whether restoration to agreed service levels or some other planned state was achieved or not.	
scon.sp3.3c	Document recommendations for improving the service continuity plan.	
scon.sp1.2c	Document recommended improvements to the verification and validation of the service continuity plan.	
scon.sp3.3e	Collect improvement proposals for services or service system components as appropriate based on the analyses of results.	
scon.sp3.3f	Provide information on how defects can be resolved (including verification methods, criteria, and the verification environment) and initiate corrective action. Link to wmc.sg2*	
COMPLIANCE SCORE 0 0 0		
CHECKLIST SCORE #DIV/0!		

SD

Worksheet used to assess SD's coverage. Contains Specific Goals, Specific Practices and subpractices, used to obtain the results shown in section Service Delivery of 4.2 Gap Analysis and in 4.3 CMMI-SVC and Service Quality Model.

 DEPENDABLE TECHNOLOGIES FOR CRITICAL SYSTEMS		APPRAISAL REPORT												
PRACTICES	PRACTICE TEXT	RELATED COMPONENTS	SAMPLE APPRAISAL QUESTIONS					Y	N	N/A	IS	O	GAP	NOTES
SERVICE DELIVERY														
sd	<i>The purpose of Service Delivery (SD) is to deliver services in accordance with service agreements.</i>													
SG 1 Establish Service Agreements #DIV/0!														
sd.sg1	<i>Service agreements are established and maintained.</i>	Link to ssd.sg1 Link to stsm.sg2 Link to wmc.sp1.2* From cam.sp1.1 From cam.sp1.2 From cam.sp1.3 From cam.sp2.3 From irp.sp1.1 From irp.sp1.1h												
SP 1.1 Analyze Existing Agreements and Service Data #DIV/0!														
sd.sp1.1	<i>Analyze existing service agreements and service data to prepare for expected new agreements.</i>	From ssd.sp1.1												
sd.sp1.1a	Review available customer and end-user need data.	Link to stsm.sp1.1												
sd.sp1.1b	Review concerns of service delivery and support staff.													
sd.sp1.1c	Review existing service agreements and supplier agreements.													
sd.sp1.1d	Review available current service data and service system designs.	Link to cam.sg2 Link to ssd.sg2 Link to irp.sg2												
sd.sp1.1e	Analyze the capability to supply requested services.	Link to cam Link to ssd.sg2 Link to sam*												
SP 1.2 Establish the Service Agreement #DIV/0!														
sd.sp1.2	<i>Establish and maintain the service agreement.</i>	Link to stsm.sp2.1 From wp.sp2.6*											3	
sd.sp1.2a	Define the structure and format of the service agreement.												3	
sd.sp1.2b	Define, negotiate, and obtain agreement on a draft service agreement.												3	
sd.sp1.2c	Publish the service agreement and make it available to service providers, customers, and end users as appropriate.												3	
sd.sp1.2d	Review and revise the service agreement on a periodic and event-driven basis as appropriate.													
SG 2 Prepare for Service Delivery #DIV/0!														
sd.sg2	<i>Preparation for service delivery is conducted.</i>	From sstsp1.1 From sstsp2.1c												
SP 2.1 Establish the Service Delivery Approach #DIV/0!														
sd.sp2.1	<i>Establish and maintain the approach to be used for service delivery and service system operations.</i>	Link to cam Link to ssd Link to wp.sg2* From wp.sp1.1b*											4	
sd.sp2.1a	Define criteria for determining service requests.													
sd.sp2.1b	Define categories for service requests and criteria for categorizing service requests.													
sd.sp2.1c	Describe how responsibility for processing service requests is assigned and transferred.													
sd.sp2.1d	Identify one or more mechanisms that customers and end users can use to submit service requests.													
sd.sp2.1be	Identify requirements on the amount of time defined for the fulfillment of service requests in the service agreement.													
sd.sp2.1f	Determine the resource requirements for service delivery as required.	Link to cam												
sd.sp2.1g	Review, refine, or enhance stakeholder communication mechanisms (e.g., notices, status reports, dashboards) as necessary.	Link to ssd.sg2											4	
sd.sp2.1h	Document the service delivery approach.													
sd.sp2.1i	Review and get agreement with relevant stakeholders on the approach for delivering each separately identifiable service.												4	
sd.sp2.1j	Revise the approach for delivering services as necessary.													

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SP 2.2 Prepare for Service System Operations										#DIV/0!
sd.sp2.2 Confirm the readiness of the service system to enable the delivery of services.										Link to sst
sd.sp2.2a	Confirm that the appropriate service system's components and tools are operational.									
sd.sp2.2b	Evaluate the results of confirming service system component readiness and determine what corrective action is needed.	Link to irp.sg2								
sd.sp2.2c	Review the service level requirements in the service agreements and ensure that proper thresholds are set in service system monitoring tools.									
sd.sp2.2d	Develop, review, or refine service delivery procedures.	Link to sss.sg2								
sd.sp2.2e	Ensure that necessary resources are available for performing service delivery activities and tasks.									
sd.sp2.2f	Prepare and update detailed job execution and monitoring schedules for delivering services as requested.									
sd.sp2.2g	Provide orientation to incoming service delivery and support staff on current service delivery operations during staff member changes.									
sd.sp2.2h	Ensure that any necessary consumables are available for service delivery.									
SP 2.3 Establish a Request Management System										#DIV/0!
sd.sp2.3 Establish and maintain a request management system for processing and tracking request information.										
sd.sp2.3a	Ensure that the request management system allows the reassignment and transfer of requests among groups.									
sd.sp2.3b	Ensure that the request management system allows the storage, update, and retrieval of request management information.									
sd.sp2.3c	Ensure that the request management system enables data reporting that is useful to the fulfillment of requests.									
sd.sp2.3d	Maintain the integrity of the request management system and its contents.									
sd.sp2.3e	Maintain the request management system as necessary.									
SG 3 Deliver Services										#DIV/0!
sd.sg3 Services are delivered in accordance with service agreements.										Link to irp.sg2
SP 3.1 Receive and Process Service Requests										#DIV/0!
sd.sp3.1 Receive and process service requests in accordance with service agreements.										3, 4
sd.sp3.1a	Receive service requests and ensure each request is within the scope of the service agreement.									3
sd.sp3.1b	Record information about the service request.									3
sd.sp3.1c	Categorize and analyze the service request.									
sd.sp3.1d	Determine which resources are required to resolve the service request.									
sd.sp3.1e	Determine the actions to be taken to satisfy the service request.									
sd.sp3.1f	Plan the actions further as appropriate.									
sd.sp3.1g	Monitor the status of service requests as appropriate until they are fulfilled as described in the service agreement.	Link to wmc.sg1*								
sd.sp3.1h	Review service request status and resolution, and confirm results with relevant stakeholders.									4
sd.sp3.1i	Close the service request and record the actions taken and results.									

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SP 3.2 Operate the Service System										#DIV/0!
sd.sp3.2	Operate the service system to deliver services in accordance with service agreements.	From cam.sp2.1c								3, 4
sd.sp3.2a	Operate service system components according to service system procedures.									3
sd.sp3.2b	Perform operations support activities (e.g., revise thresholds).									3
sd.sp3.2c	Manage the critical dependencies and paths of the service delivery schedules according to operating procedures.									
sd.sp3.2d	Manage and control the security of service delivery.									3
sd.sp3.2e	Manage and control other operationally oriented quality attributes associated with service delivery.	Link to cam.sg2								3
sd.sp3.2f	Perform low-level monitoring of service system components using monitoring and data collection tools as appropriate.									
sd.sp3.2g	As appropriate, perform the activities needed to fulfill service requests or resolve service incidents according to the service agreement.	Link to irp.sg2 Link to wmc.sg1*								3
sd.sp3.2h	Communicate the status of service requests until closed.									4
sd.sp3.2i	Collect customer satisfaction information immediately after services are delivered or service requests are fulfilled.									3, 4
SP 3.3 Maintain the Service System										#DIV/0!
sd.sp3.3	Maintain the service system to ensure the continuation of service delivery.	Link to ssd.sg1 Link to sst.sg1 Link to cm.sg2*	From cam.sp1.1d From cam.sp2.2c From irp.sp3.3f							3, 4
sd.sp3.3a	Review maintenance requests and prioritize requests based on criteria identified when establishing the service delivery approach.									
sd.sp3.3b	Analyze impacts on service systems and services delivery.									
sd.sp3.3c	Develop a plan to implement maintenance.									
sd.sp3.3d	Release maintenance notifications to relevant stakeholders.									4
sd.sp3.3e	Update service system documentation as appropriate.									
sd.sp3.3f	Implement and test corrective or preventive maintenance according to the plan and operating procedures.									3
sd.sp3.3g	Submit maintenance documentation and configuration changes to a configuration management repository.									
COMPLIANCE SCORE										0 0 0
CHECKLIST SCORE										#DIV/0!

SSD

Worksheet used to assess SSD's coverage. Contains Specific Goals, Specific Practices and subpractices.

DEPENDABLE TECHNOLOGIES FOR CRITICAL SYSTEMS		APPRAISAL REPORT												
PRACTICES	PRACTICE TEXT	RELATED COMPONENTS	SAMPLE APPRAISAL QUESTIONS					Y	N	N/A	IS	O	GAP	NOTES
SERVICE SYSTEM DEVELOPMENT														
ssd	<i>The purpose of Service System Development (SSD) is to analyze, design, develop, integrate, verify, and validate service systems, including service system components, to satisfy existing or anticipated service agreements.</i>	From sd.sp2.1												
SG 1 Develop and Analyze Stakeholder Requirements #DIV/0!														
ssd.sg1	<i>Stakeholder needs, expectations, constraints, and interfaces are collected, analyzed, and transformed into validated service system requirements.</i>	Link to reqm.sp1.3* From sd.sg1 From sd.sp3.3 From ma.sp1.1* From sam.sp1.2* From sam.sp1.3c*												
SP 1.1 Develop Stakeholder Requirements #DIV/0!														
ssd.sp1.1	<i>Collect and transform stakeholder needs, expectations, constraints, and interfaces into prioritized stakeholder requirements.</i>	Link to sd.sp1.1										4		
ssd.sp1.1a	Engage relevant stakeholders using methods for eliciting needs, expectations, constraints, and external interfaces.											4		
ssd.sp1.1b	Transform stakeholder needs, expectations, constraints, and interfaces into prioritized stakeholder requirements.													
ssd.sp1.1c	Define constraints for verification and validation.													
SP 1.2 Develop Service System Requirements #DIV/0!														
ssd.sp1.2	<i>Refine and elaborate stakeholder requirements to develop service system requirements.</i>	Link to stsm.sg2												
ssd.sp1.2a	Develop requirements and express them in the terms necessary for service and service system design.													
ssd.sp1.2b	Derive requirements that result from solution selections and design decisions.													
ssd.sp1.2c	Establish and maintain relationships among requirements for consideration during change management and requirements allocation.													
ssd.sp1.2d	Prioritize derived requirements.													
ssd.sp1.2e	Allocate the requirements to logical entities, service system components, and other entities as appropriate.													
ssd.sp1.2f	Identify interfaces both external and internal to the service system.													
ssd.sp1.2g	Develop requirements for the identified interfaces.													
SP 1.3 Analyze and Validate Requirements #DIV/0!														
ssd.sp1.3	<i>Analyze and validate requirements, and define required service system functionality and quality attributes.</i>	From reqm.sp1.1b*												
ssd.sp1.3a	Develop operational concepts and scenarios that include operations, installation, development, maintenance, support, and disposal as appropriate.													
ssd.sp1.3b	Develop a detailed operational concept that defines the interaction of the service system, end users, and the environment, and that satisfies operational, maintenance, support, and disposal needs.													
ssd.sp1.3c	Establish and maintain a definition of required functionality and quality attributes.													
ssd.sp1.3d	Analyze requirements to ensure that they are necessary, sufficient, and balance stakeholder needs and constraints.													
ssd.sp1.3e	Validate requirements to ensure the resulting service system will perform as intended in the end user's environment.													



SG 2 Develop Service Systems																			#DIV/0!
ssd.sg2	Service system components are selected, designed, implemented, and integrated.	From cam.sp1.3 From cam.sp2.1d From irp.sp3.3f From scon.sp2.1e From sd.sp1.1d From sd.sp1.1e From sd.sp2.1g From sd.sp2.2d From sst.sp1.1 From sism.sp1.2c From sism.sp2.1g From wp.sp2.4b*																	
SP 2.1 Select Service System Solutions																			#DIV/0!
ssd.sp2.1	Select service system solutions from alternative solutions.	Link to dar* Link to sam*																	
ssd.sp2.1a	Establish defined criteria for selection.																		
ssd.sp2.1b	Develop alternative solutions.																		
ssd.sp2.1c	Select the service system solutions that best satisfy the criteria established.																		
SP 2.2 Develop the Design																			#DIV/0!
ssd.sp2.2	Develop designs for the service system and service system components.																		
ssd.sp2.2a	Develop a design for the service system.																		
ssd.sp2.2b	Ensure that the design adheres to allocated functionality and quality attribute requirements.																		
ssd.sp2.2c	Document the design.																		
ssd.sp2.2d	Design interfaces for the service system components using established criteria.																		
ssd.sp2.2e	Evaluate whether the components of the service system should be developed, purchased, or reused based on established criteria.																		
SP 2.3 Ensure Interface Compatibility																			#DIV/0!
ssd.sp2.3	Manage internal and external interface definitions, designs, and changes for service systems.																		
ssd.sp2.3a	Review interface descriptions for coverage and completeness.																		
ssd.sp2.3b	Manage internal and external interface definitions, designs, and changes for service system components.																		
SP 2.4 Implement the Service System Design																			#DIV/0!
ssd.sp2.4	Implement the service system design.	Link to sstsg2																	
ssd.sp2.4a	Use effective methods to implement the service system design.																		
ssd.sp2.4b	Adhere to applicable standards and criteria.																		
ssd.sp2.4c	Conduct peer reviews of selected service system components.																		
ssd.sp2.4d	Perform standalone testing of service system components as appropriate.																		
ssd.sp2.4e	Revise the service system as necessary.																		
SP 2.5 Integrate Service System Components																			#DIV/0!
ssd.sp2.5	Assemble and integrate implemented service system components into a verifiable service system.	From sam.sp2.3*																	
ssd.sp2.5a	Develop a service system integration strategy.																		
ssd.sp2.5b	Ensure the readiness of the integration environment.																		
ssd.sp2.5c	Confirm that each service system component required for integration has been properly identified, behaves according to its description, and that all interfaces comply with their interface descriptions.																		
ssd.sp2.5d	Evaluate the assembled service system for interface compatibility, and behavior (functionality and quality attributes).																		

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SG 3 Verify and Validate Service Systems															#DIV/0!								
ssd.sg3	Selected service system components and services are verified and validated to ensure correct service delivery.	From sst.sp2.1c From iwm.sp2.1b* From sam.sp2.2c*																					
SP 3.1 Prepare for Verification and Validation															#DIV/0!								
ssd.sp3.1	Establish and maintain an approach and an environment for verification and validation.	From iwm.sp1.3*																					
ssd.sp3.1a	Select the components to be verified and validated and the verification and validation methods that will be used for each.																						
ssd.sp3.1b	Establish and maintain the environments needed to support verification and validation.																						
ssd.sp3.1c	Establish and maintain verification and validation procedures and criteria for selected service system components.																						
SP 3.2 Perform Peer Reviews															#DIV/0!								
ssd.sp3.2	Perform peer reviews on selected service system components.	From scon.sp2.1c From scon.sp2.2c From iwm.sp1.1f* From iwm.sp1.4e* From opd.sp1.1h* From opd.sp1.2c* From opd.sp1.3e* From opd.sp1.4e*																					
ssd.sp3.2a	Determine what type of peer review will be conducted.																						
ssd.sp3.2b	Establish and maintain peer review procedures and criteria for the selected service system components and work products.																						
ssd.sp3.2c	Define requirements for the peer review.																						
ssd.sp3.2d	Establish and maintain checklists to ensure that service system components and work products are reviewed consistently.																						
ssd.sp3.2e	Develop a detailed peer review schedule, including dates for peer review training and for when materials for peer reviews will be available.																						
ssd.sp3.2f	Prepare for the peer review.																						
ssd.sp3.2g	Ensure that the service system component or work product satisfies the peer review entry criteria and make the component or work product available for review to participants early enough to enable them to adequately prepare.																						
ssd.sp3.2h	Assign roles for the peer review as appropriate.																						
ssd.sp3.2i	Conduct peer reviews on selected service system components and work products, and identify issues resulting from the peer review.																						
ssd.sp3.2j	Conduct an additional peer review if the defined criteria indicate the need.																						
ssd.sp3.2k	Ensure that exit criteria for the peer review are satisfied.																						
ssd.sp3.2l	Record and store data related to the preparation, conduct, and results of the peer reviews.																						
ssd.sp3.2m	Analyze peer review data.																						
SP 3.3 Verify Selected Service System Components															#DIV/0!								
ssd.sp3.3	Verify selected service system components against their specified requirements.	From scon.sg3																					
ssd.sp3.3a	Perform verification of selected service system components and work products against their requirements.																						
ssd.sp3.3b	Record the results of verification activities.																						
ssd.sp3.3c	Identify action items resulting from the verification of service system components and work products.																						
ssd.sp3.3d	Document the "as-run" verification method and deviations from the available methods and procedures discovered during its performance.																						
ssd.sp3.3e	Analyze and record the results of all verification activities.																						
SP 3.4 Validate the Service System															#DIV/0!								
ssd.sp3.4	Validate the service system to ensure that it is suitable for use in the intended delivery environment and meets stakeholder expectations.																						
ssd.sp3.4a	Perform functionality and quality attribute validation on selected service system components to ensure that they are suitable for use in their intended delivery environment.																						
ssd.sp3.4b	Analyze the results of validation activities.																						
																		COMPLIANCE SCORE	0	0	0		
																		CHECKLIST SCORE	#DIV/0!				

SST

Worksheet used to assess SST’s coverage. Contains Specific Goals, Specific Practices and subpractices, used to obtain the results shown in section Service System Transition of 4.2 Gap Analysis and in 4.3 CMMI-SVC and Service Quality Model.



 		APPRAISAL REPORT												
PRACTICES	PRACTICE TEXT	RELATED COMPONENTS	SAMPLE APPRAISAL QUESTIONS					Y	N	N/A	IS	O	GAP	NOTES
SERVICE SYSTEM TRANSITION														
sst	<i>The purpose of Service System Transition (SST) is to deploy new or significantly changed service system components while managing their effect on ongoing service delivery.</i>	From sd.sp2.2												
SG 1 Prepare for Service System Transition														
sst.sg1	<i>Preparation for service system transition is conducted.</i>	From cam.sp1.1 From cam.sp1.1d From sd.sp3.3 From wp.sp2.5*												#DIV/0!
SP 1.1 Analyze Service System Transition Needs														
sst.sp1.1	<i>Analyze the functionality, quality attributes, and compatibility of the current and future service systems to minimize impact on service delivery.</i>	Link to sd.sg2 Link to ssd.sg2												#DIV/0!
sst.sp1.1a	Establish a baseline of the current service system, if it has not been done previously.	Link to cm.sg1*												
sst.sp1.1b	Analyze the current service system as it operates within the current delivery environment.													
sst.sp1.1c	Analyze the service system components that are proposed for transition (e.g., the post-transition or to-be service system) for potential compatibility, functionality, quality attribute, or interface issues.													
sst.sp1.1d	Identify and mitigate potential issues.	Link to rskm.sg3*												
SP 1.2 Develop Service System Transition Plans														
sst.sp1.2	<i>Establish and maintain plans for specific transitions of the service system.</i>	Link to wp.sg2*											4	
sst.sp1.2a	Define the deployment approach for each specific service system transition.													
sst.sp1.2b	Determine the cost, resources, and schedule required for transition of the service system to a new or changed operational state.													
sst.sp1.2c	Identify relevant stakeholders for transition activities.													
sst.sp1.2d	Develop a service system transition plan.													
sst.sp1.2e	Obtain stakeholder commitment to the plan.												4	
sst.sp1.2f	Establish a baseline of the transition plan.													
sst.sp1.2g	If new or significantly changed essential functions are part of a transition, ensure that the service continuity plan is refreshed to include the new essential functions.	Link to scon.sp2.1 Link to iwm.sp1.4* Link to iwm.sg2*												
SP 1.3 Prepare Stakeholders for Changes														
sst.sp1.3	<i>Prepare relevant stakeholders for changes in services and service systems.</i>	From wp.sp2.5*											4	
sst.sp1.3a	Establish and maintain a transition notification strategy.													
sst.sp1.3b	Implement the notification strategy to keep relevant stakeholders informed about scheduled changes in services and service availability during the transition.												4	
sst.sp1.3c	Establish and maintain a transition training strategy.													
sst.sp1.3d	Implement the training strategy.	Link to ot.sp1.3												

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SG 2 Deploy the Service System												#DIV/0!
sst.sg2	The service system is deployed to the delivery environment.	From sst.sp2.4 From opm.sg3*										
SP 2.1 Deploy Service System Components												#DIV/0!
sst.sp2.1	Systematically deploy service system components into the delivery environment based on transition planning.											
sst.sp2.1a	Confirm that service system components to be deployed are placed under configuration control as appropriate.											
sst.sp2.1b	Install the service system into the delivery environment.											
sst.sp2.1c	Validate service system components in the delivery environment.	Link to sd.sg2 Link to sst.sg3										
sst.sp2.1d	In the case of service system component retirement, archive the service system components appropriately and remove them from the delivery environment.											
SP 2.2 Assess and Control the Impacts of the Transition												#DIV/0!
sst.sp2.2	Assess the impacts of the transition on stakeholders and service delivery, and take appropriate corrective action.	Link to irp										4
sst.sp2.2a	Use data gathering methods to obtain input from relevant stakeholders about the deployment.											4
sst.sp2.2b	Proactively communicate information about deployment impacts.											4
sst.sp2.2c	For significant impacts, refer to the tactical plan for details about how and when deployment backout or rollback should be performed.											
sst.sp2.2d	Continue to assess and control impacts until deployment issues are resolved.											
sst.sp2.2e	Conduct a post-deployment review.											
COMPLIANCE SCORE 0 0 0												
CHECKLIST SCORE #DIV/0!												

STSM

Worksheet used to assess STSM’s coverage. Contains Specific Goals, Specific Practices and subpractices, used to obtain the results shown in section Strategic Service Management of 4.2 Gap Analysis and in 4.3 CMMI-SVC and Service Quality Model.

 		APPRAISAL REPORT									
PRACTICES	PRACTICE TEXT	RELATED COMPONENTS	SAMPLE APPRAISAL QUESTIONS	Y	N	N/A	IS	O	GAP	NOTES	
STRATEGIC SERVICE MANAGEMENT											
stsm	<i>The purpose of Strategic Service Management (STSM) is to establish and maintain standard services in concert with strategic needs and plans.</i>	From wpsp1.1a*									
SG 1 Establish Strategic Needs and Plans for Standard Services										#DIV/0!	
stsm.sg1	<i>Strategic needs and plans for standard services are established and maintained.</i>										
SP 1.1 Gather and Analyze Data										#DIV/0!	
stsm.sp1.1	<i>Gather and analyze data about the strategic needs and capabilities of the organization.</i>	From sd.sp1.1a									
stsm.sp1.1a	Gather and analyze data on the organization's capabilities.										
stsm.sp1.1b	Gather and analyze data on the organization's strategic needs.										
stsm.sp1.1c	Describe the organization's capabilities and strategic needs.										
stsm.sp1.1d	Communicate the descriptions to relevant stakeholders.										
SP 1.2 Establish Plans for Standard Services										#DIV/0!	
stsm.sp1.2	<i>Establish and maintain plans for standard services.</i>								1, 4		
stsm.sp1.2a	Confirm strategic business objectives.										
stsm.sp1.2b	Recommend requirements for standard services based on strategic business objectives, the organization's capabilities, and strategic needs.								1		
stsm.sp1.2c	Identify needed actions on standard services.	Link to opm.sg2* Link to wmc.sg2* Link to ssd.sg2							1		
stsm.sp1.2d	Review and get agreement from relevant stakeholders on the standard services to be established and maintained.								1, 4		
SG 2 Establish Standard Services										#DIV/0!	
stsm.sg2	<i>A set of standard services is established and maintained.</i>	From cam.sp1.1 From cam.sp1.2c From cam.sp1.3 From sd.sg1 From ssd.sp1.2 From wp.sp1.4*									
SP 2.1 Establish Properties of Standard Services and Service Levels										#DIV/0!	
stsm.sp2.1	<i>Establish and maintain properties of the organization's set of standard services and service levels.</i>	Link to opd.sp1.1* From sd.sp1.2							2		
stsm.sp2.1a	Select standard services.								2		
stsm.sp2.1b	Specify the critical attributes of each service.								2		
stsm.sp2.1c	Determine common and variable parts of standard services.								2		
stsm.sp2.1d	Organize services into service lines as needed.								2		
stsm.sp2.1e	Define service levels.								2		
stsm.sp2.1f	Establish tailoring criteria as appropriate.								2		
stsm.sp2.1g	Identify needs and expectations for service systems that deliver standard services as appropriate.	Link to ssd.sg2							2		

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SP 2.2 Establish Descriptions of Standard Services										#DIV/0!
stsm.sp2.2		Establish and maintain descriptions of the organization's defined standard services.							4	
stsm.sp2.2a	Develop the descriptions of standard services for all relevant users.									
stsm.sp2.2b	Conduct peer reviews on the descriptions with relevant stakeholders.									4
stsm.sp2.2c	Revise the descriptions as necessary.									
stsm.sp2.2d	Store the descriptions in a location and medium where all intended users have access.									4
COMPLIANCE SCORE										0 0 0
CHECKLIST SCORE										#DIV/0!