Software Industry
Process Model

MoProSoft

Version 1.3.2
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Change Log

Date	Version	Description	Party responsible for accepting changes
06/Dec/05	V 1.3.1	Translated from 1.3 Spanish version	Hanna Oktaba
27/Apr/06	V 1.3.2	Replacement of relationship of MoProSoft to ISO/IEC TR 15504 for ISO/IEC 2207:1995/Amd.1:2002(E)	Hanna Oktaba

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1. Prologue

The present document was developed at the request of the Ministry of Economy to serve as the basis to the Mexican Standard for Software Development and Maintenance Industry, under the agreement with the School of Science, Universidad Nacional Autónoma de México.

The Publishing Group thanks Øyvind Mo for preparing Annex A1. Relationship of MoProSoft with ISO 9001:2000, CMM v1.1 and ISO/IEC 12207:1995/Amd.1:2002(E) and Itera for having provided the Rational Rose license to prepare the UML diagrams contained herein.

2. Introduction

Document Purpose

The purpose of this document is to present a Software Industry Processes Model (MoProSoft) in Mexico fostering the standardization of its operation through the incorporation of best practices in software management and engineering. Adopting the model will allow raising that capability of organizations to offer quality services and reach international level of competitiveness.

Requirements

Provide the software industry in Mexico, which is largely made up of small and medium-size companies, with a model based on best international practices and the following characteristics:

- Easy to understand
- Easy to apply
- Economical in its adoption
- The basis to reach successful evaluations with other models or standards, such as ISO 9000:2000 [1] or CMM®[1] V1.1[2]

Scope

The MoProSoft processes model is addressed to companies or internal areas[2] devoted to software development and/or maintenance.

Organizations which do not have established processes may use the model adjusting it to their needs. On the other hand, organizations that already have established processes may use it as a reference to identify missing elements.

[1] CMM is a registered trademark in US Patent and Trademark Office by Carnegie Mellon University

[2] In the rest of the document, the term “organization” will be used to refer to a company or internal area in charged of software development and/or maintenance.

Criteria

For the preparation of the MoProSoft processes model, the following criteria were applied:

1. Generate a process structure in accordance with the structure of software industry organizations (Top Management, Management and Operations).
2. Emphasize the role of Top Management in strategic planning, its review and continuous improvement as the driver of the good functioning of the organization.
3. Consider Management as a resource, process and project provider, as well as the party responsible of overseeing compliance with the organization's strategic goals.
4. Consider Operations as the developer of software development and maintenance projects.
5. Clearly and consistently integrate critical elements to define processes and inherent relationships.
6. Integrate the elements required for managing projects in a single process.
7. Integrate elements for software products engineering in a single framework that includes all support processes (verification, validation, documentation and configuration control).
8. Emphasize the importance of resource management, in particular those making up the organization's knowledge base, such as: measurements, process, documentation and data gather on the use and lessons learned.
9. Base the process model on ISO9000:2000 and level 2 and 3 of CMM® V.1.1. Use ISO/IEC 12207:1995/Amd.1:2002(E) [3] as a general framework and incorporate the best practices of other reference models, such as PMBOK [4], SWEBOK [9] and other more specialized ones.

Process-Based Approach

Software development and maintenance is carried out through a series of activities performed by work teams. Software Engineering has identified best practices to perform these activities gathering successful software and worldwide industry experiences. These practices have been organized by application areas, and have been widely known as key process areas, in the case of CMM, or as processes in ISO/IEC 12207:1995/Amd.1:2002(E).

MoProSoft focuses on processes and considers three basic organization or structure levels: Top Management, Management and Operations. The model intends to support organizations in the standardization of their practices, the evaluation of their effectiveness and continuous improvement.

3. Definitions

Introduction

This section defines the basic concepts to describe the process model.

Concept	Description
Process category	A set of processes that address the same general activity area within an organization.
Process	Set of interrelated practices, carried out through roles and automated elements, which by using resources and based on supplies produce a

Concept	Description
	business satisfaction factor for the customer.
Purpose	Aim to which an action or operation is undertaken.
Indicator	Mechanism that shows or signifies something with evidence and facts.
Role	Is responsible for a set of activities of one or more processes. A Role may be assumed by one or more part- or full-time individuals .
Product	Any element generated in a process.
Practice	Set of elements, such as activities, roles, infrastructure and measurements, that when carried out describe the execution of the process.
Activity	Set of specific task assigned to perform one or more roles.
Verification	Activity to confirm that the product appropriately reflects the requirement specified for it.
Validation	Activity to confirm that the resulting product is capable of satisfying the requirements for its specified application or intended use.
Work flow	Framework expressing the relationships between the activities of the process. Relationship may be sequential, parallel, cyclical, selected or nested.
Tailoring guide	Modification to practices, input and output of a process, as long as it does not affect goals achievement.
Management	Undertaking active tasks focused to attaining a business.
Administration	Organize work and allocate resources.
Organization	Company or internal area of an organization in charged of software development and/or maintenance.
Infrastructure	Set of elements or services deemed necessary for the creation and operation of an organization.
Measurement	Action or effect of measuring.
Knowledge base	Repository of all products such as software products, plans, reports, Records, lessons learned and other documents.
Exceptional situation	Circumstance that prevents the development of an activity.
Lesson learned	Positive or negative experience obtained during the performance of any activity.
Prospecting	Feasibility or capability study on whether something is capable of producing or giving results in the future; based on the analysis of previously collected data.

4. Process Pattern

Introduction	Process pattern is a framework of elements that will serve to document processes. It is made up by three parts: General Process Definition, Practices and Tailoring Guides. The general process definition identifies its name, category, purpose, general activity description, goals, indicators, quantitative objectives, responsibility and authority, sub-processes (if any), related processes, inputs, outputs, internal products and bibliographical references. Practices identify the roles involved in the process and the training required, describe activities in detail, associating them to process goals, present a work flow diagram, describe verifications and validations required, list products that are incorporated into the knowledge base, identify the infrastructure resources necessary to support activities, establish process measurements, as well as training practices, management of exceptional situations and use of lessons learned. Tailoring Guides suggest process modifications that shall not affect its goals.

4.1. Description of the Process Pattern

General Process Definition

Process	Process name, preceded by the acronym established in the definition of the process model structure elements.
Category	Name of the category to which the process and acronym belong, in parenthesis.
Purpose	General measurable goals and results expected of the effective implementation of the process.
Description	General description of activities and products that make up process workflow.
Goals	Specific goals which purpose is to ensure compliance of the process purpose. Goals are identified as G1, G2, etc.
Indicators	Definition of indicators to evaluate the effectiveness of the compliance with the process goal. Indicators are identified as I1, I2, etc. and in parenthesis one or more of the goals being answered.
Quantitative Objectives	Numerical value or satisfaction range by indicator.
Responsibility and authority	Responsibility is the main role responsible for the execution of the process. Authority is the role responsible for validating process execution and purpose compliance.

Sub-process (optional)	List of processes of which the process is made up.
Related processes	Names of related processes.

Inputs

Name	Source
Name of product or resource	Reference to product or resource origin

Outputs

Name	Description	Destination
Name of product or resource	Description and features of product or resource	Reference to user of product or resource

Internal products

Name	Description
Name of product generated and used in the process itself	Description and features of product

Bibliographical references	Bibliography that supports the process: standards, reference model, books and other sources.

Practices

Roles involved and training

Identification roles involved and training required.

Role	Abbreviation	Training
Role name	Role abbreviation	Training required by the role to be able to execute the process.

Activities

Associated to goals and describe the tasks and responsible roles.

Role	Description
A1. Name of activity (G1, G2, ...)	
Abbrev. of (of role(s)	A1.1 Description of task. 1. If the activity is a verification or validation, reference will be made towards identification.
	A1.2 Description of task 2
A2. Name of activity (G1, G2, ...)	
	A2.1 Description of task 1
	A2.2 Description of task 2

Workflow diagram

UML activity diagram [11], where workflow and product activities are specified.

Verifications and validations

The verifications and validations associated to products generated in the mentioned activities are defined.

The defects must be corrected before continuing with further activities identified both in the verification and the validation.

Validation of a product may be internal (within the organization) or external (by the customer) in order to obtain its authorization.

Validations should be made once verifications associated to the product are made.

Verification or validation	Activity	Product	Role	Description
Identification of verification or validation **Ver1** or **Val1**	Identification of task	Product Name	Abbreviation of role responsible for performing verification and validation	Description of verification and validation to be made on the product.
Ver2 or **Val2**				

Incorporation into knowledge base

Product	Approval Guidelines
Product name	Identification of verification, validation or description of another form of approval, in the event none of these are required, write the word None. These approvals define the moment as of which the product will be under the control of the Organization's Knowledge.

Infrastructure resources	**Activity** / **Resource** Identification of activity or task / Software and hardware tools requirements.
Measurements	Measurements established to evaluate process indicators. Measurements are identified as M1, M2, etc. and the corresponding indicator identification is specified in parenthesis.
Training	Definition of rules to provide the training necessary to the roles involved in the process.
Exceptional situations	Definition of mechanisms to handle exceptional situations during process execution.
Lessons learned	Definition of mechanisms to take advantage of lessons learned during process execution.

Tailoring guides

Description of possible process changes that should not affect its goals.

Guide identification	Description
Guide identification	Description

4.2. Using the process pattern

Remarks	The process pattern was used as a framework to document MoProSoft processes. Organizations adopting the process model may adapt it to their needs following the rules included in section 6. The process pattern used by organizations may be different from that suggested in this model, but it must maintain the goals, indicators, and quantitative goals corresponding to the achievement of the general MoProSoft purpose. The process pattern may be used to document and integrate other processes that were not covered in the model.

5. Process Model Structure

Introduction	The process model (MoProSoft) has three process categories: Top Management, Management and Operations, reflecting the structure of an organization. The Top Management category contains the Business Management process. The Management category is made up by Process Management, Project Portfolio Management and Resource Management. The last one is made up by the sub-processes: Human Resources and Work Environment; Goods, Infrastructure, and Services; and Organization's Knowledge. The Operation category is made up by the Specific Projects Management and Software Development and Maintenance. The roles responsible for executing the practices are defined in each process. Roles are assigned to the organization's personnel according to their skills and training to perform them. The roles in the Steering Committee, Responsible for Process and other roles involved are classified in MoProSoft. The Customer and the User are also considered as roles which are external to the organization.

5.1. Process categories

Top Management Category (TM)	Process category addressing the Top Management practices related to the business management. It provides the guidelines for the processes in the Management Category, and receives feedback from the information generated by them.
Management Category (MAN)	Process category addressing management practices for processes, projects portfolio and resources based on the guidelines established by the Top Management Category. Provides the elements for the functioning of the Operation's Category processes, receives and evaluates information generated by them and communicate the results to the Top Management Category.
Operations Category (OPE)	Process category addressing the practices of software development and maintenance projects. This category performs the activities according to the elements provided by the Management Category and delivers the information and the products generated.

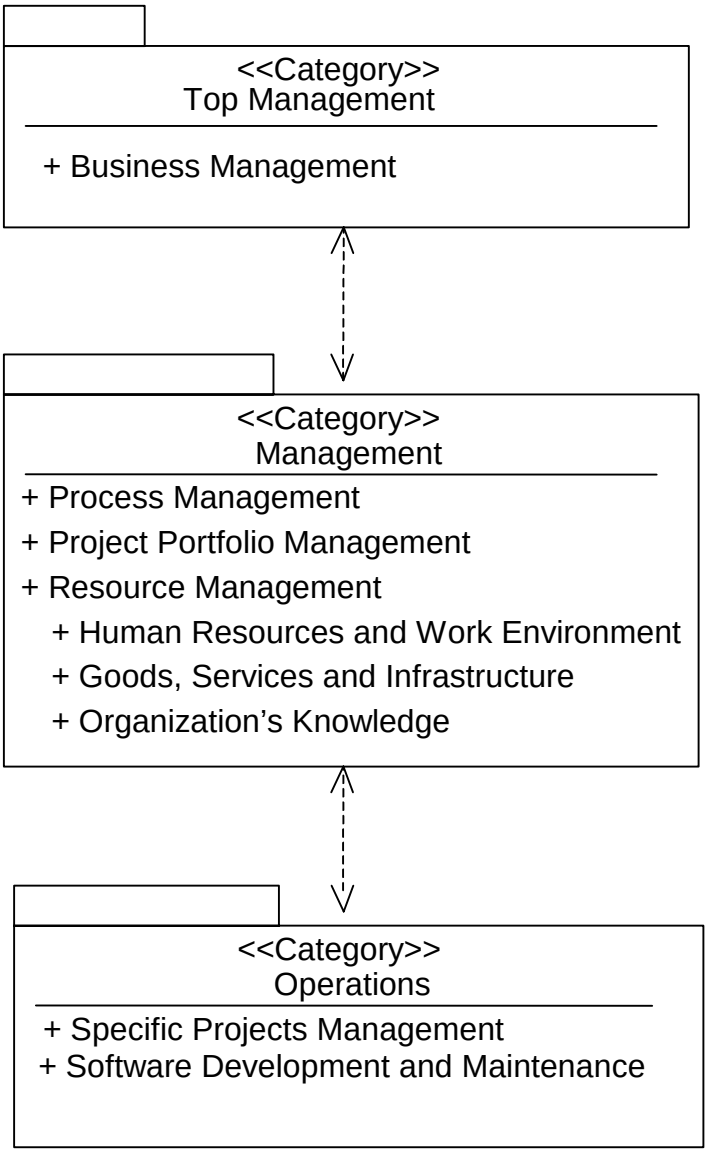

Figure 1: Process category diagram.

5.2. Process

TM.1 Business management	The purpose of Business Management is to establish the reason for being of the organization, its goals and the conditions to achieve them, for which it is necessary to take into account that customer's needs, as well as to evaluate results in order to propose changes that allow continuous improvement. Additionally, it enables the organization to respond to a changing environment and to its members to work based on the goals established.
MAN.1 Process Management	The purpose of Process Management is to establish the processes of the organization, based on the processes required and identified in the strategic plan. Also, to define, plan, and implement the improvement activities for these.
MAN.2 Project Portfolio Management	The purpose of Project Portfolio Management is to ensure that projects contribute to fulfilling the organization's goals and strategies.
MAN.3 Resource Management	The purpose of Resource Management is to obtain and provide the organization with the human resources, infrastructure, work environment and suppliers, as well as to create and maintain the organization's knowledge base. The purpose is to support compliance of the organization's strategic plan goals.
MAN.3.1 Human Resources and Work Environment	The purpose of Human Resources and Work Environment is to provide the human resources adequate for complying with the responsibilities assigned to the roles within the organization, as well as to evaluate the work environment.
MAN.3.2 Goods, Services and Infrastructure	The purpose of Goods, Services and Infrastructure is to provide suppliers of goods, services and infrastructure that satisfy the process and projects acquisition requirements.
MAN.3.3 Organization's Knowledge	The purpose of Organization's Knowledge is to keep available and manage the knowledge base containing the information and products generated by the organization.
OPE.1 Specific Projects Management	The purpose of Specific Projects Management is to establish and carry out systematically the activities that allow complying with the goals of a project on time and within expected costs.
OPE.2 Software Development and Maintenance	The purpose of Software Development and Maintenance is the systematic performance of activities such as analysis, design, construction, integration and testing of new or modified software products, fulfilling the specified requirements.

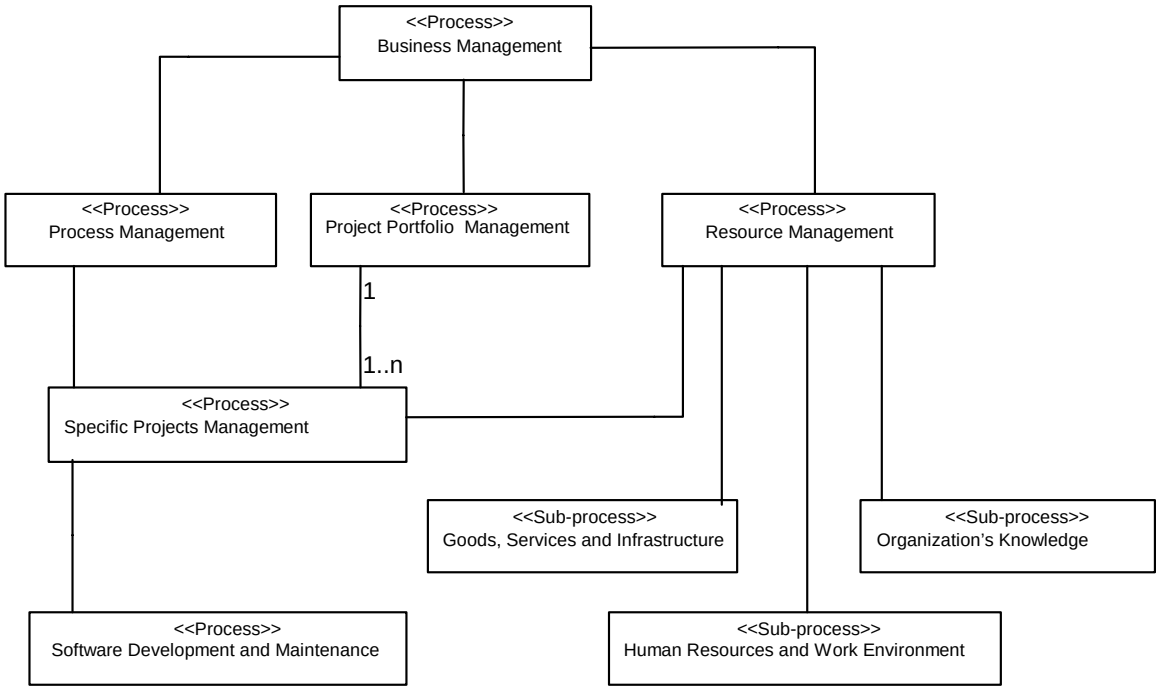

Figure 2: Diagram of relations between processes.

5.3. Roles

Customer	The one who requests a software product and finances the project for its development or maintenance.
User	The one who will use the software product.
Steering Committee	The individuals in charge of running an organization and who are responsible for its successful functioning.
Responsible for Process	The individual in charge of performing the practices of a process and complying with its goals.
Stakeholder	Other roles with abilities required for the execution of specific activities or tasks. For example: Analyst, Developer, Reviewer, among others.

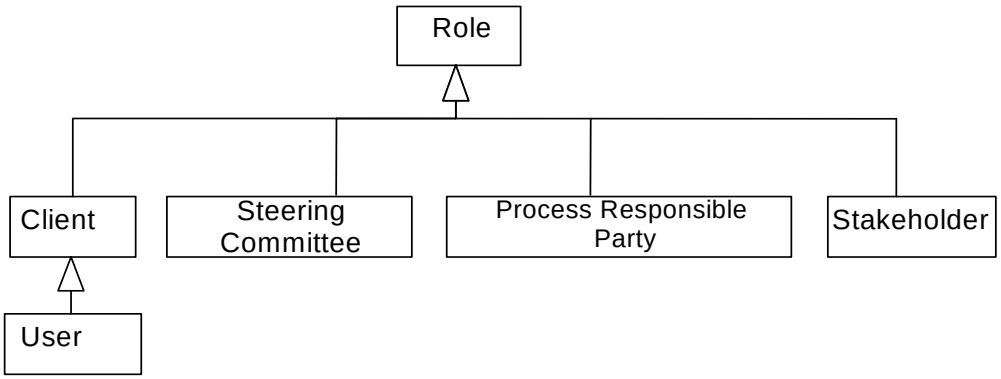

Figure 3: General roles classification.

5.4. Products

Software Product	It is the product generated in the Software Development and Maintenance process. Software products are classified in general as Specification Requirements, Analysis and Design, Software, Testing, Traceability Record and Manual. This classification may be specialized according to the needs, for example Testing may mean Test Plan or Test Report; Manual, may be specialized in User Manual, Operations Manual or Maintenance Manual; Software may be a Component, a System of components or a System made up of systems.
Software Configuration	It is a consistent set of software products.

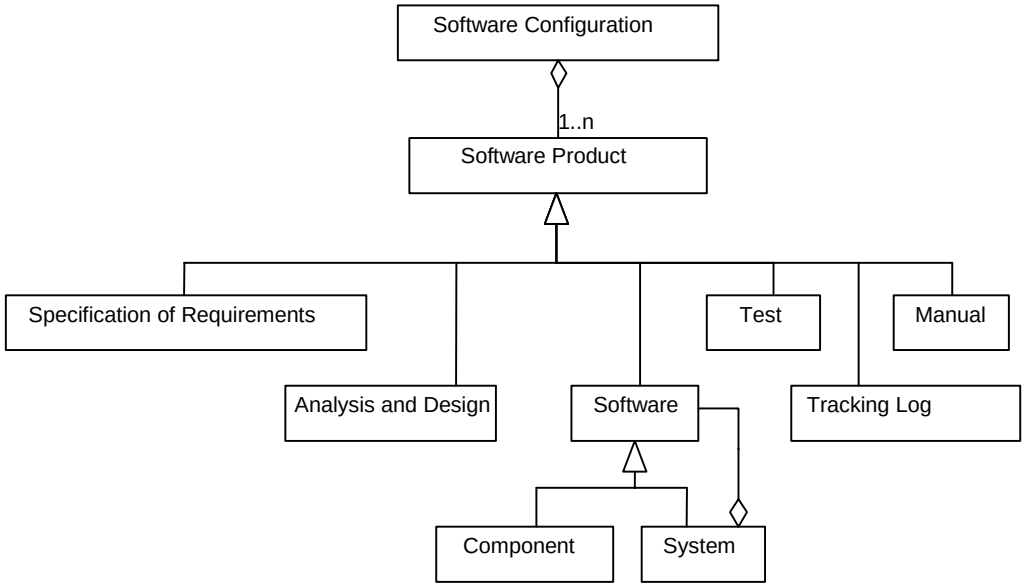

Figure 4: Configuration and software products.

Plan	Detailed program of activities, individuals in charge and schedule.
Report	Report of activities undertaken.
Record	Evidence of activities undertaken.
Lesson Learned	Positive or negative experience obtained during the performance of some activity.
Other Product	Product, different from above, also generated in processes. For example, Contract, Technological Proposals, Process Documentation, among others.

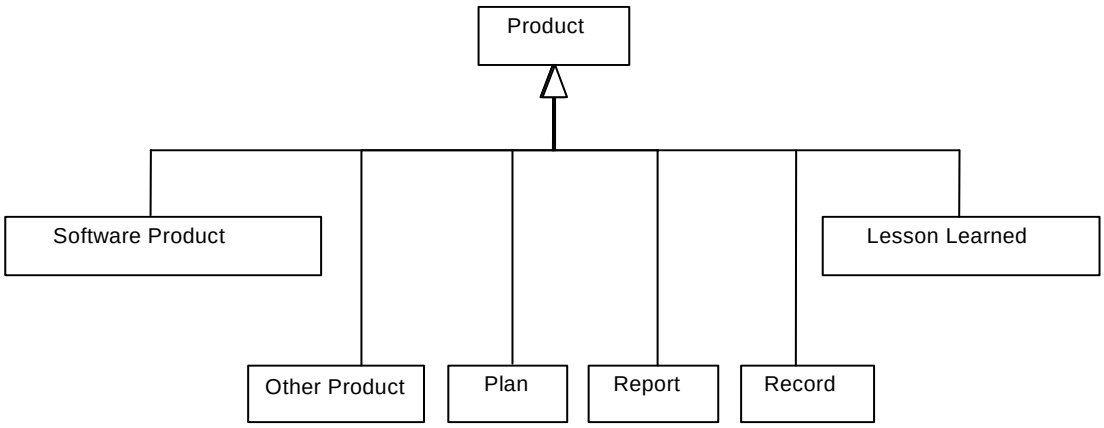

Figure 5: General products classification.

6. Using the Process Model

Organizations without established processes

To use this model in an organization that does not have established or documented processes, an instance of each one of the processes must be generated, taking into account the following considerations:

- Define the quantitative objectives as per the organization's strategies.
- Review the names of roles and products (inputs, outputs or internal) and, if applicable, substitute them by those the organization is used to.
- For each product, define the documentation standard complying with the characteristics mentioned in the product description.
- Define the infrastructure resources of each process.
- Analyze if the measurements of each process are applicable within the context of the organization and, if not applicable, modify them.
- Use the tailoring guides to adapt the process based on the organization's strategies.
- Afterward substitute the model's tailoring guidelines with adequate guidelines for the organization.

Additionally, for the Software Development and Maintenance process, the following is required:

- Define specific methods, techniques or procedures for activities, tasks, verifications and validations.

Organizations with established process

To use this model in an organization that has established or documented processes, compare these and the MoProSoft model to identify the coincidences and discrepancies.

The organization shall analyze discrepancies and plan the adjustment activities of processes to achieve complete MoProSoft coverage.

Implementation and continuous improvement

The organization shall establish the implementation strategy of the defined processes. It may decide to test them in pilot projects or deploy them at the same time to all the organization.

Processes shall evolve based on improvement suggestions and shall start reaching the organization's strategic plan goals each time with more ambitious quantitative objectives. In this way, the organization may begin reaching maturity through the continuous improvement of its processes.

7. Top Management Category (TM)

7.1. Business Management

General Process Definition

Process Category	**DIR.1 Business Management**
	Top Management (DIR)
Purpose	The purpose of Business Management is to establish the reason for being of the organization, its goals and the conditions to achieve this, for which reason it is necessary to take into account the customer's needs, as well as to evaluate the result in order to be able to propose changes that allow continuous improvement. Additionally, it enables the organization to respond to a changing environment and its members to work based on established goals.
Description	The Business Management process is comprised by strategic planning, the preparation to undertake the strategy, and the evaluation and continuous improvement of the organization. • Strategic Planning: Establishes the decisions on the critical aspects needed to achieve success in the organization, defining a *Strategic Plan*, with the following elements: - *Mission, Vision and Values*. - The organization's *Goals*, including quality goals, as well as the way in which these will be attained by defining *Strategies*. - The way in which the achievement of *Goals* is measured, by means of defining *Indicators and Quantitative Objectives* associated to such *Goals*. - *Required Processes* with their indicators and goals. - *Project Portfolio* enabling the execution of *Strategies*. - *Organizational Structure* and *Resources Strategy* that support the implementation of processes and the execution of defined projects, considering the elements of the *Knowledge Base* necessary for storing and inquiring the information generated in the organization. - *Budget,* which includes expected expenses and income. - *Assessment Periodicity* of the *Strategic plan* - *Customer Communication Plan* including the communication mechanisms with the customer for service. • Performance Preparation: The *Communication and Implementation Plan* of the *Strategic Plan* that allows disseminating it to the members of the organization is defined, ensuring that they consider it as the means to achieve the satisfaction of the customer's needs. This plan also sets forth the adequate conditions in the organization's environment to undertake the project and implement the processes.

	• Evaluation and Continuous Improvement: Analyzes the *Quantitative and Qualitative Reports* of processes and projects*, Customer-related Corrective or Preventive Actions Report, Financial Reports, Technological Proposals* and takes into account the *External Factors* to the organization. Based on the results of the analysis, *Improvement Proposals* to the *Strategic Plan* are generated. Furthermore, based on the *Process Measurement Plan* received by Process Management, the *Measurements and Improvement Suggestions Report* is generated. Once the *Strategic Plan* has been evaluated and *Improvement Proposals* have been detected, it will be necessary to review the plan's elements affected and to make the necessary changes.
Goals	G1 Achieve a successful strategic planning by complying with the *Strategic Plan*. G2 Have the organization work based on the *Strategic Plan* through its correct communication and implementation. G3 Improve the *Strategic Plan* through the implementation of *Improvement Proposals*.
Indicators	I1 (G1) Performance of the Indicators of the *Strategic Plan Goals* is satisfactory. I2 (G2) The members of the organization know the *Strategic Plan* and work based on it. I3 (G3) The improvement proposals are defined based on the *Evaluation Report*. I4 (G3) Modifications are made to the *Strategic Plan* as per the *Improvement Proposals*.
Quantitative Objectives	Numerical value or satisfaction range by indicator.
Responsibility and authority	Responsible party: • Responsible for Business Management Authority: • Steering Committee
Related processes	Process Management Project Portfolio Management Resource Management Organization's Knowledge Specific Projects Management

Inputs

Name	Source
Quantitative and Qualitative Report of processes and projects.	Process Management Project Portfolio Management Resource Management
Processes Plan • *Processes Measurement Plan*	Process Management
Customer-related Corrective or Preventive Actions Report	Project Portfolio Management
Technological Proposals	Resource Management
External Factors (technology trends, customers and competitors)	External
Financial Reports	Organization

Outputs

Name	Description	Destination
Strategic Plan	*Mission*: Reason for being of the organization. *Vision*: Desired positioning of the organization in the market. *Values*: Qualities and virtues shared amongst the members of the organization and that are desirable to maintain. *Goals*: Expected results to comply with *Mission* and *Vision*. *Indicators*: Elements to assess compliance with goals. *Quantitative Objectives*: Numerical value or satisfaction range for each indicator. *Strategies*: Way to achieve the goals. *Required Processes*: Identifying processes with their purpose, goal, indicators and quantitative objective to achieve the strategies. *Project Portfolio*: Set of external and internal projects and project opportunities. *Organizational Structure*: Definition of areas and responsibilities of the organization required to carry out the strategies. *Resources Strategy*: Definition, planning and allocation of organization resources for complying with strategies, considering the elements of the *Knowledge Base* for storage and query of information generated in the organization.	Process Management Project Portfolio Management Resource Management

Name	Description	Destination
	Budget: Expected expenses and income for specific period. *Evaluation Periodicity*: Definition of periods to carry out assessment and improvement revisions. *Customer Communication Plan*: Definition of mechanisms to establish communication channels with customers.	
Communication and Implementation Plan	Mechanisms to let know the *Strategic Plan* to the organization, emphasizing compliance with customer's needs. Conditions required in the organization's environment for performing projects and deploying process.	Project Portfolio Management Resource Management Administration of Specific Projects
Measurement and Improvement Suggestions Report	Record containing: ***** Measurements of the Business Management process indicators (see **Measurements**). ***** Business Management process improvements suggested (methods, tools, formats, standards, among others).	Process Management
Acquisition and Training Plan	Requests with resource purchase requirements. Includes trained personnel, suppliers, infrastructure and tools, as well as training requirements.	Resource Management
Lessons Learned	Record of best practices, recurring problems and successful experiences, during the implementation of this process.	Organization's Knowledge

Internal products

Name	Description
Improvements Proposal	Description of improvement suggestions for *Strategic Plan* elements.
Evaluation Report	Containing the record of results of the activity A3.1. Information, analysis and performance evaluation.
Verification Report(s)	Record of participants, date, place, duration and defects found.
Validation Report(s)	Record of participants, date, place, duration and defects found.

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Practices

Roles Involved and Training

Role	Abbreviation	Training
Steering Committee	SC	Knowledge of the effort required to carry out the strategic planning, and above all be committed to it.
Responsible for Business Management	RBM	Knowledge of activities necessary to define them and successfully implement the Business Management Process.
Management Group	MG	Knowledge to manage projects and implement the processes defined.

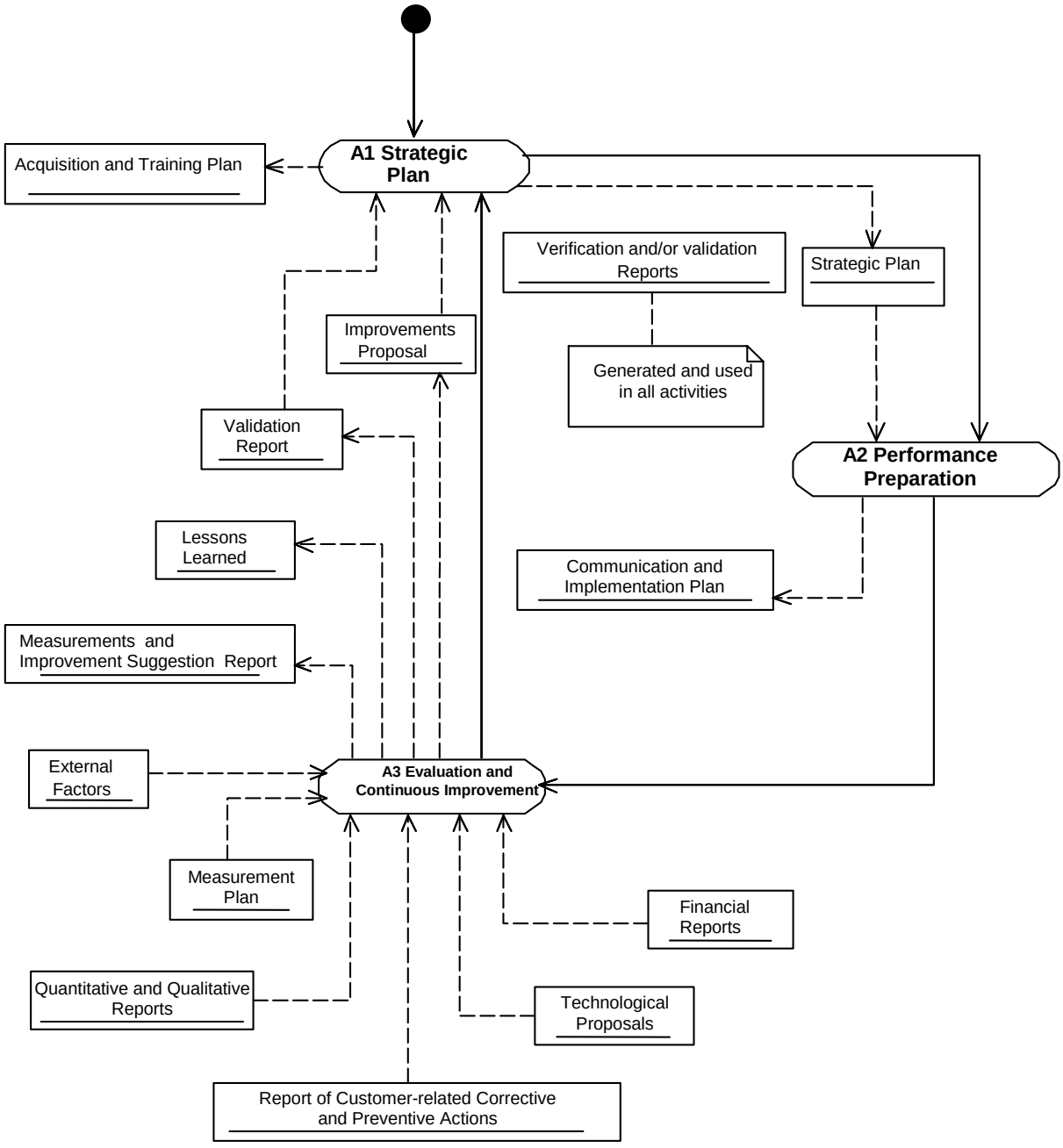
Activities

Role	Description
A1. Strategic Planning (G1)	
SC	A1.1. Articulate, document or update the *Mission, Vision and Values,* to define the Quality Policy.
RBM	A1.2. Understand the current situation. • Environmental analysis – identification of opportunities and trends based on: testimonies, competitive information, technological trends, etc. • Internal situation analysis – identification of strengths and weaknesses based on: financial analysis, resource identification, among others.

Role	Description
RBM	A1.3. Develop or update *Goals* and *Strategies*, considering the *Improvements Proposals,* if any. • Define or update the *Goals* and *Strategies* that specify the means to attain these goals. • Define or update the *Indicators* that allow measuring the achievement of *Goals.* Determine the current value of indicators and establish the desired *Quantitative Objectives*.
RBM MG	A1.4. Define or update processes and projects, considering the *Improvement Proposals,* if any. • Identify *Required Processes.* • Define the necessary *Project Portfolio*.
RBM	A1.5. Define or update the adequate *Organizational Structure* to implement the plan, for which it is necessary to consider any *Improvements Proposals*.
RBM	A1.6. Define or update the *Resources Strategy*, considering any *Improvements Proposals,* allowing to: • Identify and distribute resources necessary to implement the plan. • Identify the *Knowledge Base* elements necessary for storing and querying information generated in the organization.
RBM SC	A1.7. Calculate the required budget (expected expenses and income) to implement the *Strategic Plan* and determine the period for which it will be applied.
RBM SC	A1.8. Define or update the *Periodicity of the Strategic Plan* evaluation*,* considering any *Improvements Proposals*.
RBM SC	A1.9. Define communication mechanisms with the customer for each review and document them in the *Customer Communication Plan*.
RBM	A1.10. Integrate and document the *Strategic Plan*.
RBM	A1.11. Verify the *Strategic Plan* (**Ver1**).
RBM	A1.12. Correct defects found in the *Strategic Plan* based on *Verification Report* and obtain approval of corrections.
SC	A1.13. Validate the *Strategic Plan* (**Val1**).
RBM	A1.14. Correct defects found in the *Strategic Plan* based on the *Validation Report* and obtain approval of corrections.
RBM	A1.15. Prepare *Acquisition and Training Plan* for Business Management Process.
A2. Performance Preparation **(G2)**	
RBM SC	A2.1. Prepare adequate environment for implementing *Strategic Plan*.
RBM SC	A2.2. Define and execute the *Communication and Implementation Plan* of the *Strategic Plan*, identifying: • The communication channels and means that allow to effectively disseminate the *Strategic Plan*. • How to implement the necessary changes in the organization's structure.

Role	Description
	• How to establish and distribute the necessary and adequate resources.
SC	A2.3. Validate the *Communication and Implementation Plan* (**Val2**).
RBM	A2.4. Correct defects found in the *Communication and Implementation Plan* based on *Validation Report* and obtain approval of corrections.
A3. Evaluation and Continuous Improvement (G3)	
RBM, SC	A3.1. Analyze the information and performance evaluation: • Analysis of *Quantitative and Qualitative Reports* of processes and projects to compare results with the goals established. • *Customer-related Corrective or Preventive Actions Report* analysis, regarding compliance of customer's needs. • Analysis of *Technological Proposals*, to adopt some in benefit of the organization's activities. • Analysis of *Financial Reports* to determine project feasibility and required modifications, as well as to determine adjustments required to the established budget. • Analysis of *External Factors*, for possible modification. • Evaluation of the performance reached with current strategy, taking into account the compliance evaluation with *Goals* according to the result of its *Indicators, according with* results of its related projects and processes.
RBM	A3.2. Generate *Evaluation Report* where details of task A3.1 are recorded.
RBM, MG, SC	A3.3. Generate *Improvements Proposal* to current *Strategic Plan*.
SC	A3.4. Validate *Improvements Proposal* (**Val3**).
RBM	A3.5. Correct defects found in *Improvements Proposal* based on *Validation Report* and obtain approval of corrections.
RBM	A3.6. Generate *Measurement t and Improvement Suggestions Report* for this process, as per *Processes Measurement Plan*.
RBM	A3.7. Identify *Lessons Learned* and integrate them to the *Knowledge Base.* For example, successful best practices, risk management experiences, recurring problems, among others, may be taken into account.

Workflow Diagram



Verifications and Validations

Verification or Validation	Activity	Product	Role	Description
Ver1	A1.11	*Strategic Plan*	RBM	Verify that all elements are consistent and comply with following features: *Indicators*: allow measuring the progress made on goals, and have quantifiable objectives. *Required Processes, Project Portfolio:* that processes and projects which support one or several previously defined goals, as well as ensure that all goals are supported by adequate processes or projects. *Organizational Structure:* feasible with regard to project and work environment. *Resources Strategy:* feasible with regard to budget and work environment. *Customer Communication Plan:* that plan includes the definition of the environment to know the customer's needs. Defects found will be documented in a *Verification Report.*
Val1	A1.13	*Strategic Plan*	SC	Validate that its accordance with the organization's expectations. Defects found will be documented in a *Validation Report.*
Val2	A2.3	*Communication and Implementation Plan*	SC	Validate that it covers all levels of the organization. Defects found will be documented in a *Validation Report*.
Val3	A3.4	*Improvements Proposal*	SC	Validate they are feasible with regard to resources and time to make improvements. Defects found will be documented in a *Validation Report.*

Incorporation to the Knowledge Base

Product	Approval Guidelines
Strategic Plan	Ver1, Val1
Communication and Implementation Plan	Val2
Improvement Proposal	Val3
Measurement and Improvement Suggestions Report	None
Assessment Report	None
Acquisition and Training Plan	None
Lessons Learned	None
Verification Report(s)	None
Validation Report(s)	None

Infrastructure Resources

Activity	Resource
A1	Tools allowing documenting, handling and controlling of the *Strategic Plan.*
A2	Tools allowing publishing and disseminating *Strategic Plan* to all organization members.
A3	Tools that allow to periodically record progress made by *Goal Indicators.*

Measurements

Based on the *Processes Measurement Plan*, a periodic report on progress made on the process indicators, regarding defined quantitative objectives, is generated. We suggest the following measurements:

M1 (I1) Evaluate *Strategic Plan Indicators* using information contained in the *Knowledge Base* and *Evaluation Report* and compared with the *Quantitative Objectives* corresponding to each *Indicator*, to verify progress made.

M2 (I2) Perform periodical surveys on members of the organization to verify the level of knowledge of the *Strategic Plan* and its application to their activities, as well as the awareness of the customer's needs.

M3 (I3) Compare the *Improvements Proposal* to verify that is defined based on the analysis of *Quantitative and Qualitative Report* for Process and Project *, Corrective and Preventive Actions, Technological Proposals, Financial Reports and External Factors.*

M4 (I4) Compare the *Strategic Plan* to verify that is modified based on *Improvement Proposal.*

Training

The RBM shall offer the facilities so that the personnel involved in the Business Management process participates in the current *Knowledge Base Training Plan Activities.*

Exceptional Situations	Roles involved in Process Management shall notify RBM, in a timely manner, of the situations that prevent the development of the assigned activities. RBM shall respond to these situations and, if it is not able to solve them or they do not fall on his or her responsibility, shall escalate them to the SC.
Lessons Learned	Before initiating the activities assigned, the roles involved in the Business Management process shall consult the *Lessons Learned* in the *Knowledge Base* to leverage the organization's experience and reduce the possibility of recurrent problems.

Tailoring guides

***Strategic Plan* Adjustment**	There are strategic planning models that do not cover the *Mission, Vision and Values* elements, as defined in the *Strategic Plan* mentioned in this process; nevertheless, they include other elements containing general information.
Process modification for internal areas	This process may be adjusted for the internal areas dedicated to software development and maintenance and that make up an organization. In this case, the *Strategic Plan* becomes a plan for the corresponding area and is prepared based on their organization's goals, defined for the area, with the organization's Steering Committee's participation. The *Evaluation Reports* are submitted to the Steering Committee of the organization for evaluation.

8. Management Category (MAN)

8.1. Process Management

General Process Definition

Process Category	**MAN.1 Process Management**
	Management (MAN)
Purpose	The purpose of Process Management is to establish the organization processes based on *Required Processes* identified in the *Strategic Plan*, as well as defining, planning and implementing the corresponding improvement activities.
Description	Process Management comprises the following activities: process planning, preparation for implementation, and process evaluation and control. • Planning. Based on *Required Processes* identified in the *Strategic Plan,* in the *Improvement Plan* and in the *Actions Plan,* the process planning establishes or updates a *Processes Plan* that contains: - *Process Elements Definition,* performed taking into account reference process models, adjusting them to the organization's needs. - *Schedule* for establishing or improving processes by linking activities and responsible parties. - *Acquisition and Training Plan,* requests for trained personnel, suppliers, infrastructure and tools, as well as training requirements. - *Processes Assessment Plan*, including internal and external evaluations. - *Processes Measurement Plan* where measurement types, periodicity and responsibility are specified. - *Processes Risk Management Plan* contains risk identification and evaluation, as well as the corresponding contention and contingency plans. • Preparation for the Implementation. Perform the following tasks: - Designate persons responsible for processes. - Documentation or updating of the organization's *Processes Documentation* as per the established *Process Elements Definition*. - Training of the organization's members in the processes, according to the *Acquisition and Training Plan.* - Implementing pilots of processes, where deemed convenient. • Evaluation and Control. Perform the following tasks: - Follow up of *Processes Plan* activities. - Gathering of *Measurement and Improvement Suggestion Reports,*

	generating the *Quantitative and Qualitative Report* to be submitted to the Responsible for Business Management. Analysis of improvement suggestions contributes to the generation of the *Improvement Plan.* - Execution of the *Assessment Plan*, in order to verify the implementation of processes, gathering findings and improvement opportunities. As a result, the *Assessment Report* and the *Actions Plan* responding the findings, will be documented, and will be complemented by the *Improvement Plan* as per opportunities. - Follow up to *Actions Plan.* - Supervision of risks identified in Processes *Risk Management Plan.* - Identification and documentation of *Lessons Learned*.
Goals	G1 Planning of the process definition, implementation and improvement activities based on *Strategic Plan*. G2 Following-up on process definition, implementation and improvement activities by complying with *Processes Plan*. G3 Improving process performance by complying with *Improvement Plan.* G4 Keeping Business Management informed on the performance of processes through of the *Quantitative and Qualitative Report*.
Indicators	I1 (G1) The *Processes Plan* covers the *Required Processes,* identified in the *Strategic Plan.* I2 (G2) The process definition, implementation and improvement activities are carried out as set forth in the *Processes Plan*. I3 (G2) Members of the organization know their corresponding processes and work based on them. I4 (G2) The organization's processes are documented and updated. I5 *(*G3) *Improvement Plan* is defined based on improvement suggestions and opportunities. I6 (G3) Process performance complies with quantitative goals. I7 (G4) *Quantitative and Qualitative Report* is submitted periodically to Business Management.
Quantitative Objectives	Numerical value or satisfaction range by indicator.
Responsibility and Authority	Responsible party: • Responsible for Process Management Authority: • Responsible for Business Management
Related Processes	All processes.

Inputs

Name	Source

Name	Source
Strategic Plan • *Required processes*	Business Management
Measurement and Improvement Suggestions Report	Business Management Project Portfolio Management Resource Management Human Resources and Work Environment Goods, Services and Infrastructure Organization's Knowledge Specific Projects Management
Resource Allocation	Human Resources and Work Environment

Outputs

Name	Description	Destination
Processes Plan	*Process Elements Definition*: Contains the elements set forth for the processes. *Schedule*: Dates for activities and process definition, implementation and improvement, including responsible parties. *Acquisition and Training Plan*: Requests for resource purchasing requirements. Includes trained personnel, suppliers, infrastructure and tools, as well as training requirements. *Assessment Plan*: Proposes the ways in which processes will be evaluated, including internal or external evaluations. *Processes Measurement Plan*: Specifies the types of measurements to apply to processes, periodicity and responsibility. *Processes Risk Management Plan*: Contains the identification and evaluation of risks, as well as the corresponding contention and contingency plans.	Business Management Process Management Project Portfolio Management Resource Management Specific Projects Management
Processes Documentation	Set of the organization's processes defined based on the current *Processes Plan*. Each process has the	All processes

Name	Description	Destination
	following structure: Process name, purpose, description, goals, indicators, quantitative goals, responsibility and authority, related processes, inputs, outputs, internal products, roles involved, and training required, activities, verification and validation, incorporation to *Knowledge Base*, infrastructure resources, measurements, exceptional situation, lessons learned and tailoring guide.	
Quantitative and Qualitative Report	Quantitative and qualitative elements obtained from the gathering and analysis of *Measurement* and *Improvement Suggestion Reports.*	Business Management
Lessons Learned	Recording best practices, recurring problems and successful experiences, during implementation of this process.	Organization's Knowledge

Internal Products

Name	Description
Measurement and Improvement Suggestions Report	Record that contains: ***** Measurements of Process Management indicators (see **Measurements**). ***** Process Management improvement suggestions (methods, tools, forms, standards, among others).
Actions Plan	Establishes the actions to be taken in the event of findings arising during the evaluation of the process.
Improvement Plan	Improvement proposals resulting from the analysis of improvement suggestions and opportunities.
Assessment Report	Document containing the evaluation result, including: dates, type of the evaluation, responsible parties, participants, strengths, findings and improvement opportunities.
Verification Report(s)	Record of participants, date, place, duration and defects found.
Validation Report(s)	Record of participants, date, place, duration and defects found.

Bibliographical References

ISO 9001:2000 Quality Management Systems - Requirements

The Capability Maturity Model: Guidelines for Improving the Software Process. Carnegie Mellon University, Software Engineering Institute. 1994. Addison- Wesley.

ISO/IEC 12207:1995/Amd.1:2002(E) Information technology — Software life cycle processes.

Practices

Roles involved and training

Role	Abbreviation	Training
Responsible for Business Management	RBM	Knowledge of the effort required to carry out Process Management and, above all, to be committed to it.
Responsible for Process Management	RPM	Knowledge of the activities necessary to define and successfully implement the Process Management process.
Responsible for Process	RP	Knowledge of process under charge.
Assessor	ASS	Knowledge of methodology and application of the evaluation.

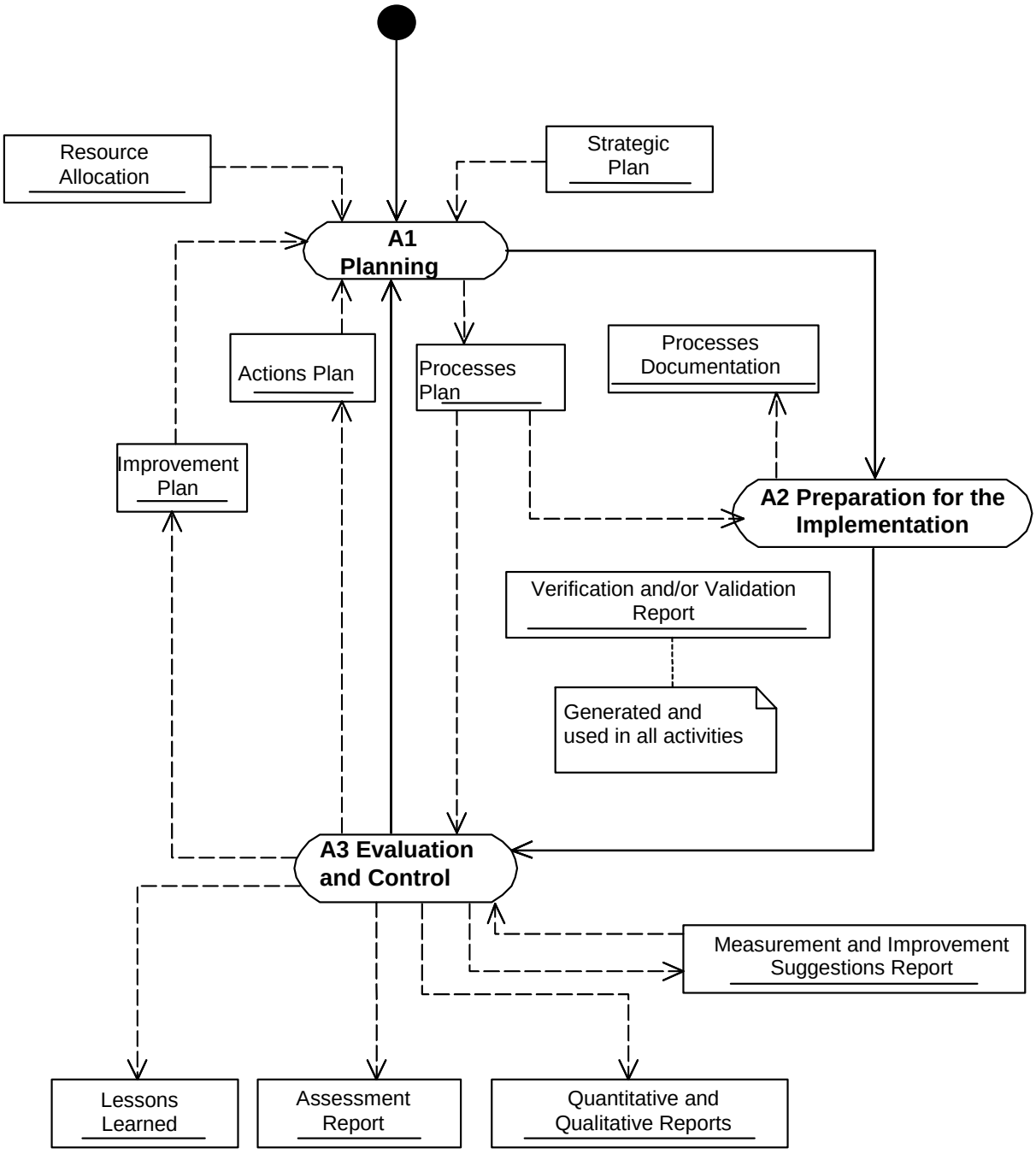
Activities

Role	Description
A1. Planning (G1)	
RPM	A1.1. Establish or update the *Process Elements Definition* • Review the reference process models to define and update the elements and the structure that make up their *Required Processes* in the *Strategic Plan.* • Establish relationships between elements.
RPM	A1.2. Establish *Schedule* to keep and improve processes. • Identify and describe activities. • Assign dates and responsible parties.
RPM	A1.3. Establish or update the *Acquisition and Training Plan*. • Consider the *Allocation of Resources*. • Identify training personnel needs. • Identify infrastructure and tool needs. • Identify the organization's training needs, with regard to processes. • Include a list of possible suppliers.

Role	Description
RPM	A1.4. Establish or update the *Assessment Plan*, for which it shall be necessary to: • Determine the type of evaluations (internal or external) that will be carried out on the organization. • For each evaluation, the purpose, scope, methods and evaluation criteria shall be determined, as well as the calendar and necessary resources.
RPM	A1.5. Establish or update the *Processes Measurement Plan*. • Specify the type of measurements to be carried out on processes. • Determine the periodicity of the measurement application. • Assign a responsible party to each measurement.
RPM	A1.6. Establish or update the *Risk Management Plan* for Process Management. • Identify and evaluate risks in each process. • Define a risk contention plan. • Define a contingency plan.
RPM	A1.7. Integrate the *Processes Plan.*
RPM	A1.8. Verify the *Processes Plan* (**Ver1**).
RPM	A1.9. Correct defects found in the *Processes Plan* based on the *Verification Report* and obtain approval of corrections.
RBM	A1.10. Validate the *Processes Plan* (**Val1**).
RPM	A1.11. Correct defects found in the *Processes Plan* based on the *Validation Report* and obtain the approval of corrections.
A2. Preparation for the implementation (G2)	
RPM	A2.1. Manage the *Acquisition and Training Plan* identified in the *Processes Plan*.
RPM	A2.2. Assign and notify those Responsible for Processes.
RP	A2.3. Prepare and update *Process Documentation* as per *Processes Plan*. • If the organization does not have documented processes, generate process instances of this model adjusted to the organization's needs. • If the organization has documented processes, identify processes or process elements already defined and complement them with any missing elements in this model. • Additional processes may be added to this model, making sure that they are consistent with the existing ones.
RPM	A2.4. Verify *Process Documentation* (**Ver2**).
RPM	A2.5. Correct defects found in *Process Documentation* based on *Verification Report* and obtain approval of corrections.
RPM RP	A2.6. Train the organization on the processes.
RPM	A2.7. Implement processes in pilot projects, if deemed necessary.
A3. Evaluation and Control (G2, G3, G4)	
RPM	A3.1. Follow up process implementation activities on *Schedule* established in *Processes*

Role	Description
	Plan.
RPM	A3.2. Generate *Measurements and Improvement Suggestions Report* for this process, as per *Processes Measurement Plan*.
RPM	A3.3. Generate *Quantitative and Qualitative Report* based on *Measurement and Improvement Suggestions Reports* gathered, to be submitted to the Responsible for Business Management.
ASS	A3.4. Perform the evaluations set forth in the *Assessment Plan*. Each evaluation includes: • Identifying and documenting findings detected and establishing the corresponding *Actions Plan*. • Identifying and documenting process improvement opportunities. • Preparing *Evaluation Report*.
RPM	A3.5. Verify *Actions Plan* (**Ver3)**.
RPM	A3.6. Correct defects found in *Actions Plan* based on *Verification Report* and obtain approval of corrections.
RBM	A3.7. Validate *Actions Plan* (**Val2**).
RPM	A3.8. Correct defects found in *Actions Plan* based on *Validation Report* and obtain approval of corrections.
ASS RPM	A3.9. Generate *Improvement Plan* based on improvement suggestion analysis and on the improvement opportunities detected during the evaluation.
RPM	A3.10. Verify *Improvement Plan* (**Ver4)**.
RPM	A3.11. Correct defects found in *Improvement Plan* based on *Verification Report* and obtain approval of corrections.
RBM	A3.12. Validate *Improvement Plan* (**Val3**).
RPM	A3.13. Correct defects found in the *Improvement Plan* based on *Validation Report* and obtain approval of corrections.
RPM	A3.14. Follow up on *Actions Plan* and *Improvement Plan*.
RPM	A3.15. Supervise risk control as per Processes Risk Management Plan.
RPM	A3.16. Identify *Lessons Learned* on processes and integrate them into the *Knowledge Base.* For example, best practices, successful risk management experiences, recurring problems among others, may be considered.

Workflow Diagram



Verifications and Validations

Verification or Validation	Activity	Product	Role	Description
Ver1	A1.8	*Processes Plan*	RPM	Verify that all *Processes Plan* elements are feasible and consistent. Defects found will be documented in a *Verification Report.*
Val1	A1.10	*Processes Plan*	RBM	Validate that *Processes Plan* element definition is in accordance with *Strategic Plan*. Defects found will be documented in a *Validation Report.*
Ver2	A2.4	*Process Documentation*	RPM	Verify that processes identified in the *Processes Plan* are documented as per the *Process Elements Definition* and that they are consistent. Defects found will be documented in a *Verification Report.*
Ver3	A3.5	*Actions Plan*	RPM	Verify that actions are established for all identified findings. Defects founded will be documented in a *Verification Report.*
Val2	A3.7	*Actions Plan*	RBM	Validate that actions are feasible for the organization. Defects found will be documented in a *Validation Report.*
Ver4	A3.10	*Improvement Plan*	RPM	Verify that an answer is given for all identified improvement opportunities. Defects found will be documented in a *Verification Report.*
Val3	A3.12	*Improvement Plan*	RBM	Validate that improvements are feasible for the organization. Defects found will be documented in a *Validation Report.*

Incorporation into the Knowledge Base

Product	Approval Guidelines
Processes Plan	Ver1,Val1
Process Documentation	Ver2
Actions Plan	Ver3, Val2
Improvement Plan	Ver4, Val3
Quantitative and Qualitative Reports	None
Evaluation Report	None
Lessons Learned	None
Verification Report(s)	None
Validation Report(s)	None

Infrastructure Resources

Activity	Resource
A1	Tools that enable documenting, handling and controlling the *Processes Plan.*

A2	Tools that allow documenting and disseminating processes.
A3	Tools that support the performance of the evaluation.

Measurements

Based on the *Processes Measurement Plan,* a periodic progress report on process indicators is generated with regard to defined quantitative objectives, suggesting the following measurements:

M1 (I1) Compare the information contained in the *Processes Plan*, with the processes required in the *Strategic Plan* to verify their correspondence.

M2 (I2) Compare the *Processes Plan* with the *Quantitative and Qualitative Report* in its section corresponding to compliance of this plan to verify compliance.

M3 (I3) Perform surveys on the organization's members to verify knowledge of corresponding processes in their application to their activities.

M4 (I4) Verify that *Process Documentation* is available and updated in the *Knowledge Base*.

M5 *(*I5) Review if the *Improvement Plan* is defined based on the suggestions and improvement opportunities contained in the *Evaluation Report*.

M6 (I6) Compare qualitative goals with measurements reported in *Measurement and Improvement Suggestion Reports* to verify their achievement.

M7 (I7) Verify the submission of the *Quantitative and Qualitative Report* according to the periodicity set forth in the *Strategic Plan*.

Training

RPM shall offer the facilities required so that the personnel involved in Process Management participates in the activities of the current *Training Plan* of the *Knowledge Base*.

Exceptional Situations

Roles involved in Process Management shall notify RPM, in a timely manner, of the situations that prevent the development of the assigned activities.

RPM shall respond to these situations and, if it is not able to solve them or they do not fall on his or her responsibility, shall escalate them to the RBM.

Lessons Learned

Before initiating the activities assigned, the roles involved in the process Management Process shall consult the *Lessons Learned* in the *Knowledge Base* to leverage the organization's experience and reduce the possibility of recurrent problems.

Tailoring Guides

Process Elements Definition	To document processes, a pattern other than that suggested in this model may be used, provided that it has defined at least the corresponding goals, indicators and quantitative objectives.
Processes Documentation	For consistency purposes with ISO 9001:2000, *Process Documentation* may be deemed as the quality manual.

8.2. Project Portfolio Management

General Process Definition

Process	**MAN.2 Project Portfolio Management**
Category	Management (MAN)
Purpose	The purpose of the Project Portfolio Management is to ensure that projects contribute to fulfilling the organization's goals and strategies.
Description	Project Portfolio Management is in charged of the organization's external, internal projects and project opportunities. Project opportunities should include prospecting the solution, the submission of the proposal and the signing of an *Contract.* For internal projects (for the organization itself or the internal development areas), prior to approval, it is necessary to evaluate different performance alternatives. External and internal projects that are approved require general planning and allocation of resources, as well as progress monitoring and performance evaluation. Project Portfolio Management comprises planning, performance, and evaluation and control. • Planning: Define the activities and resources required for each type of project to be managed, which are documented in the *Project Portfolio Management Plan*. Prepare *Acquisition and Training Plan.* Establish the *Customer Communication Mechanisms* in accordance with the *Customer Communication Plan.* For *Internal Projects, Internal Project Realization Alternatives* are generated and an alternative is chosen. • Performance: It is the execution of the activities in the *Project Portfolio Management Plan* and their follow up, as well as the control of *Customer Communication Mechanisms.* For each *Project , Project Descriptions* are generated, assigning the *Responsible for the Specific Project Management,* and submitting the *Quantitative Project Objectives.* If project is external, *a Contract* is prepared and upon its termination, it is closed. *Project Plans* are received and approved and project *Progress Reports* are collected. *Customer Comments and Complaints* are also collected. • Evaluation and Control: Comprises the analysis of the *Sales Plan,* of the *Progress Reports* and of the *Customer Comments and Complaints;* as a result, the *Corrective or Preventive Actions* for the projects are generated and progress monitoring is given until closing. To keep Business Management advised, the *Quantitative and Qualitative Report and the Customer-related Corrective or Preventive Action Report*, are generated. In addition, based on the *Processes Measurement Plan,* the *Measurement and Improvement Suggestions Report* for this process is generated.
Goals	G1 Fulfill the organization's *Strategic Plan* by generating and implementing projects. G2 Maintain Project Portfolio Management activities under control by

	complying with the Project Portfolio Management Plan. G3 Provide performance information on Projects to Business Management by generating the *Quantitative and Qualitative Report*. G4 Respond to *Customer Comments and Complaints* by defining and executing the *Corrective or Preventive Actions.*
Indicators	I1 (G1) Projects responding to the *Strategic Plan* are implemented. I2 (G2) Activities are carried out as set forth in the *Project Portfolio Management Plan.* I3 (G2) *Corrective or Preventive Actions* for the project are generated in a timely manner and based on the *Progress Report* analysis. I4 (G3) The *Quantitative and Qualitative Report* is submitted periodically to Business Management. I5 (G4) *Corrective or Preventive Actions* are generated in a timely manner and based on *Customer Comments and Complaints* Analysis*.*
Quantitative Objectives	Numerical value or satisfaction range by indicator.
Responsibility and Authority	Responsible Party: • Responsible for Project Portfolio Management Authority: • Responsible for Business Management
Related Processes	Business Management Processes Management Resource Management Human Resources and Work Environment Organization's Knowledge Specific Projects Management

Inputs

Name	Source
Strategic Plan: • *Goals* • *Strategies* • *Project Portfolio* • *Customer Communication Plan*	Business Management
Processes Plan: • *Processes Measurement Plan*	Process Management
Resource Allocation	Human Resources and Work Environment
Project Plan	Specific Projects Management
Progress Report	Specific Projects Management
Acceptance Document	Specific Projects Management

Outputs

Name	Description	Destination
Quantitative and Qualitative Report	Quantitative and qualitative elements obtained from collecting and analyzing *Project Progress Reports* and from complying with the *Sales Plan.*	Business Management
Customer-related Corrective or Preventive Actions Report	Actions established to correct or prevent a deviation or problem in *Customer's Comments and Complaints*	Business Management
Measurements and Improvement Suggestions Report	Record containing: ***** Measurements of Project Portfolio Management Indicators (see **Measurements**). ***** Improvement suggestions for Project Portfolio Management process (methods, tools, formats, standards, among others).	Process Management
Acquisition and Training Plan	Description of resources and training required for projects. For example: profile, amount of human resources, project incorporation dates, training requirements, infrastructure, financial, technological and material resources required.	Resource Management
Contract	Legal document for the rendering of services with the	Organization's

Name	Description	Destination
	customer.	Knowledge
Project Record	Administrative project information, for example, name, responsible party, starting and end dates, customer, price, etc.	Organization's Knowledge
Lessons Learned	Recording of best practices, recurring problems and successful experiences, during the implementation of this process.	Organization's Knowledge
Responsible for Specific Projects Management	Person responsible for managing a specific project.	Specific Projects Management
Project Description	Description of purpose, product, goals, scope, deliverables, business need, assumptions and premises, restrictions, among others.	Specific Projects Management
Quantitative Project Objectives	Establishes the quantitative objectives that the project shall cover for time and cost, etc.	Specific Projects Management
Corrective or Preventive Actions	Actions established to correct or prevent a deviation or problem, taking into account customer's comments and complaints regarding projects.	Specific Projects Management

Internal Products

Name	Description
Project Portfolio Management Plan	*Sales Plan:* Contains the goals, scope, resources, actions and work schedule to generate and close project opportunities. *Project Plan:* Description of activities to manage external and internal projects.
Corrective or Preventive Actions	Actions established to correct or prevent a deviation or problem, regarding the performance of the *Sales Plan* or the *Customer Communication Mechanisms.*
Customer Comments and Complaints	Record of customer's comments and complaints.
Internal Project Realization Alternatives	Description of different options to carry out internal projects. Includes the decision on the selected option.
Customer Communication Mechanisms	Information, media, messages, responsible parties and mechanisms used to communicate with customers.
Validation Report	Record of participants, date, place, duration and defects found.

Bibliographical References

ISO 9001:2000 Quality Management System - Requirements

The Capability Maturity Model: Guidelines for Improving the Software Process. Carnegie Mellon University, Software Engineering Institute. 1994. Addison- Wesley.

ISO/IEC 12207:1995/Amd.1:2002(E) Information technology — Software life cycle processes.

A guide to Project Management Body of Knowledge (PMBOK). Project Management Institute. 2000 Edition.

Practices

Roles Involved and Training

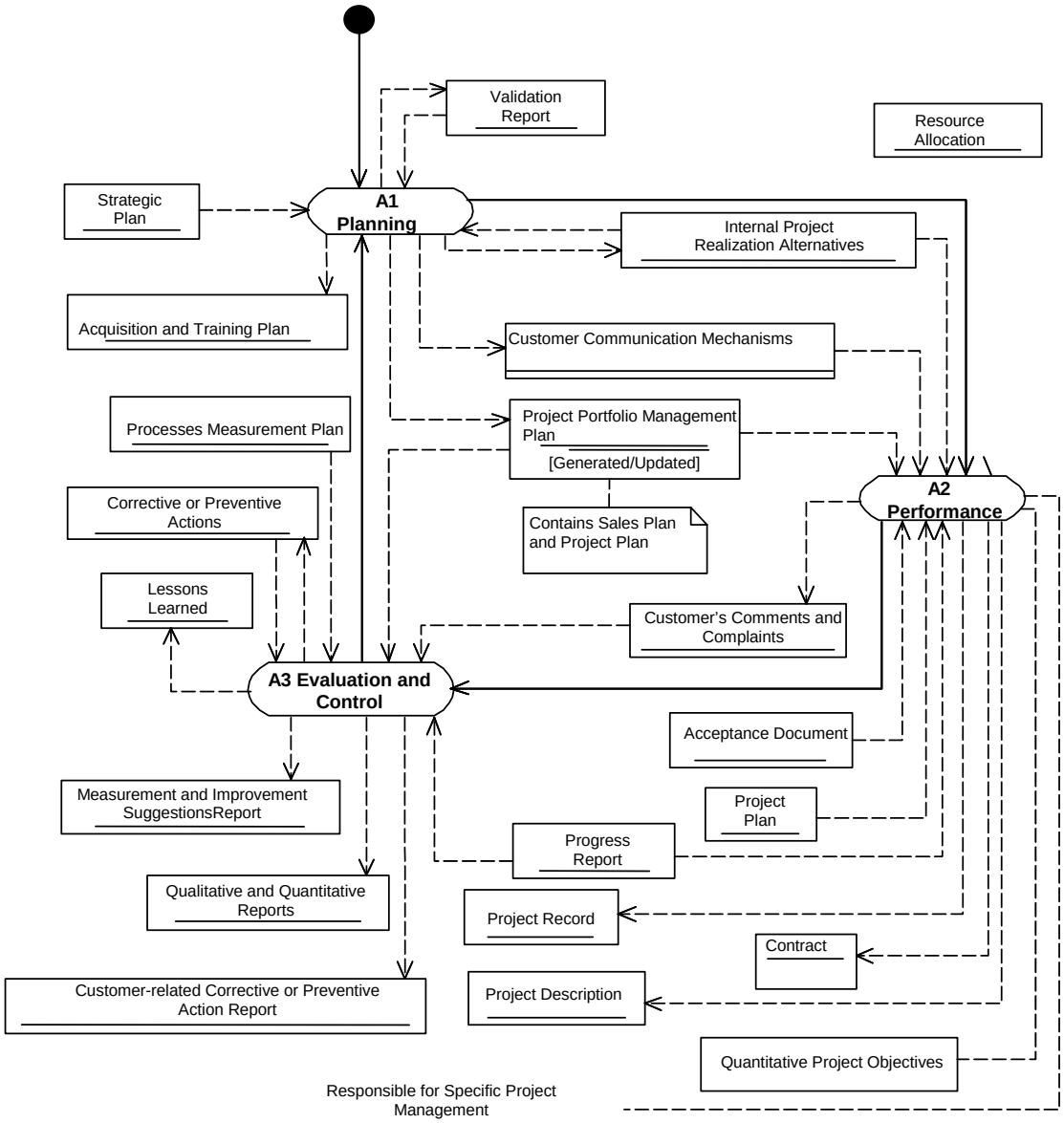
Role	Abbreviation	Training
Responsible for Business Management	RBM	Knowledge of effort required to carry out project Management Planning.
Responsible for Project Portfolio Management	RPPM	Knowledge of activities necessary to carry out Project Portfolio Management.

Activities

Role	Description
A1. Planning (G1, G4)	
RPPM	A1.1. Analyze and generate *Internal Project Realization Alternatives.*
RBM	A1.2. Select an alternative for internal projects.
RPPM	A1.3. Generate or update *Project Portfolio Management Plan* based on *the Project Portfolio* of the *Strategic Plan.* • Prepare or update *Sales Plan*, including actions and work program to generate and close project opportunities. • Prepare or update the *Project Plan* to manage external and internal projects, considering *Internal Project Realization Alternatives*.
RPPM	A1.4. Generate *Acquisition and Training Plan,* including resources and training required for projects.
RPPM	A1.5. Establish *Customer Communication Mechanisms* as per the *Customer Communication Plan.*
RBM	A1.6. Validate the *Project Portfolio Management Plan, Acquisition and Training Plan* and *Customer Communication Mechanisms* (**Val1**).
RPPM	A1.7. Correct defects found in *Project Portfolio Management Plan, Acquisition and Training Plan* and *Customer Communication Mechanisms,* based on *Validation Report* and obtain approval of corrections.
A2. Performance (G1, G2, G4)	

Role	Description
RPPM	A2.1. Perform activities of the *Sales Plan*. • Identify prospects and needs of possible customers. • Estimate times and costs jointly with development group and software maintenance representatives. • Generate and submit proposals for identifying opportunities. • Prepare *Contract*(s).
RPPM	A2.2. Perform *Project Plan* activities. • Generate *Project Record* for subcontracted or internal projects. • Generate *Project Description,* if the project is internal, consider *Internal Project Realization Alternatives*. • Generate *Quantitative Project Objectives*. • Assign *Responsible for the Specific Project Management* based on *Resource Allocation*. • Receive and approve *Project Plan*. • Collect *Progress Reports*. • Receive *Acceptance Document* to close internal or subcontracted projects.
RPPM	A2.3. Implement *Customer Communication Mechanisms* and gather *Customer Comments and Complaints.*
A3 Evaluation and Control (G2, G3, G4)	
RPPM	A3.1. Analyze *Sales Plan* compliance, generate and follow up on *Corrective or Preventive Actions.*
RPPM	A3.2. Analyze project *Progress Reports* and *Customer Comments and Complaints* on projects, generate and follow up on *Corrective or Preventive Actions.*
RPPM	A3.3. Analyze *Customer Comments and Complaints* regarding communication mechanisms, generate and follow up on *Corrective or Preventive Actions.*
RPPM	A3.4. Generate *Quantitative and Qualitative Report* based on project progress reports and compliance with *Sales Plan.*
RPPM	A3.5. Generate *Customer-related Corrective or Preventive Action Report.*
RPPM	A3.6. Generate *Measurement and Improvement Suggestions Report* for this process, under *Measurement Plan.*
RPPM	A3.7. Identify *Lessons Learned* and integrate them into *Knowledge Base*. As an example, best practices, successful risks handling experiences, recurring problems, etc., can be taken into account.

Workflow Diagram



Verifications and Validations

Verification or Validation	Activity	Product	Role	Description
Val1	A.1.6	*Project Portfolio Management Plan* *Acquisition and Training Plan* *Customer Communication Mechanisms*	RBM	Validate that they comply with that set forth in the *Strategic Plan,* regarding the *Project Portfolio* and the *Customer Communication Plan.* Defects found are documented in a *Validation Report.*

Incorporation into *Knowledge Base*

Product	Approval Guidelines
Project Portfolio Management Plan	Val1
Acquisition and Training Plan	Val1
Customer Communication Mechanisms	Val1
Quantitative and Qualitative Report	None
Customer-related Corrective or Preventive Action Reports	None
Measurement and Improvement Suggestions Report	None
Contract	None
Project Record	None
Lessons Learned	None
Project Description	None
Quantitative Project Objectives	None
Corrective or Preventive Actions	None
Customer Comments and Complaints	None
Internal Project Realization Alternatives	None
Validation Report	None

Infrastructure Resources

Activity	Resource
A1, A2, A3	Tool for documenting, planning and monitoring projects, as well as for tracking corrective and preventive actions.

Measurements

Based on *Processes Measurement Plan,* a periodic report of the progress made on the process indicators with regard to defined quantitative objectives is generated, the following measurements are suggested:

	M1 (I1) Compare *Quantitative and Qualitative Report* with *Strategic Plan Project Portfolio,* to verify its correspondence. M2 (I2) Compare *Quantitative and Qualitative Report* with *Project Portfolio Management Plan* to verify compliance. M3 (I3) Review content of *Corrective or Preventive Actions* to verify they match with *Progress Reports* and confirm its performance. M4 (I4) Verify delivery of *Quantitative and Qualitative Report* according to periodicity established in *Strategic Plan*. M5 (I5) Review content of *Corrective or Preventive Actions* to verify its correspondence with *Customer's Comments and Complains* and confirm its performance by means of the *Customer-related Corrective or Preventive Action Report.*
Training	The RPPM shall offer the facilities so that the personnel involved in the Project Portfolio Management process participates in the activities of the current *Training Plan* of the *Knowledge Base*.
Exceptional Situations	Roles involved in Project Portfolio Management shall notify RPPM, in a timely manner, of the situations that prevent the development of the assigned activities. RPPM shall respond to these situations and, if it is not able to solve them or they do not fall on his or her responsibility, shall escalate them to the RBM.
Lessons Learned	Before initiating assigned activities, the roles involved in the Project Portfolio Management process shall consult the *Lessons Learned* in the *Knowledge Base* to leverage the organization's experience and reduce the possibility of recurrent problems.

Tailoring Guides

Project Description* and *Quantitative Project Objectives	The preparation of the *Project Description and Quantitative Project Objectives* may be done together with the customer.
Proposals and Contracts	Proposals and Contracts may be verified and validated before submitting them to the customer. The party responsible for the verification may be the Responsible for Business Management and for validation by the Steering Committee.
Contract	For internal development areas, the *Contract* shall be replaced by a work order or other mechanism to formalize a project.
Sales Plan	For internal development areas, the *Sales Plan of the Project Portfolio Management Plan,* as well as the performance of corresponding activities, will be omitted.

8.3. Resource Management

General Process Definition

Process	**MAN.3 Resource Management**
Category	Management (MAN)
Purpose	The purpose of Resource Management is to obtain and provide the organization with the human resources, infrastructure, working environment and suppliers, as well as creating and maintaining the Organization's *Knowledge Base*. The purpose is to support compliance of the Organization's *Strategic Plan* goals.
Description	The Resource Management process is made up by the following activities: planning, monitoring and control of resources, and research on technological trends, supported by the three sub-processes: Human Resources and Working Environment, Goods, Services and Infrastructure and Organization's Knowledge. • Resource Planning: Established based on the *Strategic Plan and the Acquisition and Training Plan* of processes and projects. As a result, the following plans are obtained: *Human Resources and Working Environment Operating Plan, Goods, Services and Infrastructure Operating Plan, and Organization's Knowledge Operating Plan.* • Monitoring and Control: Monitoring the execution of the operating plans of the sub-processes considering the *Available Human Resources, Training and Work Environment Report, the Goods, Services and Infrastructure Report and the Knowledge Base Status Report,* in the event of any deviation, *Corrective Actions* are established. Furthermore, based on the aforementioned reports, the *Quantitative and Qualitative Report* is generated, which includes information on available resources and resources are acquired according to the *Communication and Implementation Plan.* Moreover, based on the *Processes Measurement Plan,* the *Measurements and Improving Suggestions Report* is generated. • Research on Technological Trends: Carried out based on the *Strategic Plan*, to perform a prospective and feasibility analysis addressed to the Steering Committee. *Technological Proposals* are obtained as a result.
Goals	G1 Achieve the goals of the *Strategic Plan* by providing sufficient and qualified resources to the organization. G2 Provide organization members the means and mechanisms required for the use and safeguarding of information through the *Knowledge Base*. G3 Keep the organization timely advised on technological trends by means of *Technological Proposals.*
Indicators	I1 (G1) Level of satisfaction the parties responsible for processes and projects regarding the timeliness of delivery of the resources requested. I2 (G1) Level of satisfaction the parties responsible for processes and projects regarding the quality of resources provided.

	I3 (G1) Comparison of budgeted versus actual expense for resources provided. I4 (G2) Level of user's satisfaction of the *Knowledge Base*. I5 (G3) Periodic or on-demand delivery of *Technological Proposals* to Responsible for Business Management.
Quantitative Objectives	Numerical value or satisfaction range by indicator.
Responsibility and Authority	Responsibility: • Responsible for Resource Management Authority: • Responsible for Business Management
Sub-processes	**MAN.3.1 Human Resources and Working Environment** **MAN.3.2 Goods, Services and Infrastructure** **MAN.3.3 Organization's Knowledge**
Related Processes	Business Management Process Management Project Portfolio Management Human Resources and Work Environment Goods, Services and Infrastructure Organization's Knowledge Specific Projects Management

Inputs

Name	Source
Strategic Plan	Business Management
Communication and Implementation Plan	Business Management
Acquisition and Training Plan	Business Management Process Management Project Portfolio Management Specific Projects Management
Processes Plan • *Processes Measurement Plan*	Process Management
Available Human Resources, Training and Work Environment Report	Human Resources and Work Environment
Goods, Services and Infrastructure Report	Goods, Services and Infrastructure
Knowledge Base Status Report	Organization's Knowledge

Outputs

Name	Description	Destination
Quantitative and Qualitative Report	Information on availability of human resources, goods, services and infrastructure and information on the *Knowledge Base*.	Business Management
Technological Proposals	Technology proposals, including a feasibility analysis and the benefits for the organization.	Business Management
Measurement and Improvement Suggestions Report	Record containing: ***** Measurement of Resource Management process indicators (see **Measurements**). ***** Improvement Suggestions of Resource Management process (methods, tools, formats, standards, among others).	Process Management
Human Resources and Work Environment Operating Plan • *Procurement Requirements*	Elements to consider in the selection, allocation, acceptance, training, evaluation and performance of human resources, as well as in the work environment.	Human Resources and Work Environment
Goods, Services and Infrastructure Operating Plan • *Procurement Requirements*	Elements to consider in the acquisition of goods and services, as well as in the evaluation of suppliers.	Goods, Services and Infrastructure
Organization's Knowledge Operating Plan • *Procurement Requirements*	Elements to consider in the design, operation, and maintenance of the organization's *Knowledge Base*.	Organization's Knowledge
Corrective Actions	Actions to correct deviations from operating plans of Human Resources and Work Environment, Goods, Services and Infrastructure, and Organization's Knowledge.	Human Resources and Work Environment Goods, Services and Infrastructure Organization's Knowledge
Lessons Learned	Record of best practices, recurrent problems and successful experiences, during the implementation of this process.	Organization's Knowledge

Internal Products

Name	Description
Acquisition and Training Plan	Requests of resource purchasing, includes trained personnel, suppliers, infrastructure and tools, as well as training requirements, for the Resource Management process.
Verification Report(s)	Record of participants, date, place, duration and defects found.

Bibliographical References

ISO 9001:2000 Quality Management Systems - Requirements

The Capability Maturity Model: Guidelines for Improving the Software Process. Carnegie Mellon University, Software Engineering Institute. 1994. Addison- Wesley.

ISO/IEC 12207:1995/Amd.1:2002(E) Information technology — Software life cycle processes

Practices

Roles involved and training

Role	Abbreviation	Training
Responsible for Business Management	RBM	Knowledge of the effort required to carry out Resource Management.
Responsible for Resource Management	RRM	Knowledge of activities necessary to define and successfully implement the Resource Management process.
Responsible for Human Resources and Work Environment	RHRWE	Knowledge of activities necessary to successfully implement the Human Resource Management sub-process.
Responsible for Goods, Services and Infrastructure	RGSI	Knowledge of activities necessary to successfully implement the Goods, Services and Infrastructure sub-process.
Responsible for the Organization's Knowledge	ROK	Knowledge necessary to guaranty the integrity, security and efficiency of the Knowledge Base.

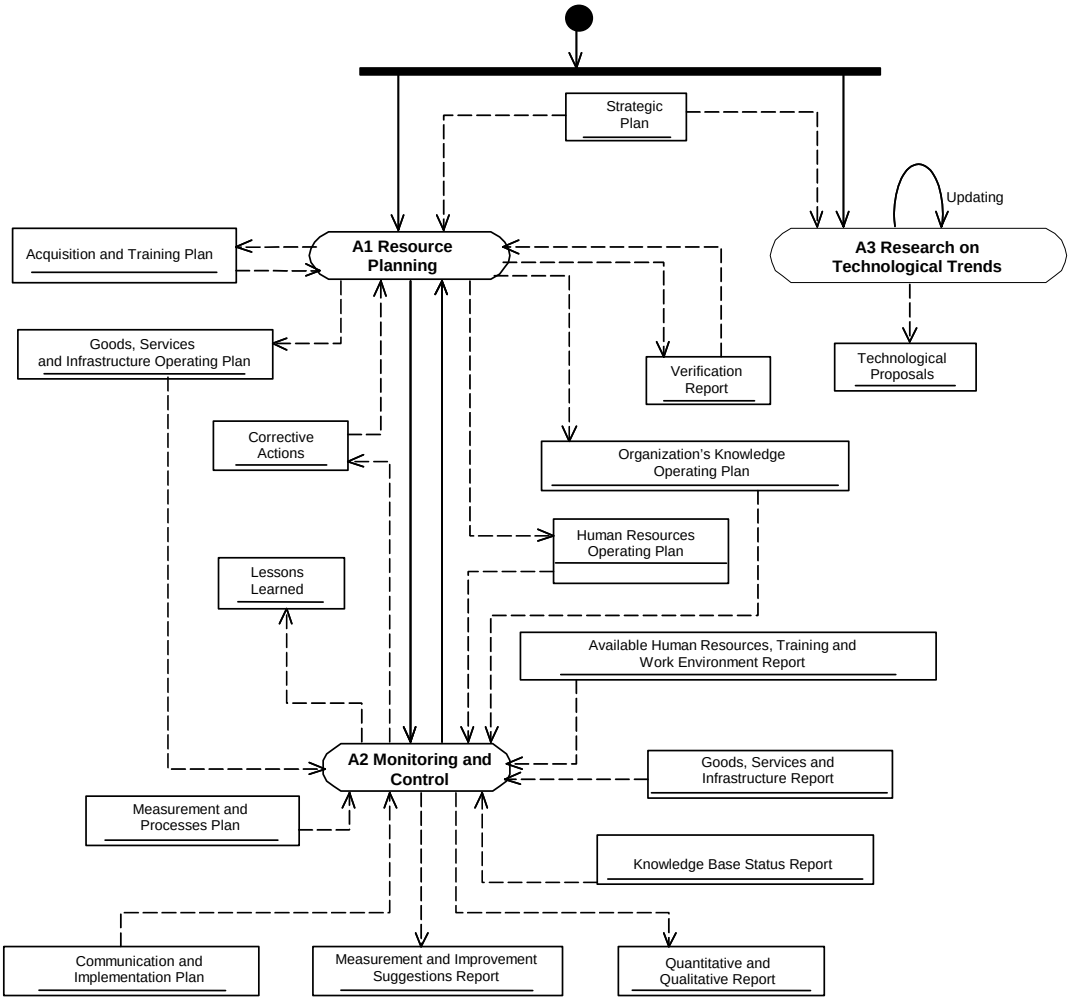
Activities

Role	Description
A1. Resource Planning (G1,G2)	
RRM	A1.1. Generate or update the *Acquisition and Training Plan* necessary for this process.
RRM RHRWE	A1.2. Generate or update the *Human Resources and Work Environment Operating Plan,* based on the *Strategic Plan* and the *Acquisition and Training Plans,* to be

Role	Description
	performed in the Human Resources and Work Environment sub-process. • Establish elements to be considered in the selection, allocation, acceptance, training, evaluation and performance of human resources. • Establish elements that assist the work environment and the organization.
RHRWE	A1.3. Verify the *Human Resource and Work Environment Operating Plan* (**Ver1**).
RRM	A1.4. Correct defects found in the *Human Resources and Work Environment Operating Plan* based on the *Verification Report* and obtain approval for corrections.
RRM RGSI	A1.5. Generate or update *Goods, Services and Infrastructure Operating Plan,* based on the *Strategic Plan* and the *Acquisition and Training Plans,* to be performed in the Goods, Services and Infrastructure sub-process. • Establish elements to ensure the acquisition and allocation of goods, services and infrastructure necessary to perform the organization's activities. • Establish elements to evaluate and rate the service's suppliers.
RGSI	A1.6. Verify the *Goods, Services and Infrastructure Operating Plan* (**Ver2**).
RRM	A1.7. Correct defects found in the *Goods, Services and Infrastructure Operating Plan* based on the *Verification Report* and obtain approval for corrections.
RRM ROK	A1.8. Generate or update the *Organization's Knowledge Operating Plan,* based on the *Strategic Plan*, to be performed in the knowledge sub-process in the Organization. • Establish elements to define, operate and maintain the knowledge generated in the organization.
ROK	A1.9. Verify the *Organization's Knowledge Operating Plan* (**Ver3**).
RRM	A1.10. Correct the defects found in the *Organization's Knowledge Operating Plan* based on the *Verification Report* and obtain approval for corrections.
A2. Monitoring and Control (G1,G2)	
RRM	A2.1. Monitor the execution of the *Human Resources and Work Environment Operating Plan* based on the *Available Human Resources, Training and Work Environment Report*. • Determine if the selection, allocation, acceptance, training, evaluation and performance of human resources is adequate. • Determine the suitability of the work environment. • If there is any deviation, generate *Corrective Actions* and provide follow up until closing.
RRM	A2.2. Monitor the execution of the *Goods, Services and Infrastructure Operating Plan* based upon the *Goods, Services and Infrastructure Report*. • Determine if the purchase and allocation of goods and services is adequate. • Determine if the service rendered by provider is adequate and timely. • If there is any deviation, generate *Corrective Actions* and provide follow up until closing.
RRM	A2.3. Monitor the performance of the *Organization's Knowledge Operating Plan* based on the *Knowledge Base Status Report*. • Determine if the organization's knowledge is stored and updated correctly. • Determine if the organization's knowledge is available for query.

Role	Description
	• If any deviation is detected, generate *Corrective Actions* and follow up until closing.
RRM	A2.4. Periodically analyze the use of resources and the work environment in the organization and compare them to the *Communication and Implementation Plan.* Generate the *Quantitative and Qualitative Report.*
RRM	A2.5. Generate the *Measurement and Improvement Suggestions Report* for this process, as per *Processes Measurement Plan*.
RRM	A2.6. Identify *Lessons Learned* and integrate them into the *Knowledge Base.* For example, best practices, successful risk handling experiences, recurring problems,among others.
A3. Research on Technological Trends (G3)	
RRM RBM	A3.1. Generate *Technological Proposals*. • Perform a prospective and feasibility analysis on technological trends. • Determine the benefit and impact of technological trends on the Strategic Plan.

Workflow Diagram



Verifications and validations

Verification or Validation	Activity	Product	Role	Description
Ver1	A1.3	*Human Resources and Work Environment Operating Plan*	RHRWE	Verify that the *Human Resources and Work Environment Operating Plan* complies with the needs set forth in the *Strategic Plan* and in the *Acquisition and Training Plans.* Defects found will be documented in a *Verification Report*.
Ver2	A1.6	*Goods, Services and Infrastructure Operating Plan*	RGSI	Verify that the *Goods, Services and Infrastructure Operating Plan* complies with the needs set forth in the *Strategic Plan* and in the *Acquisition and Training Plans.* Defects found will be documented in a *Verification Report.*
Ver3	A1.9	*Organization's Knowledge Operating Plan*	ROK	Verify that the *Organization's Knowledge Operating Plan* complies with the needs set forth in the *Strategic Plan*. Defects found will be documented in the *Verification Report.*

Incorporation into the *Knowledge Base*

Product	Approval Guidelines
Human Resources and Work Environment Operating Plan	Ver1
Goods, Services and Infrastructure Operating Plan	Ver2
Organization's Knowledge Operating Plan	Ver3
Quantitative and Qualitative Report	None
Technological Proposals	None
Measurement and Improvement Suggestions Report	None
Acquisition and Training Plan	None
Corrective Actions	None
Lessons Learned	None
Verification Report(s)	None

Infrastructure Resources

Activity	Resource

A1,A2	Tools to document and follow up plans, as well as corrective actions.
A3	Tools to assist technological research.

Measurements

Based on the *Processes Measurement Plan,* a periodic report of progress on process indicators is generated with regard with defined quantitative goals; the following measures are suggested:

M1 (I1,I2) Perform surveys to those responsible for projects and processes to know the level of satisfaction with regard to timeliness and quality of resources provided.

M2 (I3) Compare budgeted versus actual expense on products provided to understand the deviation against the plan.

M3 (I4) Perform surveys on members of the organization to know the level of user satisfaction of the *Knowledge Base*.

M4 (I5) Verify the submission of *Technological Proposals* based on the periodicity set forth or on demand.

Training

The RBM shall offer the facilities required so that the personnel involved in the Resource Management process participates in the activities of the current *Training Plan* of the *Knowledge Base.*

Exceptional situations

Roles involved in Resource Management shall notify RPM, in a timely manner, of the situations that prevent the development of the assigned activities.

The RRM shall respond to these situations and, if it is not able to solve them or they do not fall on his or her responsibility, shall escalate them to the RBM.

Lessons Learned

Before initiating the activities assigned, the roles involved in the Resource Management process shall consult the *Lessons Learned* in the *Knowledge Base* to leverage the organization's experience and reduce the possibility of recurrent problems.

Tailoring guides

Sub-processes

Elements considered in sub-processes may be incorporated directly in the Resource Management process.

Sub-processes

A different sub-process scheme may be considered if compliance with goals established in the Resource Management is ensured.

8.3.1. Human Resources and Work Environment

General process definition

Process	**MAN.3.1 Human Resources and Work Environment**
Category	Management (MAN)
Purpose	The purpose of Human Resources and Work Environment is to provide the adequate human resources to comply with the responsibilities assigned to the roles within the organization, as well as to evaluate the work environment.
Description	Based on the *Human Resources and Work Environment Plan,* as well as the *Corrective Actions* for Human Resources, preparation, implementation and report generation activities will be carried out. • Preparation. Perform the following tasks: - Review the *Human Resources and Work Environment Operating Plan* and the *Corrective Actions.* - Criteria definition. - Preparation of *Training Plan*. - Preparation of forms for *Performance Evaluation* and *Survey on the Work Environment*. • Implementation. Perform the following tasks: - Selection, allocation and acceptance of human resources. *Resource Allocation* is obtained as result.,. - Training of human resources as per current and future needs of processes and projects. As a result, the *Training Report* isgenerated. - Periodical performance evaluation of human resources assigned to processes and projects, which is recorded in the *Human Resources Record.* - Evaluation of work environment and its record in the *Work Environment Report*. • Report Generation. Produce the following: - *Available Human Resources, Training and Work Environment Report*. - *Measurements and Improvement Suggestions Report*.
Goals	G1 Provide the organization with qualified human resources by means of the adequate selection and training in roles assigned. G2 Evaluate the organization's work environment through a *Work Environment Survey*.
Indicators	I1 (G1) Acceptance percentage of resources assigned during certain period. I2 (G1) Personnel performance level in the roles assigned during certain

	period. I3 (G1) Satisfaction level of training provided during certain period. I4 (G2) Personnel's level of satisfaction with regard to work environment during certain period.
Quantitative Objectives	Numerical value or satisfaction range by indicator.
Responsibility and Authority	Responsibility: • Responsible for Human Resources and Work Environment Authority: • Responsible for Resource Management
Related Processes	Process Management Project Portfolio Management Resource Management Organization's Knowledge Specific Projects Management

Inputs

Name	Source
Processes Plan • *Processes Measurement Plan*	Process Management
Human Resources and Work Environment Operating Plan	Resource Management
Corrective Actions	Resource Management

Outputs

Name	Description	Destination
Resource Allocation	Competent personnel with appropriate education, training, skills and experience, regarding the role to be performed.	Process Management Project Portfolio Management Specific Projects Management
Measurements and Improvement Suggestions Report	Record containing: ***** Measurements of Human Resource and Work Environment process indicators (see **Measurements**). ***** Improvement Suggestions on Human Resource and Work Environment process (methods, tools, formats, standards, among others).	Process Management
Available Human	Periodic report concentrating information on:	Resource

Name	Description	Destination
Resources, Training and Work Environment Report	Human Resource Status . Performed and planed training activities. Work environment survey results.	Management
Training Plan	Description of the training activities, including: Courses, workshops, calendar, trainers, logistics, among others.	Organization's Knowledge
Lessons Learned	Record of best practices, recurring problems and successful experiences, during the implementation of this process.	Organization's Knowledge

Internal Products

Name	Description
Human Resources Record	Personnel information, including personal data, education, experience, roles assigned, training, performance evaluations, among others.
Work Environment Report	Summary of surveys regarding work relationships, leadership, team work, schedules, infrastructure provided, among other topics.
Training Report	Record containing data on training provided, dates, number of attendees, trainer, supplier, evaluation, among others.
Performance Evaluation	Performance evaluation of human resources according to role assigned.
Survey on Work Environment	Survey applied on human resources regarding the work environment.
Validation Report(s)	Record of participants, date, place, duration and defects found.

Bibliographical References

ISO 9001:2000 Quality management systems - Requirements

The Capability Maturity Model: Guidelines for Improving the Software Process. Carnegie Mellon University, Software Engineering Institute. 1994. Addison- Wesley.

ISO/IEC 12207:1995/Amd.1:2002(E) Information technology — Software life cycle processes

Practices

Roles involved and training

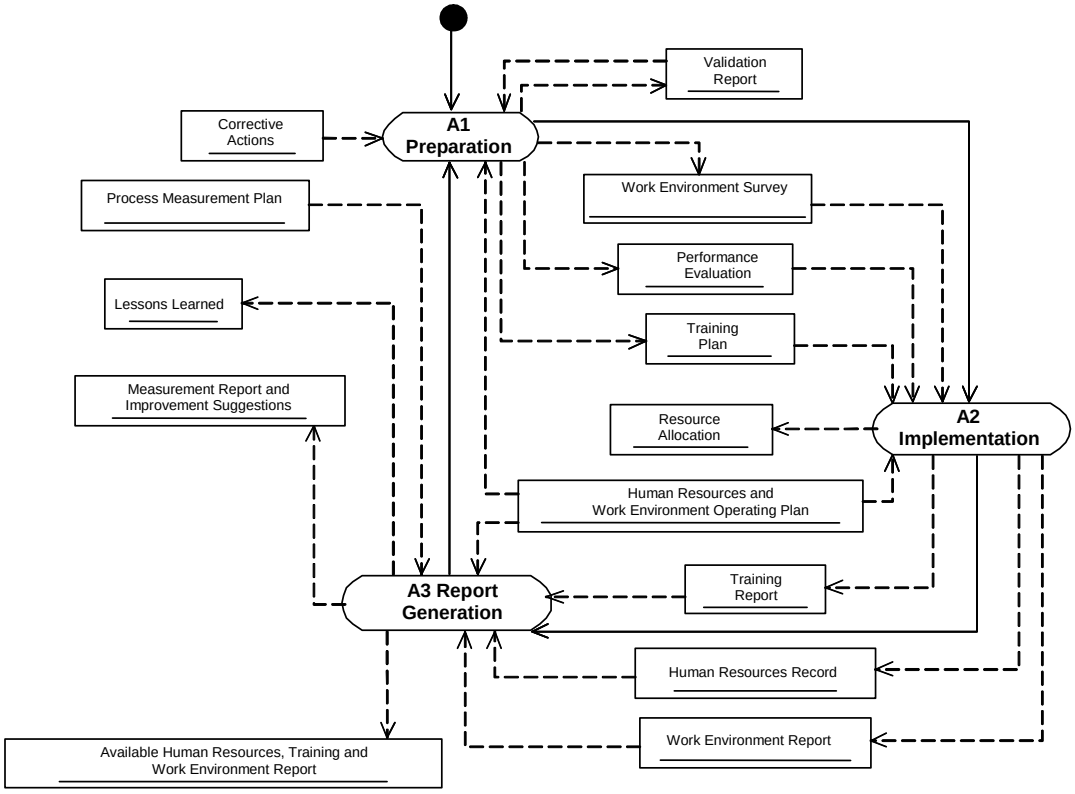
Role	Abbreviation	Training
Responsible for Resource Management	RRM	Knowledge of activities necessary to successfully implement the Human Resources and Work Environment sub-processes.
Responsible for Human Resources and Work Environment	RHRWE	Knowledge of the activities necessary to successfully implement the Human Resources and Work environment sub-process.
Responsible for Training	RT	Knowledge of activities necessary to successfully implement training requested.

Activities

Role	Description
A1. Preparation (G1, G2)	
RHRWE	A1.1. Review of the *Human Resources and Work Environment Operating Plan* and *Corrective Actions.*
RHRWE	A1.2. Define criteria for: • Selection, allocation and acceptance of resources. • Training and other actions that satisfy these needs. • Performance evaluation. • Work environment evaluation. These criteria apply to activities A2.1, A1.3, A2.2, A1.6 and A.1.9.
RT	A1.3. Prepare and update *Training Plan* based on *Human Resources* and *Work Environment Operating Plan* and *Corrective Actions.*
RRM	A1.4. Validate *Training Plan* (**Val1**).
RT	A1.5. Correct defects found and *Training Plan* based on *Validation Report* and obtain approval of corrections.
RHRWE	A1.6. Prepare and update form for *Performance Evaluation.*
RRM	A1.7. Validate *Performance Evaluation* (**Val2**).
RHRWE	A1.8. Correct defects found in *Performance Evaluation* based on *Validation Report* and obtain approval of corrections.
RHRWE	A1.9. Prepare or update form for *Survey on Work Environment.*
RRM	A1.10. Validate *Survey on Work Environment* (**Val3**).

Role	Description
RHRWE	A1.11. Correct defects found in *Survey on Work Environment* based on *Validation Report* and obtain approval of corrections.
A2. Implementation (G1, G2)	
RHRWE	A2.1. Select, assign and obtain acceptance of human resources. • Based on profile requested, select the human resource within the organization or hire him/her from external sources. • Issue *Resource Allocation* and notify applicant. • Obtain acceptance of *Resource Allocation*. • If *Resource Allocation* is rejected, this activity is repeated. • If new personnel is hired, record in *Human Resources Record.*
RT	A2.2. Carry out *Training Plan.* • Prepare *Training Plan,* including evaluation of training provided. • For each member of trainded personnel, record provided training in *Human Resources Record*.
RHRWE	A2.3. Apply *Performance Evaluation* based on *Human Resources and Work Environment Operating Plan* and record result in the evaluation on *Human Resources Record.*
RHRWE	A2.4. Apply *Survey on Work Environment* based on *Human Resources and Work Environment Operating Plan* and record result in *Work Environment Report.*
A3. Reports Generation (G1, G2)	
RHRWE	A3.1. Generate *Available Human Resources, Training and Work Environment Report* as per *Human Resources and Work Environment Operating Plan, Human Resources Record, Training Report* and *Work Environment Report.*
RHRWE	A3.2. Generate *Measurements and Improvement Suggestions Report* of processes based on *Processes Measurement Plan*.
RHRWE	A3.3. Identify *Lessons Learned* for process and integrate them in *Knowledge Base.* For example, best practices, successful risk handling experiences, recurring problems, among others may be considered.

Workflow Diagram



Verifications and Validations

Verification or Validation	Activity	Product	Role	Description
Val1	A1.4	*Training Plan*	RRM	Validate that all *Training Plan* elements are feasible and correspond to process and projects needs. Defects found will be documented in a *Validation Report.*
Val2	A1.7	*Performance Evaluation*	RRM	Validate that all *Performance Evaluation* elements offer useful information for the organization. Defects found will be documented in a *Validation Report*.
Val3	A1.10	*Survey on Work Environment*	RRM	Validate that all elements of the *Work Environment Survey* offer useful information for the organization. Defects found will be documented in the *Validation Report.*

Incorporation into the *Knowledge Base*

Product	Approval Guidelines
Training Plan	Val1
Performance Evaluation	Val2
Work Environment Survey	Val3
Resource Allocation	Applicant's acceptance
Available Human Resources, Training and Work Environment Report	None
Human Resources Record	None
Work Environment Report	None
Training Report	None
Measurements and Improvement Suggestions Report	None
Lessons Learned	None
Validation Report(s)	None

Infrastructure Resources

Activity	Resource
A1, A2, A3	Tools that allow documenting the information

Measurements	Based on the *Processes Measurement Plan,* a periodic process indicator progress report is generated with regard to defined quantitative objectives. The following are suggested: M1 (I1) Calculate the percentage of human resources accepted with regard to *Resource Allocations* performed during the period set forth, to know the efficiency of personnel selection. M2 (I2) Perform statistical analysis of *Performance Evaluations* during the period established to know the readiness of human resources in the performance of their roles. M3 (I3) Perform statistical analysis of training evaluations contained in *Training Reports* to know the pertinence of the training provided. M4 (I4) Performs statistical analysis of *Work Environment Survey* during the period established to know the personnel's opinion on the subject.
Training	The RHRWE shall offer the facilities so that personnel involved in the Human Resources and Work Environment sub-process participates in the activities of the current *Training Plan* of the *Knowledge Base.*
Exceptional Situations	Roles involved in Human Resources and Work Environment sub-process shall notify RHRWE, in a timely manner, of the situations that prevent the development of the assigned activities. RHRWE shall respond to these situations and, if it is not able to solve them or they do not fall on his or her responsibility, shall escalate them to the RRM.
Lessons Learned	Before initiating activities assigned, the roles involved in the Human Resources and Work Environment sub-process shall consult the *Lessons Learned* in the *Knowledge Base* to leverage the organization's experience and reduce the possibility of recurrent problems.

Tailoring Guides

Training Plan	The training plan may consider everything from formal courses offered by external vendors to internal self-training, individual or in groups.
Performance Evaluation and Work Environment Survey	For small organizations (less than 10 people) the preparation and application of *Performance Evaluation and Work Environment Survey* forms, may be substituted by periodical meetings where both subjects are dealt with and results are recorded in minutes.

8.3.2. Goods, Services and Infrastructure

General Process Definition

Process	**MAN.3.2 Goods, Services and Infrastructure**
Category	Management (MAN)
Purpose	The purpose of Goods, Services and Infrastructure is to provide suppliers of goods, services and infrastructure that meet the process and project procurement requirements.
Description	Based on the *Goods, Services and Infrastructure Operating Plan* and *Corrective Actions* from Resource Management*,* preparation, implementation, and report generation activities are undertaken. • Preparation. Perform the following tasks: - Review of the *Goods, Services and Infrastructure Operating Plan* and *Corrective Actions*. - Define Criteria. - Prepare *Maintenance Plan*. - Obtain *Goods or Services Request*. • Implementation. Perform the following tasks: - Supplier selection and purchasing of goods and services. As a result, the *Goods or Services Record* is created and the *Suppliers' List* is updated. - Periodical applicant satisfaction evaluation for the purchase of goods or services and its recording in the *Suppliers' List*. - Infrastructure maintenance*.* • Report Generation. Produce the following: - *Goods, Services and Infrastructure Report*. - *Measurement and Improvement Suggestions Report*.
Goals	G1 Provide the organization the goods and services required by processes and projects by means of selecting and evaluating suppliers. G2 Maintain the organization's infrastructure by means of complying with the *Maintenance Plan*.
Indicators	I1 (G1) Level of satisfaction of applicants for goods and services received to know the efficiency of suppliers' selection. I2 (G2) Level of compliance with maintenance activities plan over a certain period.
Quantitative Objectives	Numerical value or satisfaction range by indicator.
Responsibility and Authority	Responsibility:

	• Responsible for Goods, Services and Infrastructure Authority: • Responsible for Resource Management
Related Processes	Process Management Resource Management Organization's Knowledge

Inputs

Name	**Source**
Processes Plan • *Processes Measurement Plan*	Process Management
Goods, Services and Infrastructure Operating Plan	Resource Management
Corrective Actions	Resource Management

Outputs

Name	**Description**	**Destination**
Goods, Services and Infrastructure Report	Periodic report concentrating information on: Acquired goods and services. Satisfaction evaluation of acquired goods and services. Performed and planned maintenance activities.	Resource Management
Measurement and Improvement Suggestions Report	Record containing: ***** Measurement of Goods, Services and Infrastructure process indicators (see **Measurements**). ***** Improvement Suggestions on Goods, Services and Infrastructure process (methods, tools, formats, standards, among others.)	Process Management
Lessons Learned	Record of best practices, recurring problems and successful experiences, during the implementation of this process.	Organization's Knowledge

Internal Products

Name	Description
Maintenance Plan	Description of preventive and corrective infrastructure maintenance activities, including: Schedule, responsible parties, suppliers, among others.
Maintenance Record	Preventive and corrective infrastructure maintenance activity Record, including responsible parties, type of activity, dates, among others.
Goods or Services Request	Features of good or service, applicant, request dates, delivery and reception, among others..
Record of Goods or Services	Characteristics of good or service, price, purchase date, allocation of good or service, useful life, service period, among others.
Supplier List	Record of good or service suppliers, including their general data, goods or services provided, satisfaction evaluation, among others.
Validation Report	Record of participants, date, place, duration and defects found.

Bibliographical References

ISO 9001:2000 Quality Management System - Requirements

The Capability Maturity Model: Guidelines for Improving the Software Process. Carnegie Mellon University, Software Engineering Institute. 1994. Addison- Wesley.

ISO/IEC 12207:1995/Amd.1:2002(E) Information technology — Software life cycle processes

Practices

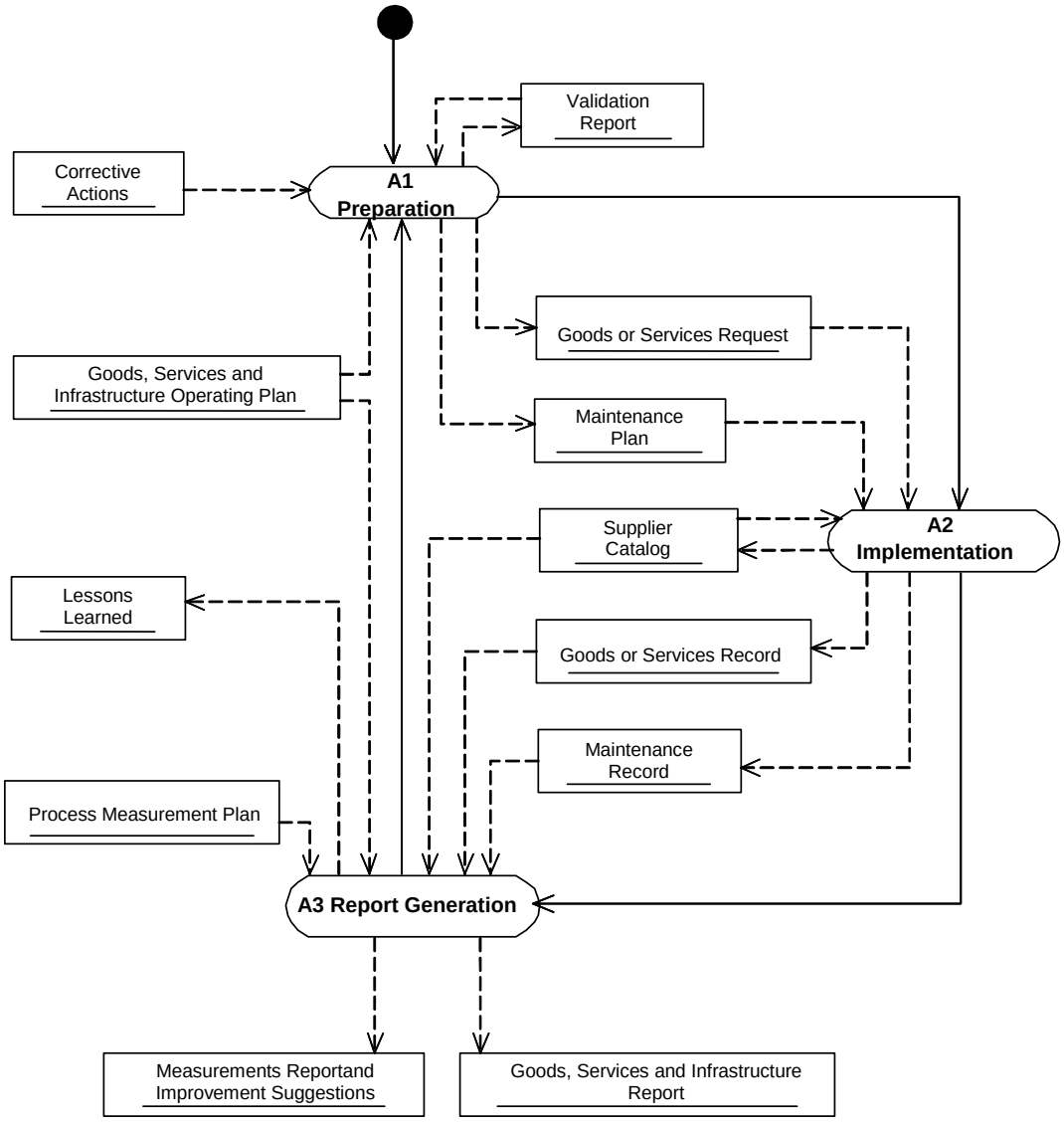
Roles Involved and Training

Role	Abbreviation	Training
Responsible for Resource Management	RRM	Knowledge of activities necessary to plan the Goods, Services and Infrastructure sub-process.
Responsible for Goods, Services and Infrastructure	RGSI	Knowledge of activities necessary to implement the Goods, Services and Infrastructure sub-process.

Activities

Role	Description
A1. Preparation (G1, G2)	
RGSI	A1.1. Review of *Goods, Services and Infrastructure Operating Plan* and *Corrective Action*.
RGSI	A1.2. Define criteria for: • Selection and acceptance of goods and services. • Evaluation of suppliers. These criteria apply to activity A2.1.
RGSI	A1.3. Prepare or update *Maintenance Plan* based on *Goods, Services and Infrastructure Operating Plan* and *Corrective Actions*.
RRM	A1.4. Validate *Maintenance Plan* (**Val1**).
RGSI	A1.5. Correct defects found in *Maintenance Plan* based on *Validation Report* and obtain approval of corrections.
RGSI	A1.6. Obtain the *Goods or Services Request* from *Goods, Services and Infrastructure Operating Plan* and *Maintenance Plan.*
A2. Implementation (G1, G2)	
RGSI	A2.1. Acquire the good or service requested in the *Goods or Services Request.* • Select suppliers from the *Supplier List* or choose new suppliers. • Obtain budgets and descriptions of good or service offered by suppliers. • Ask for supplier's selection by the applicant. • Acquire the good or service and ask the applicant for acceptance. • If the good or service is rejected, it is returned to the supplier or cancelled and this activity is repeated. • Record the good or service accepted in the *Goods or Services Record.* • If the good or service is purchased from a new supplier, record it in the *Supplier List*. • Periodically evaluate the applicant's satisfaction for the good or service purchased, record in the *Supplier List.*
RGSI	A2.2. Carry out a *Maintenance Plan,* follow up on it and record the activities performed in the *Maintenance Record*.
A3. Reports Generation (G1, G2)	
RGSI	A3.1. Generate the *Goods, Services and Infrastructure Report* for the *Goods, Services and Infrastructure Operating Plan*, the *Goods or Services Record,* the *Supplier List* and the *Maintenance Record*.
RGSI	A3.2. Generate the *Measurements and Improvement Suggestion Report* of processes based on the *Processes Measurement Plan*.
RGSI	A3.3. Identify *Lessons Learned* on processes and integrate them into the *Knowledge Base.* As an example, best practices, successful risk management experiences, recurring problems, among others, may be taken into account.

Workflow Diagram



Verifications and Validations

Verification or Validation	Activity	Product	Role	Description
Val1	A1.4	*Maintenance Plan*	RRM	Validate that all *Maintenance Plan* elements are feasible and correspond to the organization's needs. Defects found are documented in a *Validation Report*.

Incorporation to *Knowledge Base*

Product	Approval Guidelines
Maintenance Plan	Val1
Goods, Services and Infrastructure Report	None
Measurements and Improvement Suggestions Report	None
Lessons Learned	None
Maintenance Record	None
Goods or Services Request	None
Goods or Services Record	None
Supplier List	None
Validation Report	None

Infrastructure Resource

Activity	Resource
A1, A2, A3	Documentation tools

Measurements

Base on the *Processes Measurement Plan,* a periodic report on process indicator progress is generated regarding defined quantitative objectives, suggesting the following measures:

M1 (I1) Perform statistical analysis of applicant's satisfaction evaluation that are recorded in the *Supplier List.*

M2 (I2) Calculate the percentage of activities undertaken, contained in the *Maintenance Record,* regarding *Maintenance Plan* activities during the period established to know planned vs. actual performance.

Training

RGSI shall offer the facilities for the personnel involved in the Goods, Services and Infrastructure sub-process to participate in the activities of the current *Training Plan* of the *Knowledge Base.*

Exceptional Situations	The roles involved in the Goods, Services and Infrastructure sub-process shall notify the RGSI, in a timely manner, of the situations that prevent the development of the assigned activities. RGSI shall respond to these situations and, if it is not able to solve them or they do not fall on his or her responsibility, shall escalate them to the RRM.
Lessons Learned	Before initiating assigned activities, the roles involved in the Goods, Services and Infrastructure sub-process shall consult the *Lessons Learned* of the *Knowledge Base* to leverage the organization's experience and reduce the possibility of recurrent problems.

Tailoring Guides

Planning	For defining the goods and services selection and acceptance criteria, the organization is supported by an impact matrix for each one of the goods or services with the level of affectation in processes and projects in the event of a failure.

8.3.3. Organization's Knowledge

General Process Definition

Process	**MAN.3.3 Organization's Knowledge**
Category	Management (MAN)
Purpose	The purpose of Organization's Knowledge is to make available and manage the *Knowledge Base* that contains information and products generated by the organization.
Description	Based on the *Organization's Knowledge Operating Plan* and *Corrective Actions* from Resource Management, the following activities are performed • Planning: Establishing the *Knowledge Base Administration Plan* that contains the description of activities for defining or modifying the conceptual *Knowledge Base* (KB) model, users and their requirements, as well as operating, maintenance, verification and validation mechanisms based on users' requirements. • Performance: Establishment of the *Organization's Knowledge Base Design,* constituted by the conceptual model, including metamodel, and by operating mechanisms. Based on process requirements, the *Knowledge Base* is made up of the following repositories: - Business: documentation used and generated in the Business Management Process. - Processes: documentation used and generated in the Process Management process. - Projects: documentation used and generated in the Project Portfolio Management and Specific Projects Management process. - Development and Maintenance: software products generated in the Software Development and Maintenance process. - Resources: documentation used and generated in the Resource Management process. - Human Resources: documentation used and generated in Human Resources and Work Environment sub-process. - Purchased Goods and Suppliers: documentation used and generated in Goods, Services and Infrastructure sub-process. - KB Documentation: documentation used and generated on its structure, content and operation. This *Knowledge Base* may optionally have other types of repositories, such as: - Technological knowledge (terminology, concepts, methodologies). - Reuse libraries. Another design activity is to define and document operating mechanisms: feeding, query, maintenance and back up for each type of repository. Finally, the *Knowledge Base* is put into operation and supported to ensure its updating and adequate use in processes and projects. • Evaluation and Control: Periodically a *Knowledge Base Status Report*

	is generated.
Goals	G1 Provide the organization of the *Knowledge Base* in a reliable, timely and secure manner by means of complying with the *Knowledge Base Administration Plan*.
Indicators	I1 (G1) Level of satisfaction of users with regard to feeding, modification and maintenance mechanisms of the *Knowledge Base*. I2 (G1) Level of satisfaction of users with regard to *Knowledge Base* query mechanisms. I3 (G1) Level of satisfaction of users with regard to *Knowledge Base* access and backup control mechanisms.
Quantitative Objectives	Numerical value or satisfaction range by indicator.
Responsibility and Authority	Responsibility: • Responsible for Organization's Knowledge Authority: • Responsible for Resource Management
Related Processes	All processes

Inputs

Name	**Source**
Products of the **Incorporation to the Knowledge Base** section	Business Management Process Management Project Portfolio Management Resource Management Human Resources and Work Environment Goods, Services and Infrastructure Organization's Knowledge Specific Projects Management Software Development and Maintenance
Processes Plan • *Processes Measurement Plan*	Process Management
Organization's Knowledge Operating Plan	Resource Management
Corrective Actions	Resource Management

Outputs

Name	Description	Destination
Knowledge Base	Contains the following repositories: Business: documentation used and generated in the Business Management process. Processes: documentation used and generated in the Process Management process. Projects: documentation used and generated in the Project Portfolio Management and Specific Projects Management process. Development and Maintenance: software products generated in the Software Development and Maintenance process. Resources: documentation used and generated in the Resource Management process. Human Resources: documentation used and generated in the Human Resource and Work Environment sub-process. Purchased Goods and Suppliers: documentation used and generated in Goods, Services and Infrastructure sub-process. KB Documentation: documentation used and generated on its structure, content and operation. Optionally it can also contain: Technological Knowledge (terminology, concepts, methodologies). Reuse Libraries.	All process
Knowledge Base Status Report	Recording of information on the current content of the Knowledge Base. It may include: ***** Level of coverage and update of information contained in the KB. ***** Statistics on KB usage. ***** Adaptation proposals to improve service.	Resource Management
Measurements and Improvement Suggestions Report	Record containing: ***** Measurements of indicators of the Organization's Knowledge process (see **Measurements**). ***** Improvement suggestions for the Organization's Knowledge process (methods, tools, formats, standards, among others.)	Process Management
Lessons Learned	Record of best experiences, recurring problems and successful experiences, during the implementation of	Organization's Knowledge

Name	Description	Destination
	this process.	

Internal Products

Name	Description
Knowledge Base Management Plan	Description of activities that define or modify the following KB elements: • Conceptual KB model, users of each process and their requirements. • Operating, verification, validation mechanisms based on users' requirements.
Knowledge Base Design	Contains the conceptual model design, including its metamodel, and the definition of operating mechanisms: feeding, query, access control, maintenance and backup for each type of repository.
Validation Report(s)	Record of participants, date, place, duration and defects found.

Bibliographical References

ISO 9001:2000 Quality management system - Requirements

The Capability Maturity Model: Guidelines for Improving the Software Process. Carnegie Mellon University, Software Engineering Institute. 1994. Addison- Wesley.

ISO/IEC 12207:1995/Amd.1:2002(E) Information technology — Software life cycle processes

Practices

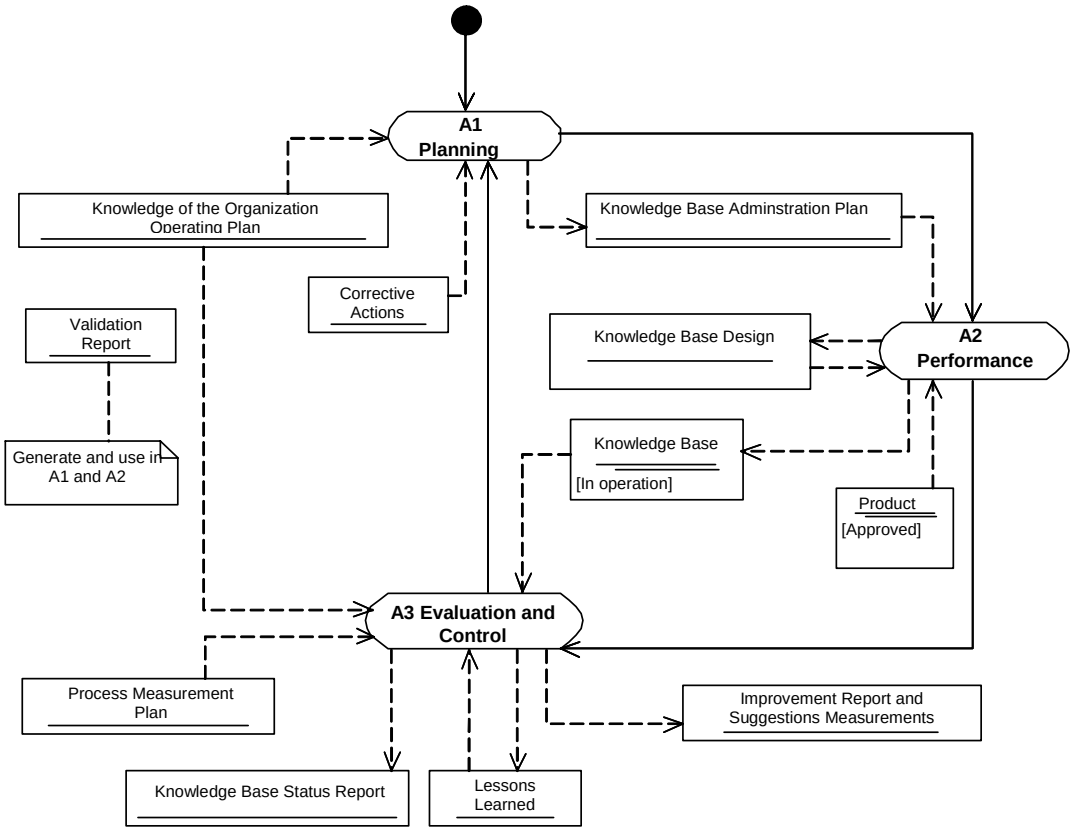
Roles Involved and Training

Role	Abbreviation	Training
Responsible for Resource Management	RRM	Knowledge for the effort necessary to manage the Knowledge Base.
Responsible for Organization's Knowledge	ROK	Knowledge of definition administration of documentary or automated repositories.
Group of individuals responsible for Processes	GRP	Knowledge of process needs with regard to Knowledge Base.

Activities

Role	Description
A1. Planning (G1)	
ROK	A1.1. Identify, document or update the activities required to define or modify the conceptual model of the *Knowledge Base* (BC) according to the *Organization's Knowledge Operating Plan* and *Corrective Action*.
ROK GRP	A1.2. Identify users of each process and document or update their requirements.
ROK GRP	A1.3. Identify feeding, query, maintenance and back up mechanisms for each type of repository, based on user requirements.
ROK	A1.4. Integrate the *Knowledge Base Administration Plan*.
RKR GRP	A1.5. Validate the *Knowledge Base Administration Plan* (**Val1**).
ROK	A1.6. Correct defects found in *Knowledge Base Administration Plan* based on *Validation Report,* and obtain approval of corrections.
A2. Performance (G1)	
ROK	A2.1. Design or update the conceptual model, including its metamodel, of the *Knowledge Base*, based on processes requirements.
ROK	A2.2. Define or update feeding, query, maintenance and back up mechanism for each type of repository, based on process requirements.
ROK	A2.3. Integrate and document the organization's *Knowledge Base Design*.
GRP	A2.4. Validate *Knowledge Base Design* (**Val2**).
ROK	A2.5. Correct defects found in *Knowledge Base Design* based on *Validation Report* and obtain approval of corrections.
ROK	A2.6. Put *Knowledge Base* into operation and provide the maintenance so that products approved coming from all processes and projects are incorporated and consulted.
A3. Monitoring and Control (G1)	
ROK	A3.1. Review if the use of the *Knowledge Base* is made according to the feeding, query, maintenance and back up mechanisms defined.
ROK	A3.2. Generate a *Knowledge Base Status Report,* based on the *Organization's Knowledge Operating Plan*.
ROK	A3.3. Generate the *Measurements and Improvement Suggestions Report* of this process based on the *Processes Measurement Plan.*
ROK	A3.4. Identify *Lessons Learned* for processes and integrate them into the *Knowledge Base.* As an example, best practices, successful risk management experiences, recurring problems, among others can be considered.

Workflow Diagram



Verifications and Validations

Verification or Validation	Activity	Product	Role	Description
Val1	A1.5	*Knowledge Base Administration Plan*	RRM, GRP	Validate that all *Processes Plan* elements are feasible and correspond to process needs. Defects found will be documented in a *Validation Report*.
Val2	A2.4	*Knowledge Base Design*	GRP	Validate that all *Knowledge Base Design* elements correspond to process needs. Defects found will be documented in a *Validation Report*.

Incorporation into *Knowledge Base*

Product	Approval Guidelines
Knowledge Base Administration Plan	Val1
Knowledge Base Design	Val2
Knowledge Base Status Report	None
Measurements and Improvement Suggestions Report	None
Lessons Learned	None
Validation Report(s)	None

Infrastructure Resources

Activity	Resource
A1, A3	Documentation tool.
A2, A3	Automated or non automated design, start up and maintenance tools of the KB.

Measurements

Based on the *Processes Measurement Plan,* a periodical progress report is generated on process indicators with regard to defined quantitative objectives, suggesting the following measurements:

M1 (I1) Perform surveys on users to know the level of satisfaction with regard to feeding, modification and maintenance mechanisms of the *Knowledge Base*.

M2 (I2) Perform surveys on users to know the level of satisfaction with regard to *Knowledge Base* query mechanisms.

M3 (I3) Perform surveys on users to know level of satisfaction with regard to access control mechanisms and backup of *Knowledge Base*.

Training

The ROK shall offer the facilities so that personnel involved in the Organization's Knowledge sub-process participates in the activities of the current *Training Plan* of the *Knowledge Base.*

Exceptional Situations

Roles involved in Organization's Knowledge sub-process shall notify ROK, in a timely manner, of the situations that prevent the development of the assigned activities.

	activities. ROK shall respond to these situations and, if it is not able to solve them or they do not fall on his or her responsibility, shall escalate them to the RRM.
Lessons Learned	Before initiating assigned activities, the roles involved in the Organization's Knowledge process shall consult the *Lessons Learned* of the *Knowledge Base* to leverage the organization's experience and reduce the possibility of recurrent problems.

Tailoring Guides

Knowledge Base	According to the size of the organization (in terms of personnel and number of projects developed), KB may be started in a simplified manner, maintained in a documentary manner, either totally or partially. However, work may be performed on a conceptual design that allows adequate handling and possible automation with support of data base management tools.
Knowledge Base Design	Repository structure may be adapted to the needs or structure of the *Knowledge Base* already established in the organization.
Knowledge Base Design	For consistency purposes with ISO 9001:2000, feeding, query, maintenance and backup mechanisms for each type of repository shall comply with requirement 4.2.3, Documentary Control and 4.2.4 Record Control. For purposes of consistency with CMM level 2, feeding, query, maintenance and backup mechanisms for the Software Development and Maintenance repository, shall comply with key Software Configuration Administration area practices.

9. Operations Category (OPE)

9.1. Specific Projects Management

General Process Definition

Process	**OPE.1 Specific Projects Management**
Category	Operation (OPE)
Purpose	The purpose of Specific Projects Management is to establish and carry out in a systematic way, the activities that allow complying with the project's goals in the expected time and cost.
Description	Specific Projects Management applies knowledge, skills, techniques and tools to each one of the following project activities: • Planning: Set of activities which purpose is to obtain and maintain the *Project Plan* and the *Development Plan* that will rule the specific project, based on the *Project Description.* To generate this plan, the following tasks are performed: - Define the *Specific Process* based on the *Project Description* and the Software Development and Maintenance Process of the organization or based on the Customer Contract. - Define the *Delivery Protocol* with Customer. - Define *Cycles and Activities* based on *Project Description* and the *Specific Process.* - Determine the *Estimated Time* for each activity, considering the *Quantitative Project Objectives.* - Prepare the *Acquisition and Training Planning* to obtain trained human resources and purchase materials, equipment and tools to carry out the project. - Establish the *Work Team* that will perform the project. - Establish the activities *Schedule*. - Calculate the *Estimated Project Cost*. - Define the *Risk Management Plan*. - Document the *Project Plan*. - Document the *Development Plan.* - Formalize the start-up of a new project cycle. • Performance: Refers to carry out the activities of the *Project Plan,* as per the following tasks: - Agree on tasks of the *Work Team* with the Responsible for Software Development and Maintenance. - Agree on the distribution of the information to the *Work Team*. - Review with the Responsible for Software Development and Maintenance the *Product Description,* the *Work Team* and the *Schedule.* - Review compliance with *Acquisition and Training Plan.* - Manage subcontracts. - Gather *Activities Reports, Measurement and Improvement Suggestions Reports* and work products. - Record the real project cost. - Review the *Tracking Record* based on work products gathered.

	- Review finished products during project. - Receive and analyze Customer´s *Change Request.* - Perform meetings with the *Work Team* and the Customer to report on progress made on project and reach agreements. • Evaluation and Control: It is assuring that the project's *Goals* are achived. Progress is supervised and evaluated to identify deviations and undertake *Corrective Actions*, whenever necessary. Within this activity, the following activities are undertaken: - Evaluate achivement of the *Project Plan* and the *Development Plan*. - Analyze and control risks. - Generate *Project Progress Report.* As a result of these activities, the *Project Plan* and the *Development Plan* are updated. • Closing: It refers to deliver the products according to the *Delivery Protocol* and formalize conclusion of the cycle or project. As a result, we have the Customer *Acceptance Document.* The following tasks are undertaken: - Formalize project or cycle conclusion. - Carry out contract closing with subcontractors. - Generate *Measurements and Improvement Suggestions Report.*
Goals	G1 Achieve the project's *Goals* on time and cost coordinating and handling its resources. G2 Keep the Customer informed through project progress meetings. G3 Attend customer's *Change Requesta* receiving and analyzing them.
Indicators	I1 (G1) The *Project Plan* and *Development Plan* comprises *Goals* established in the *Project Description* and the *Quantitative Project Objectives*. I2 (G1) Project activities are performed according to the *Project Plan* and the *Development Plan.* I3 (G1) Actual time and cost as per that estimated. I4 (G2) Project progress meeting as per that agreed with the Customer. I5 (G3) Reception and analysis mechanism are applied to all *Change Requests*.
Quantitative Objectives	Numerical value or satisfaction range by indicator.
Responsibility and Authority	Responsible: • Responsible for Specific Projects Management Authority: • Responsible for Project Portfolio Management

Related Processes	Business Management Process Management Project Portfolio Management Resource Management Human Resources and Work Environment Organization's Knowledge Software Development and Maintenance

Inputs

Name	**Source**
Communication and Implementation Plan	Business Management
Processes Plan: • *Process Measurements Plan*	Process Management
Process Documentation • *Software Development and Maintenance*	Process Management
Project Description • *Product Description* • *Scope* • *Goals* • *Deliverables*	Project Portfolio Management
Responsible for Specific Projects Management	Project Portfolio Management
Quantitative Project Objectives	Project Portfolio Management
Corrective or Preventive Actions	Project Portfolio Management
Resource Allocation	Human Resources and Work Environment
Activities Report	Software Development and Maintenance
Measurement and Improvement Suggestions Report	Software Development and Maintenance
Software Configuration	Software Development and Maintenance
Change Request	Customer

Outputs

Name	Description	Destination
Measurements and Improvement Suggestions Report	Record containing: ***** Measurements of Specific Projects Management process (see **Measurements**). ***** Improvement Suggestions on Specific Projects Management process (methods, tools, formats, standards, among others.)	Process Management
Project Plan	Formal document used as a guide for project execution and control. Made up of: • *Cycles and Activities* • *Estimated Time* • *Acquisition and Training Plan* • *Work Team* • *Estimated Cost* • *Schedule* • *Risks Management Plan* • *Delivery Protocol*	Project Portfolio Management
Progress Report	Contains the progress record of activities undertaken, including those undertaken in the *Risk Management Plan.* Progress is recorded per cycle, including the start and finish dates. Contains periodic measurements record of: actual project cost, actual effort, changes implemented and clasified by type, actual time invested, defects found, size of products and duplicated work.	Project Portfolio Management
Acceptance Document	Document which establises the customer's acceptance on project´s deliverables	Project Portfolio Management
Project Plan • *Acquisition and Training Plan*	Contains the list of human resources, training, materials, equipment and tools needed for project performance.	Resource Management
Lessons Learned	Record of best practices, recurring problems and successful experiences in the solution of problems found during project development.	Organization's Knowledge

Name	Description	Destination
Development Plan	Document used as a guide to undertake software development or maintenance. Contains: *Description of Product and Deliverables:* Contains the description of the product to be developed or the change to be made and the description of deliverables. *Specific Process:* Includes the process adjusted to the project where it will be applied (process defined from the organizational process) or Customer Contract. Indicates the number of cycles and the phases in each cycle. Includes the activities to carry out the verifications, validations and tests, and specifies the techniques to be applied. *Work Teams* Human resources assigned to the project. *Schedule:* Contains the activities to be carried out with start and end dates.	Software Development and Maintenance

Internal Products

Name	Description
Corrective Actions	Actions established to correct a deviation or problem with regard to *Project Plan* and *Development Plan* compliance.
Minute(s)	Document describing the purpose of meetings held, items discussed and agreements.
Verification Report	Record of participants, date, place, duration and defects found.
Validation Report	Record of participants, date, place, duration and defects found.

Bibliographical References

ISO 9001:2000 Quality Management Systems - Requirements

The Capability Maturity Model: Guidelines for Improving the Software Process. Carnegie Mellon University, Software Engineering Institute. 1994. Addison- Wesley.

ISO/IEC 12207:1995/Amd.1:2002(E) Information technology — Software life cycle processes

A guide to Project Management Body of Knowledge (PMBOK). Project Management Institute. Edición 2000.

Practices

Roles involved and Training

Role	Abbreviation	Training
Responsible for Project Portfolio Management	RPPM	Knowledge of activities necessary to carry out project portfolio management.
Responsible for Specific Projects Management	RSPM	Leadership with experience in decision making, strategic planning, personnel management, delegating and supervising, finance and software development.
Customer	CU	Knowledge on change request Processing
Responsible for Subcontracting	RSC	Knowledge of project management .
Responsible for Software Development and Maintenance	RDM	Knowledge and experience in software development and maintenance
Work Team	WT	Knowledge and experience as per role.

Activities

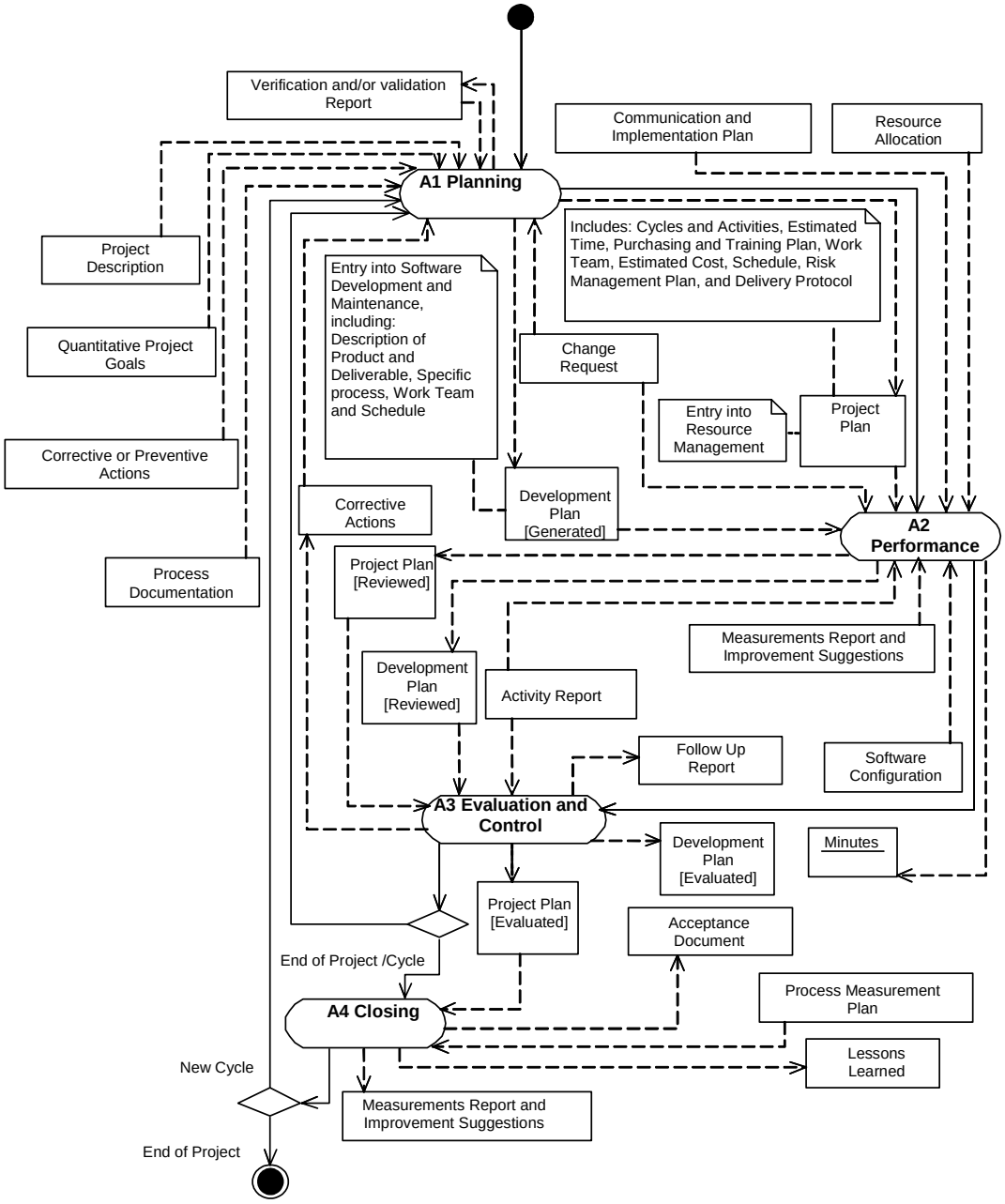
Role	Description
A1. Planning (G1)	
RPPM RSPM RDM	A1.1. Review *Project Description* with Responsible for Project Portolio Management.
RSPM	A1.2. Based on *Project Description,* define *Specific Project Process* based on organization´s *Software Development and Maintenance Process* or on the Contract established with the Customer. Project scope, extension and complexity are considered.

Role	Description
RSPM CU	A1.3. Define with Customer the *Delivery Protocol* of each deliverable specified in the *Project Description.*
RSPM	A1.4. Identify the number of cycles and the specific activities that shall be carried out to produce deliverables and their components identified in the *Project Description*. Identify the specific activities that must be carried out to achieve project goals, define the activities to carry out periodical product or service reviews and to carry out reviews among colleagues. Identify activities to undertake the *Deliver Protocol.* Document the result as *Cycles and Activities*.
RSPM	A1.5. Identify and document the relationship and dependency of each one of the activities.
RSPM RDM	A1.6. Establish the *Estimated Time* to develop each activity, considering the historical information and the *Quantitative Project Objectives*.
RSPM	A1.7. Prepare a *Acquisition and Training Plan,* defining the features and schedule with regard to human resources, material, equipment and tools, including the training required by the work team to perform the project.
RPPM RSPM	A1.8. Establish the *Work Team*, assigning roles and responsibilities based on *Project Description.*
RSPM	A1.9. Assign start and finish dates for each activity to generate the work *Schedule* taking into account the resources assigned, the sequence and dependency of activities.
RSPM	A1.10. Evaluate and document the *Estimated Project Cost,* taking into account *Quantitative Project Goals*.
RPPM RSPM RDM	A1.11. Identify, describe and evaluate the risks that may affect the project, including those related to the work team, Customer and the users, risks with technology or methodology, risks with project organization (cost, time, scope and resources) or external project risks. Identify the probability and impact of each risk, estimating its implications on project objectives (quantitative analysis). Prioritize the effects of risks on project goals (qualitative analysis). Develop procedures to reduce the impact of risks. Document or update in the *Risk Management Plan*.
RSPM	A1.12. Generate or update the *Project Plan* before starting the new cycle. Furthermore, the *Project Plan* may be updated based on a *Change Request* by the Customer, *Corrective Actions* or *Preventive Actions* coming from Project Portfolio Management or *Corrective Actions* of this process.
RSPM RDM	A1.13. Generate or update a *Development Plan* based on the *Project Plan* before starting a new cycle. Furthermore, the *Development Plan* must be updated as a result of the *Change Request* by the Customer, *Corrective or Preventive Actions* coming from Project Portfolio Management or *Corrective Actions* of this process.
RSPM RDM	A1.14. Verify the *Project Plan* and the *Development Plan* (**Ver1**).
RSPM	A1.15. Correct defects found in the *Project Plan* and the *Development Plan* based on the *Verification Report* and get approval of corrections.
RPPM	A1.16. Validate the *Project Plan* and the el *Development Plan* (**Val1**).
RSPM	A1.17. Correct defects found in the *Project Plan* and the *Development Plan* based on the el *Validation Report* and get approval of corrections.

Role	Description
RSPM RDM	A1.18. Formal startup of a new cycle once compliance with initial cycle conditions has been ensured.
A2. Performance (G1, G2, G3)	
RSPM RDM	A2.1. Agree with Responsible for Project Development and Maintenance the tasks assigned to the *Work Team,* including subcontractors.
RSPM RDM	A2.2. Agree on the distribution of information necessary to the work team based on the *Communication and Implementation Plan*.
RSPM RDM	A2.3. Review with the Responsible for project Development and Maintenance *Product Description, Work Team* and *Schedule*.
RSPM RDM RSC	A2.4. Monitor the *Acquisition and Training Plan,* accept or reject the *Allocation of Human Resources* or subcontractors. Distribute resources to team members so that they may carry out activities.
RSPM RSC	A2.5. Handle the relationship with subcontractors, which implies planning, reviewing and auditing activities, ensuring the quality of the products or services hired and compliance with standards and specifications agreed upon.
RSPM	A2.6. Gather and analyze *Activities Reports, Measurement and Improvement Suggestions Reports* and work products.
RSPM	A2.7. Record actual costs and resources for the cycle.
RSPM	A2.8. Review *Tracking Record* of user requirements through cycle.
RSPM RDM	A2.9. Review products generated during cycle, which form part of *Software Configuration.*
RSPM RDM	A2.10. Receive and analyze *Change Requests* and incorporate changes approved into the *Project Plan* and in the *Development Plan.* In the event of changes to requirements, these are incorporated upon starting a new cycle.
RSPM WT CU	A2.11. Perform review meetings with the work team and with the Customer, generating *Minutes* with items discussed and treatments made.
A3. Evaluation and Control (G1)	
RSPM	A3.1. Evaluate compliance of *Project Plan* and *Development Plan*, with regard to scope, cost, schedule, work team, process to establish *Corrective Actions.*
RSPM RPPM	A3.2. Monitor and control *Risk Management Plan.* Identify new risks and update plan.
RSPM	A3.3. Generate project *Progress Report,* considering *Activities Report.*
A4. Closing (G1)	
RSPM CU	A4.1. Formalize termination of cycle or project as per the *Delivery Protocol* set forth in the *Project Plan* and obtain *Acceptance Document.*
RSPM RSC	A4.2. Perform closure with subcontractors as per established agreement.
RSPM	A4.3. Generate *Measurement and Improvement Suggestions Report* for this process, as per *Processes Measurement Plan*.

Role	Description
	per *Processes Measurement Plan*.
RSPM	A4.4. Identify *Lessons Learned* and integrate them into the *Knowledge Base.* As an example, best practices, successful risk handling experiences, recurring problems, among other things can be considered.

Workflow Diagram



Verifications and Validations

Verification or Validation	Activity	Product	Role	Description
Ver1	A1.14	*Project Plan* *Development Plan*	RSPM RDM	Verify that all elements of the *Project Plan* and the *Development Plan* are feasible and consistent. Defects found will be documented in a *Verification Report.*
Val1	A1.16	*Project Plan* *Development Plan*	RPPM	Validate that the definition of *Project Plan* and *Development Plan* elements are in accordance with *Project Description*. Defects found will be documented in a *Validation Report.*

Incorporation to the *Knowledge Base*

Product	Approval Guidelines
Project Plan	Ver1, Val1
Development Plan	Ver1, Val1
Progress Report	None
Measurement Report and Improvement Suggestions	None
Acceptance Document	None
Lessons Learned	None
Corrective Actions	None
Minute(s)	None
Verification Report	None
Validation Report	None
Change Request	None

Infrastructure Resources

Activity	Resource
A1, A2, A3, A4	Tools that allow documenting, handling and controlling the *Project Plan* and *Development Plan.*

Measurements

Based on the *Processes Measurement Plan,* a periodic progress report is generated on process indicators, with regard to defined quantitative objectives. The following measurements are suggested:

M1 (I1) Verify that the *Project Plan* and the *Development Plan* consider the *Goals* established in the *Project Description* and the *Quantitative Objectives for the Project* to achieve consistency.
M2 (I2) Compare the *Project Plan* and the *Development Plan* against *Progress and Activity Report* to find out the deviation against plan.
M3 (I3) Compare the *Project Plan* against the actual time and cost contained in the *Progress Report* to find out deviation against estimations .

	M4 (I4) Review *Minutes* to verify the performance of project progress meetings. M5 (I5) Review *Change Requests* to verify that they have been properly taken into account.
Training	The RSPM shall offer the facilities so that the personnel involved in the Specific Projects Management process participates in the activities of the current *Training Plan* of the *Knowledge Base*.
Exceptional situations	Roles involved in Specific Projects Management shall notify RSPM, in a timely way, of the situations that prevent the development of the assigned activities. RSPM shall respond to these situations and, if it is not able to solve them or they do not fall on his or her responsibility, shall escalate them to the RPPM level.
Lessons Learned	Before initiating the assigned activities, the roles involved in the Specific Projects Management process shall consult the *Lessons Learned* of the *Knowledge Base* to take advantage of the organization's experience and reduce the possibility of recurrent problems.

Tailoring Guides

Project Plan	The *Project Plan* may be generated in one or several documents. If it is in several documents plans administration should be included.
Development Plan	The *Development Plan* may be omitted if the RSPM and RDM roles are performed by one same individual. In this case, the document that shall govern the Software Development Maintenance process shall be the *Project Plan.*
Administration of Subcontractors	For purposes of consistency with CMM level-2, subcontractor management shall satisfy with the practices of the Software Subcontractor Administration key area.

9.2. Software Development and Maintenance

General Process Definition

Process	**OPE.2 Software Development and Maintenance**
Category	Operation (OPE)
Purpose	The purpose of Software Development and Maintenance is the systematic performance of analysis, design, construction, integration and testing activities on new or modified software products, in compliance with specified requirements.
Description	The Software Development and Maintenance process is composed by one or more development cycles. Each cycle is made up by the following phases: • Start: Review of *Development Plan* by *Work Team* members to achieve a common understanding of the project and commitment for its performance. • Requirements: Set of activities whose purpose is to obtain the documentation of the *Requirement Specification* and the *System Test Plan,* in order to have a common understanding between the customer and the project. • Analysis and Design: Set of activities where specified requirementsto produce a description of the software component structure are analyzed, which will serve as a basis for construction. As result, the *Analysis and Design* documentation and the *Integration Test Plan* are obtained. • Construction: Set of activities to produce software component(s) that correspond to *Analysis and Design* as well as the performance of unit test. As a result, tested software *Component(s)* are obtained. • Integration and Tests. Set of activities to integrate and test software components, based on *Integration and System Test Plans,* in order to obtain the *Software* that satisfies the specified requirements. The final versions of the *User Manual, Operations Manual and Maintenance Manual* are generated. As a result, the proven and documented *Software* product is obtained. • Closing: Final integration of *Software Configuration* generated in the different phases is performed for delivery. Identification and documentation of *Lessons Learned.* Generation of *Measurements Report and Improvement Suggestion.* To generate the products of each one of the phases, the following activities are performed: • Task distribution, the responsibilities of each member of the *Work Team* are assigned according to the *Development Plan*. • Production, verification, validation and testing of products, as well as the corresponding correction. • Generation of *Activity Report.*
Goals	G1 Make sure that output products are consistent with input products in each phase of a development cycle by means of verification, validation or testing activities. G2 Support the performance of future cycles or maintenance projects by

	means of the integration of the current cycle *Software Configuration*. G3 Carry out the activities of the cycle phases by complying with the current *Development Plan*.
Indicators	I1 (G1) All the verification, validation or testing activities, as well as the corresponding corrections, will be made during each phase of the cycle. I2 (G2) *Software Configuration* is integrated by the products generated in the cycle. I3 (G3) Activities planned in each cycle phase will be performed according to that set forth in the *Development Plan*.
Quantitative Objectives	Numerical value or satisfaction range by indicator.
Responsibility and Authority	Responsible Party: • Responsible for Software Development and Maintenance Authority: • Responsible for Specific Projects Management
Related Processes	Specific Projects Management Organization's Knowledge

Inputs

Name	**Source**
Development Plan • *Product Description* • *Deliverables* • *Specific Process* • *Work Team* • *Schedule*	Specific Projects Management

Outputs

Name	Description	Destination
Requirement Specification	Made up of an introduction and a description of requirements. Introduction: General software description and its use in the customer's business environment. Description of Requirements: ***** Functional: Established needs that software must meet when used under specific conditions. Functionality must be adequate, accurate and safe. * User interface: Definition of those features of the user interface that allow the software to be easy to understand and learn, that generates satisfaction and with which the user may perform his/her tasks efficiently. It includes a description of the interface prototype. * External interfaces: Definition of interfaces with other software or hardware. ***** Reliability: Software performance level specification with regard to maturity, fault tolerance and recovery. ***** Efficiency: Specification of software performance level with regard to time and use of resources. ***** Maintenance: Description of elements facilitating the understanding and performance of future software modifications. ***** Portability: Description of software features that allow its transfer to another environment. ***** Design and construction restrictions: Needs imposed by customer. ***** Legal and regulatory: Needs imposed by laws, regulations, etc.	Specific Projects Management
Analysis and	This document contains text and graphic description of	Specific Projects

Name	Description	Destination
Design	the software components structure, which comprises the following parts: Architectural: Contains the internal system structure, the breakdown of the system into subsystems. It also contains the identification of the components that make up the subsystems and their interactions. Detailed: Contains the detail of components that clearly enables building and testing them in the programming environment.	Management
Component	Set of related code units.	Specific Projects Management
Software	Software system for a customer or user, constituted by components grouped in subsystems, possibly nested.	Specific Projects Management
Software Configuration	Set consisting of software products, that includes: • *Requirement Specification* • *Analysis and Design* • *Software* • *Traceability Record* • *System Testing Plan* • *System Testing Report* • *Integration Testing Plan* • *Integration Testing Report* • *User Manual* • *Operation Manual* • *Maintenance Manual*	Specific Projects Management
User Manual	Electronic or printed document that describes software use based on the user interface. It shall be written in terms understandable by users.	Specific Projects Management
Operations Manual	Electronic or printed document containing essential information for the installation and administration of software, as well as the operating environment (operating system, database, servers, etc.). This shall be written in terms that the personnel responsible for the operation can understand.	Specific Projects Management
Maintenance Manual	Electronic or printed document describing *Software Configuration* and the environment used for development and tests (compilers, analysis and design tools, constructions and tests.) This shall be written in terms that maintenance personnel can understand.	Specific Projects Management

Name	Description	Destination
Activity Report	Periodic activity record, start and finish dates, responsible party and measurements, such as: • Production, correction, verification and validation times • Defects found in verification, validation or testing • Product size	Specific Projects Management
Lessons Learned	Record of best practices, recurrent and successful experiences in the solution of problems found in a development and maintenance cycle.	Organization's Knowledge
Measurements and Improvement Suggestions Report	Record containing: ***** Measurements of Software Development and Maintenance process indicators (see **Measurements**.) ***** Improvement Suggestions on Software Development and Maintenance process (methods, tools, formats, standards, etc.)	Specific Projects Management
Traceability Record	Relationships between requirements, analysis and design elements, components and testing plans.	Specific Projects Management
System Test Plan	Identification of tests required for satisfaction of the specified requirements.	Specific Projects Management
System Test Report	Record of participants, date, place, duration and defects found.	Specific Projects Management
Integration Testing Plan	Description containing: ***** The order of integration of components or subsystems, guided by the architectural part of *Analysis and Design.* ***** Tests to be applied to verify the interaction between components.	Specific Projects Management
Integration Test Report	Record of participants, date, place, duration and defects found.	Specific Projects Management

Internal Products

Name	Description
Verification Report(s)	Record of participants, date, place, duration and defects found.
Validation Report(s)	Record of participants, date, place, duration and defects found.

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The Capability Maturity Model: Guidelines for Improving the Software Process. Carnegie Mellon University, Software Engineering Institute. 1994. Addison- Wesley.

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SWEBOK, Trial Version. Software engineering Coordinating Committee, Computer Society, Software Engineering Institute. 2001.

Introduction to Team Software Process, Watts Humphrey, Addison Wesley, 2000.

Practices

Roles Involved and Training

Role	Abbreviation	Training
Responsible for Specific Projects Management	RSPM	Leadership with experience in decision making, strategic planning, personnel management and software development.
Responsible for Software Development and Maintenance	RDM	Knowledge and experience in software development and maintenance.
Analyst	AN	Knowledge and experience in obtaining, specifying and analyzing requirements.
User Interface Designer	IUD	Knowledge in the design of user interfaces and ergonomic criteria.
Designer	DE	Knowledge and experience in the design of the software component structure.
Developer	DEV	Knowledge and/or experience in programming, integration and unit tests.
Responsible for Testing	RTE	Knowledge and experience in planning and performing system and integration tests.
Reviewer	RE	Knowledge of review techniques and experience in software development and maintenance.
Responsible for Manuals	RM	Knowledge of writing techniques and experience in software development and maintenance.
Work Team	WT	Knowledge and experience as per role.
Customer	CU	Interpretation of requirements specification standard.
User	US	None

Activities

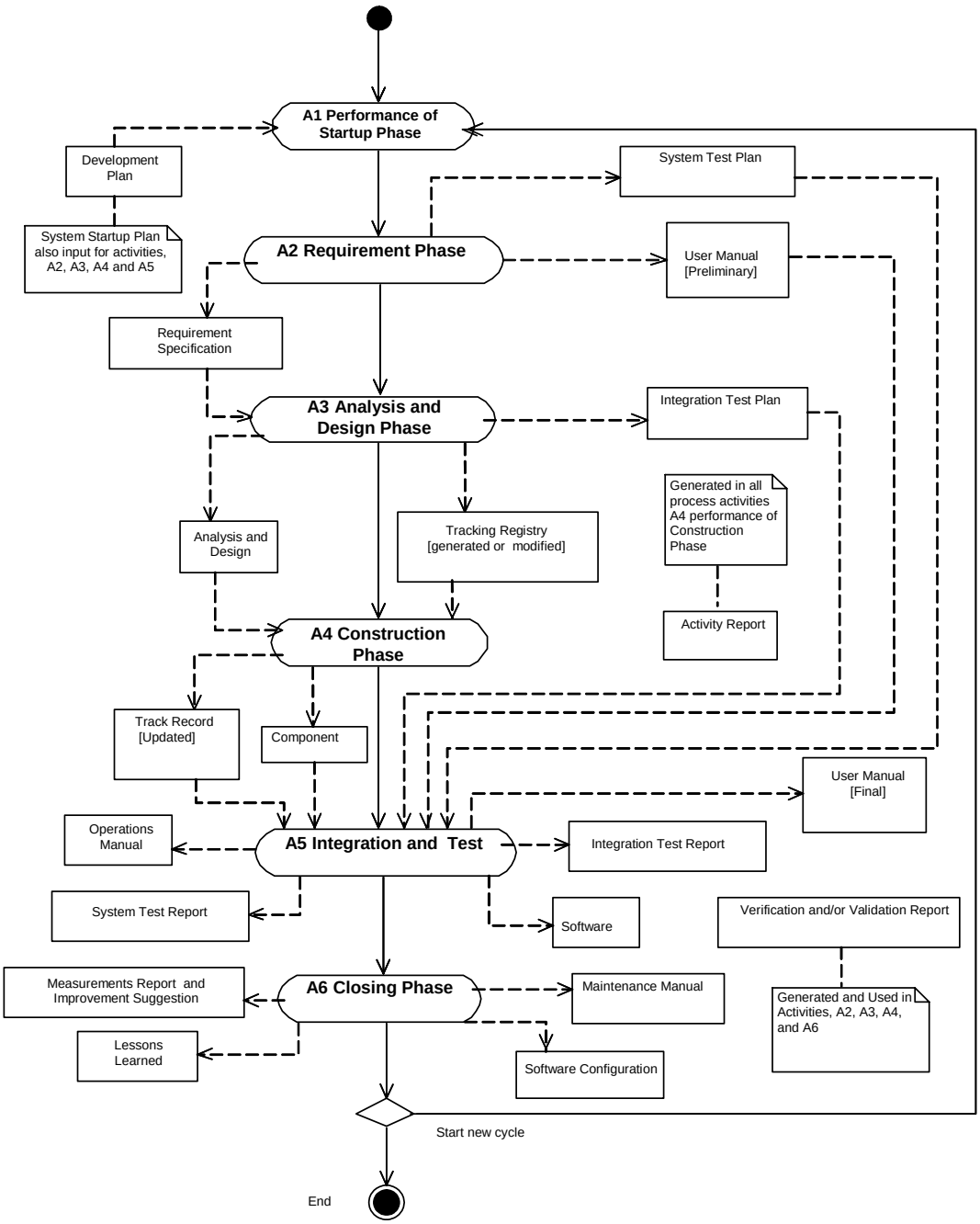
Role	Description
A1. Performance of the Startup Phase (G3)	
WT	A1.1. Review current *Development Plan* with work team members to achieve common understanding and obtain project commitment.
RDM	A1.2. Prepare the *Activities Report* recording the activities performed, start and finish dates, party responsible per activity and measurement required.
A2. Performance of the Requirement Phase (G1, G3)	
RDM AN	A2.1. Distribute tasks to work team members as per role, according to the current *Development Plan*.
AN CU US	A2.2. Document or modify *Requirement Specifications*. • Identify and query information sources (customers, users, previous systems, documents, etc.) to obtain new requirements. • Analyze requirements identified to limit their scope and feasibility, considering the customer's or project's business environment restrictions. • Prepare or modify the user interface prototype. • Generate or update the *Requirement Specifications.*
RE	A2.3. Verify the *Requirements Specification* (**Ver1**).
AN	A2.4. Correct defects found in *Requirement Specification* based on *Verification Report* and obtain approval of corrections.
CU US RTE	A2.5. Validate *Requirements Specification* (**Val1**).
AN	A2.6. Correct defects found in *Requirements Specification* based on *Validation Report* and obtain approval of corrections.
RTE AN	A2.7. Prepare or modify *System Test Plan*.
RE	A2.8. Verify the *System Test Plan* (**Ver2**).
RTE	A2.9. Correct defects found in *System Test Plan* based on *Verification Report* and obtain approval of corrections.
RM	A2.10. Document preliminary version of *User Manual* or modify existing manual.
RE	A2.11. Verify *User Manual* (**Ver3**).
RM	A2.12. Correct defects found in *User Manual* based on *Verification Report* and obtain approval of corrections.
RDM	A2.13. Incorporate *Requirements Specification, System Test Plan and User Manual* as baselines to *Software Configuration.*
RDM	A2.14. Prepare the *Activities Report* recording the activities undertaken, start and finish dates, responsible party per activity and measurements required.
A3. Performance of the Analysis and Design Phase (G1,G3)	
RDM	A3.1. Distribute tasks to work team members as per the role, according to current *Development Plan*

Role	Description
AN DE	*Development Plan*.
AN DE	A3.2. Document or modify *Analysis and Design:* • Analyze *Requirements Specification* to generate the description of the internal system structure and its subsystem decomposition, and this into components, defining the interfaces among them. • Describe in detail the appearance and behavior of the interface based on the *Requirement Specification* in a way that resources for its implementation can be foreseen. • Describe the detail of components that allow their construction in an evident manner. • Generate or update *Analysis and Design*. • Generate or modify the *Traceability Record.*
RE	A3.3. Verify the *Analysis and Design and the Traceability Record* (**Ver4**).
AN DE	A3.4. Correct defects found in *Analysis and Design* and in the *Traceability Record* based on the *Verification Report* and obtain approval of corrections.
CU RTE	A3.5. Validate *Analysis and Design* (**Val2**).
AN DE	A3.6. Correct defects found in *Analysis and Design* based on *Validation Report* and obtain approval of corrections.
RTE	A3.7. Prepare or modify *Integration Testing Plan*.
RE	A3.8. Verify *Integration Testing Plan* (**Ver5**).
RTE	A3.9. Correct defects found in *Integration Testing Plan* based on *Verification Report* and obtain approvals of corrections.
RDM	A3.10. Incorporate *Analysis and Design*, *Traceability Record and Integration Testing Plan* as baselines to *Software Configuration*.
RDM	A3.11. Prepare *Activities Report* recording the activities performed, start and finish dates, responsible party per activity and measurements required.
A4. Performance of the Construction Phase (G1,G3)	
RDM	A4.1. Distribute tasks to work team members as per the role, according to the current *Development Plan*.
DE	A4.2. Build or modify software Component(s)*:* • Implement or modify Component(s) based on the detailed part of *Analysis and Design.* • Define and apply unit tests to verify that the operation of each component is in accordance with the detailed part of *Analysis and Design.* • Correct defects found until successful unit tests are achieved (without defects). • Update the *Traceability Record,* incorporating built or modified components.
RE	A4.3. Verify the *Traceability Record* (**Ver6**).
DEV	A4.4. Correct defects found and the *Traceability Record* based on *Verification Report* and obtain approval of corrections.

Role	Description
RDM	A4.5. Incorporate *Components and Traceability Record* as baseline to *Software Configuration*.
RDM	A4.6. Prepare the *Activities Report,* recording the activities, start and finish dates, responsible party per activity and measurements required.
A5. Performance of the Integration and Testing Phase (G1,G3)	
RDM	A5.1. Distribute tasks to work team members as per the role, according to current *Development Plan*.
DEV RTE	A5.2. Perform integration and tests. • Integrate components in software subsystems or system and apply the tests following the *Integration Test Plan*, documenting the results in an *Integration Test Report*. • Correct defects found, based on *Integration Test Report,* until a successful integration test (without defects) is achieved. • Update *Traceability Record.*
RM	A5.3. Document the *Operation Manual* or modify the existing one.
RE	A5.4. Verify *Operations Manual* (**Ver7**).
RM	A5.5. Correct defects found in *Operations Manual* based on *Verification Report* and obtain approval of corrections.
RTE	A5.6. Perform system tests following the *System Tests Plan,* documenting the results in *System Test Report*.
DE	A5.7. Correct defects found in system test based on *System Test Report* and obtain approval of corrections.
RM	A5.8. Document *User Manual* or modify the existing one.
RE	A5.9. Verify the *User Manual* (**Ver8**).
RM	A5.10. Correct defects found in *User Manual* based on *Verification Report* and obtain approval of corrections.
RDM	A5.11. Incorporate *Software*, *Integration Test Report, Traceability Record, Operations Manual and User Manual* to *Software Configuration baseline*.
RDM	A5.12. Prepare *Activities Report* recording the activities performed, start and finish dates, party responsible per activity and measurements required.
A6. Performance of the Closing Phase (G2)	
RM	A6.1. Document *Maintenance Manual* or modify the existing one.
RE	A6.2. Verify the *Maintenance Manual* (**Ver9**).
RM	A6.3. Correct defects found and *Maintenance Manual* based on the *Verification Report* and obtain the approval of corrections.
RDM	A6.4. Incorporate *Maintenance Manual* to the *Software Configuration baseline*.
RDM WT	A6.5. Identify *Lessons Learned* and integrate them into the *Knowledge Base.* As an example, best practices, successful risk management experiences, recurring problems, among others , can be considered.

Role	Description
RDM WT	A6.6. Generate *Measurements and Improvement Suggestions Report*.
RDM	A6.7. Prepare the *Activities Report* recording the activities performed, start and finish dates, responsible party per activity and measurements required.

Workflow Diagram



Verifications and Validations

Verification or Validation	Activity	Product	Role	Description
Ver1	A2.3	*Requirement Specification*	RE	Verify the clearness of the *Requirement Specification* and its consistency with the *Product Description* and with the documentation standard required in the *Specific Process.* Additionally, review that requirements are complete, unambiguous and not contradictory. Defects found will be documented, in a *Verification Report*
Val1	A2.5	*Requirement Specification*	CU, US, RTE	Validate that*Requirement Specification* satisfies needs and agreed upon expectations, including the user interface usability test Defects found are documented in a *Validation Report.*
Ver2	A2.8	*System Test Plan*	RE	Verify consistency of the *System Test Plan* with the *Requirement Specification* and with the standard documentation required in the *Specific Process.* Defects found will be documented in a *Verification Report.*
Ver3	A2.11	*User Manual*	RE	Verify consistency of the *User Manual* with the *Requirement Specification* and with the standard documentation required in the *Specific Process.* Defect found will be documented in a *Verification Report.*
Ver4	A3.3	*Analysis and Design* *Tracking RegistryTraceability Record*	RE	Verify clearness of *Analysis and Design* documentation, its feasibility and consistency with their *Requirement Specification* and with the standard documentation required in the *Specific Process.* Verify that the *Traceability Record* contains the adequate relationships between requirements and the *Analysis and Design* elements. Defects found will be documented in a *Verification Report.*
Val2	A3.5	*Analysis and Design*	CU, RT	Validate that *Analysis and Design* complies with the needs and expectations agreed upon with the customer. Defects found will be documented in a *Validation Report*.
Ver5	A3.8	*Integration Test Plan*	RE	Verify consistency of the *Integration Test Plan* with *Analysis and Design* and with the standard documentation required in the *Specific Process*. Defects found will be documented in a *Verification Report*.

Verification or Validation	Activity	Product	Role	Description
Ver6	A4.3	*Traceability Record*	RE	Verify that the *Traceability Record* contains the adequate relationships between *Analysis and Design* elements and components. Defects found will be documented in a *Verification Report*.
Ver7	A5.4	*Operations Manual*	RE	Verify consistency of the *Operations Manual* with the *Software* and with the standard documentation required in the *Specific Process.* Defects found will be documented in a *Verification Report.*
Ver8	A5.9	*User Manual*	RE	Verify consistency of the *User Manual* with the *Software* and with the standard documentation required in the *Specific Process.* Defects found will be documented in a *Verification Report.*
Ver9	A6.2	*Maintenance Manual*	RE	Verify consistency of *Maintenance Manual* with *Software Configuration* and with the standard documentation required in the *Specific Process.* Defects found will be documented in a *Verification Report.*

Incorporation into the *Knowledge Base*

Product	Approval Guidelines
Requirement Specification	Ver1, Val1
System Test Plan	Ver2
User Manual	Ver3
Analysis and Design	Ver4, Val2
Traceability Record	Ver4
Integration Test Plan	Ver5
Component(s)	Successful unit test
Traceability Record	Ver6
Software	Successful integration test, successful system test
Operations Manual	Ver7
User Manual	Ver8
Maintenance Manual	Ver9
Integration Test Report	None
System Test Report	None
Activity Report(s)	None

Lessons Learned	None
Verification Report(s)	None
Validation Report(s)	None

Infrastructure Resources

Activity	Resource
A1, A2, A3, A4, A5, A6	Documentation tool.
A2	*Requirement Specification* tools
A3	*Analysis and Design* tools.
A4	Construction tools.
A4, A5	Testing tools.

Measurements

At the end of each cycle, a process indicator status report is generated with regard to defined quantitative objectives; the following measures are suggested:

M1 (I1) Review *Verification Reports, Validation Reports* and/or test reports for each phase to confirm that these activities have been performed and the corrections have been incorporated.

M2 (I2) Review *Software Configuration* to verify that products included are the same that were generated in the cycle.

M3 (I3) Compare the current *Development Plan* for each phase with the corresponding *Activities Report* to know actual vs. planned results.

Training

The RDM shall offer the facilities so that personnel involved in Software Development and Maintenance participates in the activities of the current *Training Plan* of the *Knowledge Base.*

Exceptional Situations

Roles involved in Software Development and Maintenance shall notify RDM, in a timely manner, of the situations that prevent the development of the assigned activities.

RDM shall respond to these situations and, if it is not able to solve them or they do not fall on his or her responsibility, shall escalate them to the RSPM.

Lessons Learned

Before initiating assigned activities, roles involved in the Software Development and Maintenance process shall consult the *Lessons Learned* of the *Knowledge Base* to take advantage of the organization's experience and reduce the possibility of recurrent problems.

Tailoring Guides

Requirements: *Requirement Specification*	*Requirement Specification* may include a simple user interface prototype, even without functionality.
Requirements: User Manual	In the Requirements phase, the preparation or updating of the *User Manual,* as well as its verification may be omitted. However, this activity shall be performed not later than during the integration and testing phase.
Requirements: *System Test Plan*	The *System Test Plan* may be validated with the customer, if agreed upon.
Analysis and Design: *Analysis and Design*	If agreed with the customer, *Analysis and Design* validation may be omitted.
Construction: Revision of code among colleagues	Before performing unit test, revisions among colleagues to verify component code with regard to *Analysis and Design* may be included. The benefit of these reviews is a reduction in the number of defects in future phases and correction time.
Construction: Unit Tests	Unit tests may be defined systematically and documented following the IEEE Std 1008-1987 (R 1993) Standard for Software Unit Testing.
Construction: Interface Prototype	In the Construction phase, the preparation or modification of the interface prototype may be added, in order to perform a test with the user, so that critical usage defects may be identified. If users are not available for the interface test, revision by an expert may be undertaken or individuals of a similar profile may be chosen.
Activity Report	Measurements required in the *Activity Report* may be modified as per the organization's or project's needs.

Annexes

A1. Relationship of MoProSoft with ISO 9001:2000, CMM v1.1 and ISO/IEC 12207:1995/Amd.1:2002(E)

This annex presents a comparison between MoProSoft processes and the most important standards and models of its bibliography, such as:

- ISO 9001:2000
- CMM v1.1 (as specified in “CMM Practices” document - CMU/SEI-93-TR-25)
- ISO/IEC 12207:1995/Amd.1:2002(E)

Mapping between MoProSoft and each one of the aforementioned documents is presented, first of all, MoProSoft processes in general, and then for each specific process.

Note that mapping of MoProSoft to ISO 9001:2000 and CMM is made in items written down in ***bold and italic*** font. For clearness, the context of each item being referred to is presented in a hierarchical tree illustrating the context of each item referred to. In the case of ISO/IEC 12207:1995/Amd.1:2002(E) the comparison is at the level of corresponding processes.

For all processes

The following references are common and important for all MoProSoft processes. That listed here will not be repeated in the items of each specific process.

ISO 9001:2000

8 – Measurement, analysis and improvement
- 8.2 – Follow Up and Measurement
  - ***8.2.3 – Process monitoring and measurements***

ISO/IEC 12207:1995/Amd.1:2002(E)

- F.2.1 Documentation Process
- F.2.2 Configuration Management Process
- F.2.3 Quality Assurance Process
- F.2.4 Verification Process
- F.2.5 Validation Process
- F.2.8 Problem Resolution Process
- F.3.1.6 Measurement

TM.1 Business Management

ISO 9001:2000

4 – Quality Management System
- 4.1 – General Requirements ***(a)***
- 4.2 – Documentation Requirements
  - 4.2.1 – General ***(a)***

5 – Management’s Responsibility

7 – Product performance
- 7.2 – Customer-related processes
  - ***7.2.3 – Customer communication***

8 – Measurement, analysis and improvement

8.1 - General
8.2 – Monitoring and measurement
8.2.1 – Customer satisfaction
8.2.2 – Internal auditing
8.2.3 – Monitoring and measurement
8.4 – Data analysis
8.5 – Improvement

CMM v1.1

- Level 3
  - Organization Process Scope
    - ***Commitment 1, 2, 3, Ability 1, 2, Activity 1, 2, 3, 4, 6, Verification1***
  - Organization Process Definition
    - ***Commitment 1, Ability 1***
- Level 4
  - Quantitative Process Management
    - ***Commitment 2, Ability 1, 2***
- Level 5
  - Technology Change Management
    - ***Commitment 2, Activity 7***
  - Process Change Management
    - ***Commitment 2, Activity 1, 5, 9, 10, Verification 1***

ISO 12207 ISO/IEC 12207:1995/Amd.1:2002(E)

- F.3.1 Management Process
- F.3.1.4 Quality management
- F.3.1.5 Risk management
- F.3.1.1 Organizational alignment
- F.3.3 Improvement Process

MAN.1 Process Management

ISO 9001:2000
4 – Quality Management System
4.1 – General requirements
4.2 – Documentation requirements
4.2.1 – General ***(b, d)***
4.2.2 – Quality manual
5 – Management's responsibility
5.6 – Management's review
5.6.2 – Information for review
7 – Product performance
7.1 – Product performance planning ***(b, d)***
8 – Measurement, analysis and improvement
8.1 – General **(b, c)**
8.2 – Monitoring and measurement
8.2.2 – Internal Auditing
8.2.3 – Monitoring and measurement
8.4 – Data analysis ***(c)***

8.5 – Improvement

CMM v1.1

- Level 2
  - Requirements Management
    - ***Commitment 1, Verification 1, 3***
  - Software Project Planning
    - ***Commitment 2, Verification 1, 3***
  - Software Project Tracking & Oversight
    - ***Commitment 2, Verification 1, 3***
  - Software Subcontract Management
    - ***Commitment 2, Verification 1, 3***
  - Software Quality Assurance
    - ***Commitment 2, Verification 1, 3***
  - Software Configuration Management
    - ***Commitment 2, Verification 1, 3***
- Level 3
  - Organization Process Scope
    - ***Measurement 1***
  - Organization Process Definition
    - ***Activity 1, 2, 3, 4, 6, Measurement 1, Verification 1***
  - Training Program
    - ***Commitment 1, Measurement 1, 2, Verification 1***
  - Integrated Software Management
    - ***Commitment 1, Verification 1, 3***
  - Software Product Engineering
    - ***Commitment 1, Verification 1, 3***
  - Cross-Group Coordination
    - ***Commitment 1, Verification 1, 3***
  - Peer Reviews
    - ***Commitment 1, Verification 1***
- Level 4
  - Quantitative Process Management
    - ***Commitment 1, Verification 1, 3***
  - Software Quality Management
    - ***Commitment 1, Verification 1, 3***
- Level 5
  - Defect Prevention
    - ***Commitment 1, Ability 1, Activity 6, Verification 1, 3***
  - Technology Change Management
    - ***Commitment 1, 3, Activity 8, Verification , 2***
  - Process Change Management
    - ***Commitment 1, Activity 2, 3, 4, 5, 8, 9, 10, Measurement 1, Verification 1, 2***

ISO 12207 ISO/IEC 12207:1995/AMD.1:2002(E)

- F.2.7 Audit Process
- F.3.1 Management Process
- F.3.3 Improvement Process

MAN.2 Project Portfolio Management

ISO 9001:2000

5 – Management's responsibility
- 5.6 – Management's revision
  - 5.6.2 – Information for revision ***(b, c, d, g)***

7 – Product performance
- 7.1 – Product performance planning ***(a, b)***
- 7.2– Customer-related processes
  - ***7.2.1 – Determining product-related requirements***
  - ***7.2.2 – Revision of product-related requirements***
  - ***7.2.3 – Customer communication***
- 7.3 – Design and development
  - **7.3.4 – Design and development revision**
- 7.5 – Production and service rendering
  - 7.5.1 – Production control and service rendering ***(a, c, f)***

8 – Measurement analysis and improvement
- 8.2 – Monitoring and measurement
  - ***8.2.1– Customer satisfaction***
  - ***8.2.3 – Monitoring and measurement***
- 8.4 – Data analysis *(a, b, c)*

8.5– Improvement

CMM v1.1

- Level 2
  - Requirements Management
    - ***Ability 3***
  - Software Project Planning
    - ***Commitment 1, Ability 1, Ability 3, Activity 1, 2, 4***
  - Software Project Tracing and Monitoring
    - ***Commitment 1, Ability 1, 3, Activity 3***
  - Software Subcontract Management
    - ***Ability 2***
  - Software Quality Assurance
    - ***Ability 2***
  - Software Configuration Management
    - ***Ability 3***
- Level 3
  - Integrated Software Management
    - ***Ability 1, Activity 3, Measurement 1***
  - Software Product Engineering
    - ***Ability 1***
  - Cross-Group Coordination
    - ***Ability 1, Verification 1***
  - Peer Reviews
    - ***Ability 1***
- Level 4
  - Quantitative Process Management
    - ***Commitment 2, Ability 2, 3, Activity 6, 7, Measurement 1***
  - Software Quality Management
    - ***Ability 1, Measurement 1***
- Level 5
  - Defect Prevention
    - ***Ability 1, 3, Measurement 1***
  - Technology Change Management

        - ***Activity 6***
    - Process Change Management
        - ***Activity 7***

ISO 12207 ISO/IEC 12207:1995/AMD.1:2002(E)

- F.1.2 Supply Process
- F.1.3.1 Requirements elicitation
- F.3.1.3 Project management
- F.3.1.4 Quality management
- F.3.1.5 Risk management
- F.3.3 Improvement Process

MAN.3 Resource Management

ISO 9001:2000

4 – Quality Management System
    4.1 – General Requirements ***(d)***
6 – Resource Management
    6.1 – Resource provision
8 – Measurement, analysis and improvement
    8.4 – Data analysis
8.5– Improvement

CMM v1.1

- Level 2
    - Software Subcontract Management
        - ***Commitment 1***
- Level 3
    - Organization Process Scope
        - ***Activity 4, 6***
    - Organization Process Definition
        - ***Activity 5, 6***
    - Training Program
        - ***Ability 1, Measurement 1, 2, Verification 2, 3***
- Level 5
    - Technology Change Management
        - ***Ability 1, Activity 1, 2, 3, 4, 5, 7***

ISO/IEC 12207:1995/AMD.1:2002(E)

- F.1.1 Acquisition Process
- F.2.1 Documentation Process
- F.2.2 Configuration Management Process
- F.2.8 Problem Resolution Process
- F.3.2 Infrastructure Process
- F.3.4.1 Human Resource Management
- F.3.6 Reuse Program Management Process

MAN.3.1 Human Resources and Work Environment

ISO 9001:2000

6 – Resource Management

6.2 – Human Resource

6.4 – Work Environment

CMM v1.1

- Level 2
  - Requirements Management
    - ***Ability 3, 4***
  - Software Project Planning
    - ***Ability 3, 4***
  - Software Project Tracing and Monitoring
    - ***Ability 3, 4, 5***
  - Software Subcontract Management
    - ***Ability 1, 2,3***
  - Software Quality Assurance
    - ***Ability 2, 3, 4***
  - Software Configuration Management
    - ***Ability 3, 4, 5***
- Level 3
  - Organization Process Scope
    - ***Ability 2, 3, 4***
  - Organization Process Definition
    - ***Ability 1, 2***
  - Training Program
    - ***Ability 2, 3, 4, Activity 2, 3, 4, 5, Measurement 1, 2***
  - Integrated Software Management
    - ***Ability 1, 2, 3***
  - Software Product Engineering
    - ***Ability 1, 2, 3, 4***
  - Cross-Group Coordination
    - ***Ability 1, 3, 4, 5***
  - Peer Reviews
    - ***Ability 1, 2, 3***
- Level 4
  - Quantitative Process Management
    - ***Ability 2, 4, 5***
  - Software Quality Management
    - ***Ability 1, 2, 3***
- Level 5
  - Defect Prevention
    - ***Ability 3, 4***
  - Technology Change Management
    - ***Ability 2***
  - Process Change Management
    - ***Ability 1, 2, 3, 4***

ISO/IEC 12207:1995/AMD.1:2002(E)

- F.3.4.1 Human Resource Management

MAN.3.2 Goods, Services and Infrastructure

ISO 9001:2000
6 – Resource management
6.3 – Infrastructure
7 – Product performance
7.4 - Purchases
8 – Measurement, analysis and improvement
8.4 – Data analysis

CMM v1.1

- Level 2
  - Requirements Management
    - ***Ability 3***
  - Software Project Planning
    - ***Ability 3***
  - Software Project Tracing and Monitoring
    - ***Ability 3***
  - Software Subcontract Management
    - ***Commitment 2, Ability 1, Activity 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13***
  - Software Quality Assurance
    - ***Ability 2***
  - Software Configuration Management
    - ***Ability 3***
- Level 3
  - Organization Process Scope
    - ***Ability 2***
  - Organization Process Definition
    - ***Ability 1***
  - Training Program
    - ***Ability 2***
  - Integrated Software Management
    - ***Ability 1***
  - Software Product Engineering
    - ***Ability 1***
  - Cross-Group Coordination
    - ***Ability 1, 2***
  - Peer Reviews
    - ***Ability 1***
- Level 4
  - Quantitative Process Management
    - ***Ability 2***
  - Software Quality Management
    - ***Ability 1***
- Level 5
  - Defect Prevention
    - ***Ability 3***
  - Technology Change Management
    - ***Ability 2***
  - Process Change Management
    - ***Ability 1***

ISO/IEC 12207:1995/AMD.1:2002(E)

- F.1.1 Acquisition Process
- F.3.2 Infrastructure Process

MAN.3.3 Organization's Knowledge

ISO 9001:2000

4 – Quality Management System
- 4.2 – Documentation requirements
  - 4.2.3 – Document control ***(c, d, e, f, g)***
  - ***4.2.4 – Registry control***

7 – Product performance
- 7.3 – Design and development
  - 7.3.2 – Design and development input elements ©

CMM v1.1

- Level 3
  - Organization Process Definition
    - ***Activity 5, 6***
- Level 4
  - Quantitative Process Management
    - ***Activity 7***
- Level 5
  - Process Change Management
    - ***Activity 9***

ISO/IEC 12207:1995/AMD.1:2002(E)

- F.2.1 Documentation Process
- F.2.2 Configuration Management Process
- F.2.8 Problem Resolution Process
- F.3.6 Reuse Program Management Process

OPE.1 Specific Projects Management

ISO 9001:2000

4 – Quality Management System
- **4.1 – General Requirements**

6 – Resource Management
- 6.2 – Human Resources
  - 6.2.2 – Competency, awareness, creation and education ***(a)***
- ***6.3 – Infrastructure***

7 – Product performance
- ***7.1 – Product performance planning***
- 7.2 – Customer-related processes
  - 7.2.1 – Determination of product-related requirements ***(a)***
  - ***7.2.3 – Customer communication***
- 7.3 – Design and development
  - ***7.3.1 –Design and development planning***
  - ***7.3.4 – Design and development revision***
- ***7.4 – Procurement***
- 7.5 – Production and service rendering
  - ***7.5.1 – Production control and service rendering***
- ***7.6 – Monitoring and measurement device control***

8 – Measurement, analysis and improvement
- 8.2 – Monitoring and measurement

8.2.4 – Product monitoring and measurement

8.5 - Improvement

CMM v1.1

- Level 2
  - Requirements Management
    - ***Ability 1, 2, Activity 3, Measurement 1, Verification 2***
  - Software Project Planning
    - ***Ability 1, Activity 2, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, Measurement 1, Verification 1***
  - Software Project Tracking & Oversight
    - ***Ability 1, Activity 1, 2, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, Measurement1, Verification 2***
  - Software Subcontract Management
    - ***Commitment 2, Activity 1, 4, 5, 6, 7, 8 , 9, 10, 11, 12, Measurement1, Verification 2***
  - Software Quality Assurance
    - ***Ability 1, Activity 1, 2, 3, 4, 5, 6, 7, 8, Measurement 1, Verification2***
  - Software Configuration Management
    - ***Verification 1***
- Level 3
  - Training Program
    - ***Activity 1***
  - Integrated Software Management
    - ***Activity 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, Measurement 1, Verification1***
  - Software Product Engineering
    - ***Activity 1, Verification 2***
  - Cross-Group Coordination
    - ***Activity 1, Activity 3, 4, 5, 6, Measurement 1, Verification 1***
- Level 4
  - Quantitative Process Management
    - ***Activity 1, 2, 3, 4, 5, 6, Measurement 1, Verification 2***
  - Software Quality Management
    - ***Activity 1, 3, 4, 5, Measurement 1, Verification 2***
- Level 5
  - Defect Prevention
    - ***Ability 2, Activity 1, 7, 8, Measurement 1, Verification 2***

ISO 12207 ISO/IEC 12207:1995/AMD.1:2002(E)

- F.1.1 Acquisition Process
- F.1.2 Supply Process
- F.1.3.1 Requirements elicitation
- F.1.5 Maintenance Process
- F.2.6 Joint Review Process
- F.3.1.3 Project management
- F.3.1.4 Quality management
- F.3.1.5 Risk management

OPE.2 Software Development and Maintenance

ISO 9001:2000

7 – Product performance

7.2 – Customer-related processes

7.2.1 – Determination of product-related requirements
7.2.2 – Revision of product-related requirements
7.3 – Design and development
7.3.1 –Design and development planning
7.3.2 – Design and development input element
7.3.3 – Design and development results
7.3.5 – Design and development verification
7.3.6 – Design and development validation
7.3.7 – Design and development change control
7.5 – Production and service rendering
7.5.3 – Identification and traceability
7.5.4 – Customer property
7.5.5 – Product preservation
8 – Measurement, analysis and improvement
8.2 – Follow up and measurement
8.2.4 – Product follow up and measurement
8.3 – Non conforming product control

CMM v1.1

- Level 2
  - Requirements Management
    - ***Activity 1, 2***
  - Software Project Planning
    - ***Activity 3***
  - Software Project Tracking & Oversight
    - ***Ability 2***
  - Software Configuration Management
    - ***Ability 1, 2, Activity 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, Measurement 1***
- Level 3
  - Software Product Engineering
    - ***Activity 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, Measurement 1, 2***
  - Intergroup Coordination
    - ***Activity 2, 7***
  - Peer Reviews
    - ***Activity 1, 2, 3, Measurement 1***
- Level 4
  - Quantitative Process Management
    - ***Measurement 1***
  - Software Quality Management
    - ***Activity 2, Measurement 1***
- Level 5
  - Defect Prevention
    - ***Activity 2, 3, 4, 5, Measurement 1***

ISO/IEC 12207:1995/AMD.1:2002(E)

- F.1.3.1 Requirements elicitation
- F.1.3 Development Process
- F.1.5 Maintenance Process
- F.2.6 Joint Review Process

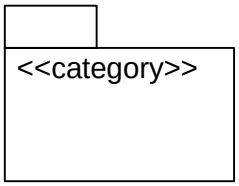
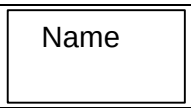
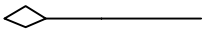
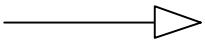
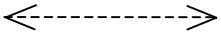
A2. Diagram Notation

Introduction

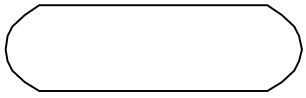
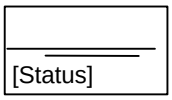
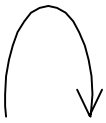
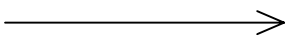
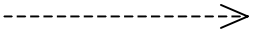
This annex presents the UML 1.4 [11] elements used in the diagrams generated in the Process Model description for the Software Industry (MoProSoft). Diagrams used are:

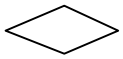
- Class diagrams (classes and packages), to represent process
- categories, relationships between processes, general role classification, general product classification and configuration and software products.
- Activity diagrams, to represent workflow for each process.

Class Diagrams

Element	Description
	Representation of a suite. In the case of the model, it is used to represent categories.
	Representation of a class. It is used to represent, roles, products, and processes.
	Association between two classes.
	Aggregation relationship between two classes. Diamond indicates that the class contains another class.
	Class inheritance relationship. The triangle points toward the inheriting class.
	Dependency relationship in both directions between two classes or packages.

Activity Diagram

Element	Description
	Activity to be performed in a process. The identification of the activity being represented is added to its name.
	Product generated in an activity. In some cases, the status of a product is indicated.
	Transition toward the same activity.
	Transition between activities.
	Information flow. It indicates the starting activity that generates a product, and in some cases, its destination.

	Association between comments and activities.
	Comments
	Diversion. Allows modifying the transition of an activity as per some condition.
	Synchronization bar. Indicates the activities that should be concluded before initiating another.
	Process start
	Process end

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