

# Project Management and Maintenance on Information Systems Departments

Diogo Pinto - nº69905

Diogo.Reis.Pinto@tecnico.ulisboa.pt

Instituto Superior Técnico

**Abstract.** It is proposed a generic process for dealing with requests for new projects or for evolutionary maintenance in an information systems department of an organization. Assuming the information systems department's organization as the main stakeholder, the proposal considers the alignment of three views: the processes, the responsibilities and the information. Information systems management on an organization requires handling these requests in alignment with business expectations and several other criteria (risk, priority, team capabilities). These requests must then be managed accordingly to a set of defined processes until its fulfillment, stating what activities must be executed and who must be the entities involved in those activities. This process architecture was developed using the Design Science Research Method, first considering the real case scenario of a real organization, and after generalized in order to make it reusable for any potential organization. An assessment of the proposal concerning the real case also was performed by stakeholders of the real organization.

## Keywords:

Information Systems Management, Project Management, Maintenance Management, Responsibilities.

## 1 Introduction

Classification of project and maintenance requests in terms of opportunities and business value in information systems departments, together with the need to define management activities for these requests, introduces the need to define a management process for the complete request life cycle.

Over the years, professionals in information systems management came across with a set of frameworks and guides, trying to provide normalized practices in the area. In terms of project management, ISO 21500 and PMBOK are the main references, providing a set of practices in project management applicable to any organization, independently of the project type, complexity or duration. Considering maintenance management, ISO/IEC 14764 defines maintenance processes in the software and services life cycle, covering the planning, implementation, monitoring, review and evaluation of maintenance. COBIT 5, ITIL V3 and ISO 31000 are also presented as complementary references, providing a set of best practices in specific areas of interest.

From the set of references considered, it is intended to develop a process architecture that aligns three views, the processes view, the responsibilities view and the information view. This architecture, despite being applicable to a concrete real case scenario, should also be applicable to a large number of other organizations.

## 2 Research Method

In order to guide all the development method it was used the DSRM research method [14], widely used in the information systems area for presenting and validating solutions developed. This method has an iterative character and consists of six phases, starting in an entry point to serve as a starting point for problem identification and definition of the objectives of the solution. After these two phases, the design and development, demonstration, evaluation and communication phases will define the various aspects of the solution and provide feedback for new iterations. The DSRM mapping to this dissertation is presented in figure 1.

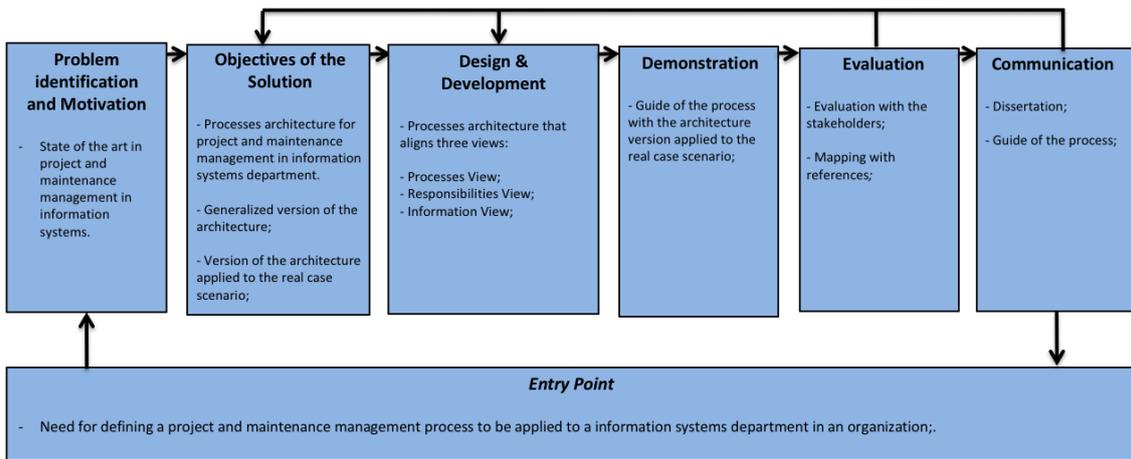


Fig. 1. DSRM Mapping applied to this dissertation.

### 3 Problem Identification

A project is a unique set of activities coordinated and controlled with a specific start and end date defined, executed to achieve a set of objectives defined. A maintenance is a set of activities executed for the implementation or modification of a solution after delivery, in order to correct specific failures. Considering the real case scenario of an organization, we intend to define:

- Which processes (and related activities) must be performed for project and maintenance requests management?
- What are the responsibilities of the various elements in the information systems department in the whole process?
- What are the supporting documents of the whole process?

Despite providing answers to these questions, the solution developed must still meet a limited period of development, reason why it is not possible to guarantee an extensibility in all areas, ensure compliance with the set of analyzed references and also being applicable to a set of other organizations, generalizing intrinsic aspects of the real case scenario.

### 4 Fundamentals

The frameworks, standards and guides considered as the main references of this work correspond to a body of knowledge considered by professionals as the best practices in project and maintenance management, being necessary to select the set of effective knowledge to apply, according to the objectives defined for the architecture.

Regarding project management processes, the main references to consider are the ISO 21500[5] and the PMBOK[2]. The ISO 21500: Guide on Project Management presents a set of high-level concepts and processes that are considered good practices in project management. It can be used by any organization regardless of its context (public, private, community) and the type, complexity or duration of projects carried out.

This standard identifies and details the project management processes, defining the integration, stakeholder, scope, resource, time, cost, risk, quality, procurement and communication processes. It is focused mainly on the inputs and outputs of each process, not detailing the various artifacts that result from it and presenting only the objectives to be achieved in each process.

PMBOK, considered as the main reference on project management by professionals in the area, details aspects of project governance, as the project acceptance criteria, processes for the identification, escalation and resolution of problems, processes for information communication, processes for decision-making and processes for setting and reviewing changes to the budget, scope, quality and calendar.

In terms of processes identification, PMBOK is similar to the ISO 21500 approach, identifying 47 processes for integration, scope, time, cost, quality, human-resources, communications, procurement and stakeholders management. It complements the ISO 21500 in the way it presents a set of techniques and tools to use and identifies detailed activities to be carried within each process.

Regarding maintenance management, ISO/IEC 14764: Software Life Cycle Processes - Maintenance [6] was considered as an specialization of the maintenance process identified by ISO/IEC 12207[7] and defines the entire process for maintenance planning, implementation, monitoring, review and evaluation. It defines a set of concepts related to the maintenance and presents the maintenance process in terms of activities and tasks to develop, dividing it in sub-processes: Process implementation, maintenance analysis, implementation of maintenance, review and acceptance of maintenance, Migration and Disposal of Software.

To complement the references already presented, it is also considered a set of further references aimed at bridging some of the gaps identified in the coverage of the various project and maintenance management processes. COBIT 5 (Control Objectives for Information and Related Technology)[3] is a framework oriented to the governance and management of information systems, being useful in the receipt and delivery activities for project and maintenance requests. The ITIL V3 (Information Technology Infrastructure Library)[9, 10, 11, 12, 13], oriented to services management in information systems, provides a body of knowledge in areas such as incident, problems and changes management. The ISO 31000[4] is a set of international standards in risk management, providing a framework and a set of processes for the application of risk management principles in the organization.

## 5 Problem Analysis

Considering the project and maintenance definitions provided in this document, it is necessary to define the main constraints assumed for this solution, directly derived from the problem we are considering.

It is considered that the organization is unable to carry out the implementation of projects internally, which is held for outsourcing implementation, making it necessary to define the entire procurement process for the project implementation. In terms of implementation of maintenance, it is considered that it can be done on outsourcing or on in-house implementation, depending on the capacity of the organization.

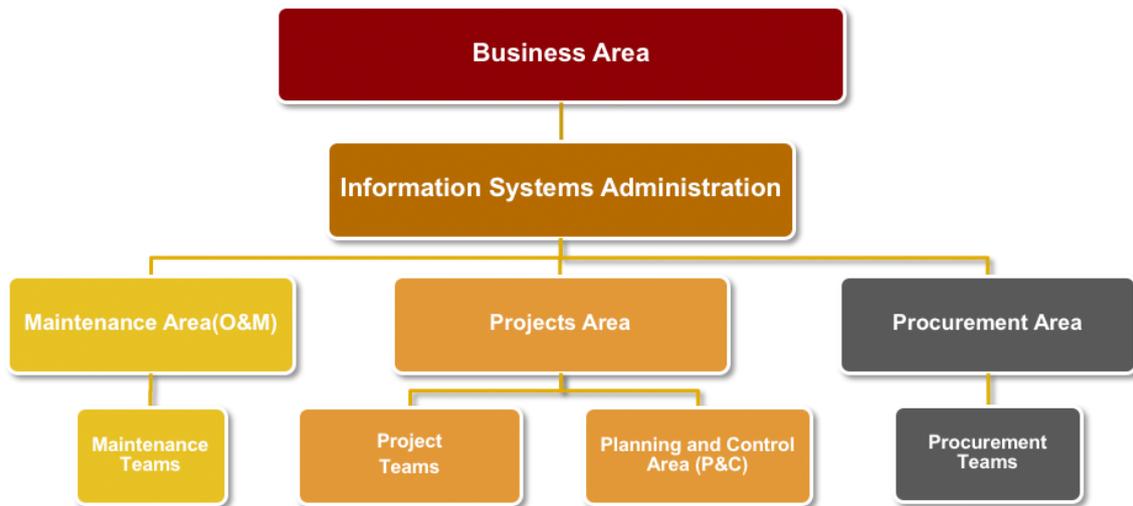
It is assumed that all the requests that come to the information systems department come from the organization own business area, reason why it will not be considered aspects of invoicing and budgeting to the organization, as long as we are considering internal requests. In terms of the requests to be considered in the scope of this problem, the solution to develop is confined to project requests, assuming that the organization already has an established process for maintenance management.

## 6 Practical Context of the Problem

A set of details and constraints are derived from the real case scenario considered, that will be used as the basis for the design of the architecture applicable to the real case scenario, and later subject of a generalization.

The information systems department is organized according to the chart shown in figure 2. The information systems administration corresponds to the governing body, being responsible for the budgeting and strategic management of the entire department. The information systems director (DSI director) regulates the projects and maintenance areas, being also responsible for portfolio management. The procurement area, that reports to the DSI director, is responsible for conducting the procurement process. The planning and control area, part of the projects area, is responsible for operational management of budget, making changes and revisions to it.

In terms of procurements, projects area will outsource the implementation, while maintaining distinct planning and control processes from the ones developed by the partner. The maintenance area is responsible for the decision of either implement the maintenance requests internally or outsourcing them, with the approval of the DSI director. Maintenance requests considered are



**Fig. 2.** Information systems department structure.

confined to evolutionary maintenance, assuming that corrective maintenance is carried out by a help-desk service.

Regarding the classification into project or maintenance request, information systems department has a well-defined criteria for classification. Requests classified with a level of effort (effort by person) higher than five days are classified as project requests, otherwise are treated as maintenance requests.

It is assumed that project only enters into production, final stage of the project already in operation and accepted by the business area, after being accepted by the maintenance area, becoming its responsibility. Further correction requests will be addressed to this area, reason why it must ensure to be in possession of all the tools and necessary knowledge.

## 7 Concrete Definition of the Problem

Taking into account the limited time of solution development and the set of processes identified by the references, it is necessary to make a specific definition of the problem, detailing which processes will be considered in the architecture to develop. Considering the project management processes identified by ISO 21500 and the PMBOK, the processes related to project management and procurement management will be considered, including:

Issues management process will also be included, assuming an issue as an event occurred and not planned, being necessary to manage it. Not identified by the ISO 21500 and the PMBOK, it can be easily adapted from the incident management process and the problem management process presented by ITIL v3. In terms of portfolio and delivery management processes we will consider the areas of Align, Plan and Organise (APO), Build, Acquire and Implement (BAI) and Deliver, Service and Support (DSS) presented by COBIT to address these processes.

Requests reception and classification is not directly covered by any of these references, requiring some unique development based on real case scenario analysis. Classification is intrinsic to the organization and to the aspects that it considers as differentiating for these two types of requests. In terms of maintenance requests, it is considered that once classified, it is integrated in maintenance services portfolio, implemented through outsourcing, or scheduled for implementation in a maintenance backlog.

Management Processes	Processes
<b>Integration</b>	- Project kick-off; - Project plans development; - Monitoring and control of project activities; - Changes control; - Project closure; - Lessons learned identification;
<b>Stakeholders</b>	- Stakeholders identification; - Stakeholders control;
<b>Calendar</b>	- Project calendar definition; - Project calendar control;
<b>Costs</b>	- Project costs identification; - Project budgeting; - Project costs control;
<b>Risks</b>	- Risks identification; - Risks evaluation; - Risks treatment; - Risks control;
<b>Procurement</b>	- Procurement planning; - Partner selection; - Procurement control;
<b>Communication</b>	- Communication planning; - Information distribution; - Communication control;

**Table 1.** Project and procurement management processes considered for the processes architecture.

## 8 Solution

According to ISO / IEC 42010[8], oriented to architectures description, an architecture corresponds to the main concepts and properties of a system according to the context in which it exists, encompassing all of its elements and relationships. Given this definition, we intend to develop an architecture of processes whose system of interest is the projects and maintenance management in information systems department. The main stakeholders of this architecture are the information systems administration and the business area.

The process was divided into four phases according to the processes view presented. It is assumed that a process phase has a well-defined beginning and end, where are achieved strategic objectives of the organization. The phases of opportunity, planning, implementation and control and handover constitute the entire life cycle of the project request since it was received by the Information Systems department, provided by the business area, to the delivery and closure of the project. After the opportunity phase, requests classified as maintenance are integrated in maintenance services portfolios or scheduled for implementation. In figure 3 is presented the high-level process flow for the project and maintenance management process developed.

For the responsibilities view definition it was considered the organizational structure of the information systems department. For each activity, the process participants have a set of responsibilities according to their role in the organization and activities to perform. Based on RACI responsibilities model, a new responsibility model was proposed, the responsibility matrix model, presented in [1] and used for responsibilities definition in this architecture.

The information view defines a set of supporting documents produced and consumed by activities defined in processes view, describing the information contained and their objectives. The definition of these documents was proposed from the analyzed references, being still considered a set of additional documents taking into account the real case scenario considered and the assumed constraints. Based on the concept of interactions matrix or CRUD matrix (Create, Read, Update and Delete), it was defined the CRUC (Create, Read, Update and Close) matrix, which presents a set of interactions carried out by the participants of the process in relation to supporting documents identified.

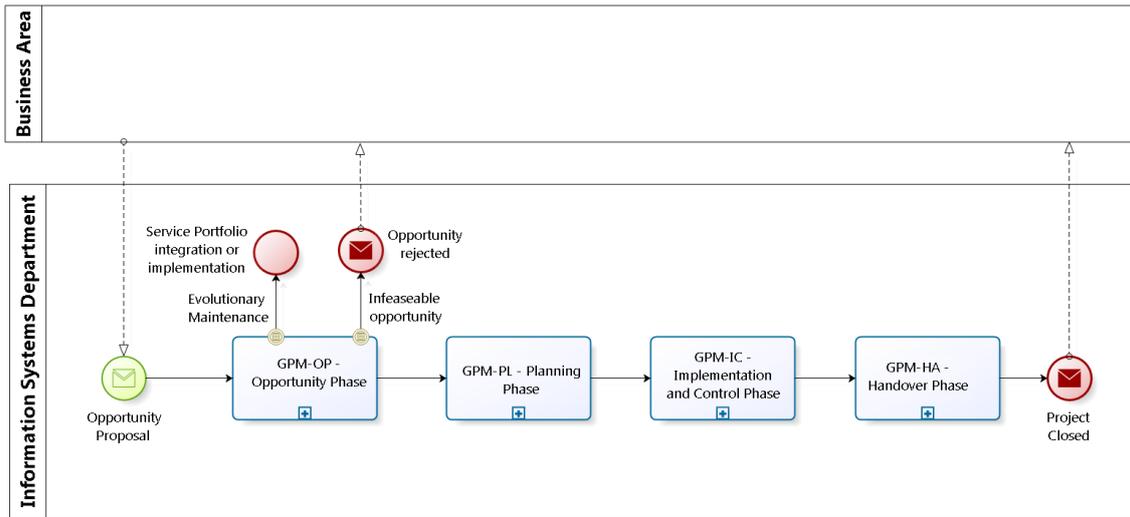


Fig. 3. High-level process flow for the project and maintenance management process.

### 8.1 Opportunity Phase

During the opportunity phase it is performed the request identification and classification into project or maintenance request, being also possible to reject the opportunity. If accepted, the planning of opportunity is started in terms of scope, budget, schedule and technical analysis. Maintenance opportunities that have not been scheduled for implementation are integrated into portfolio, being proceeded by a definition of budget, schedule and priority. The process flow for the opportunity phase is presented in figure 4.

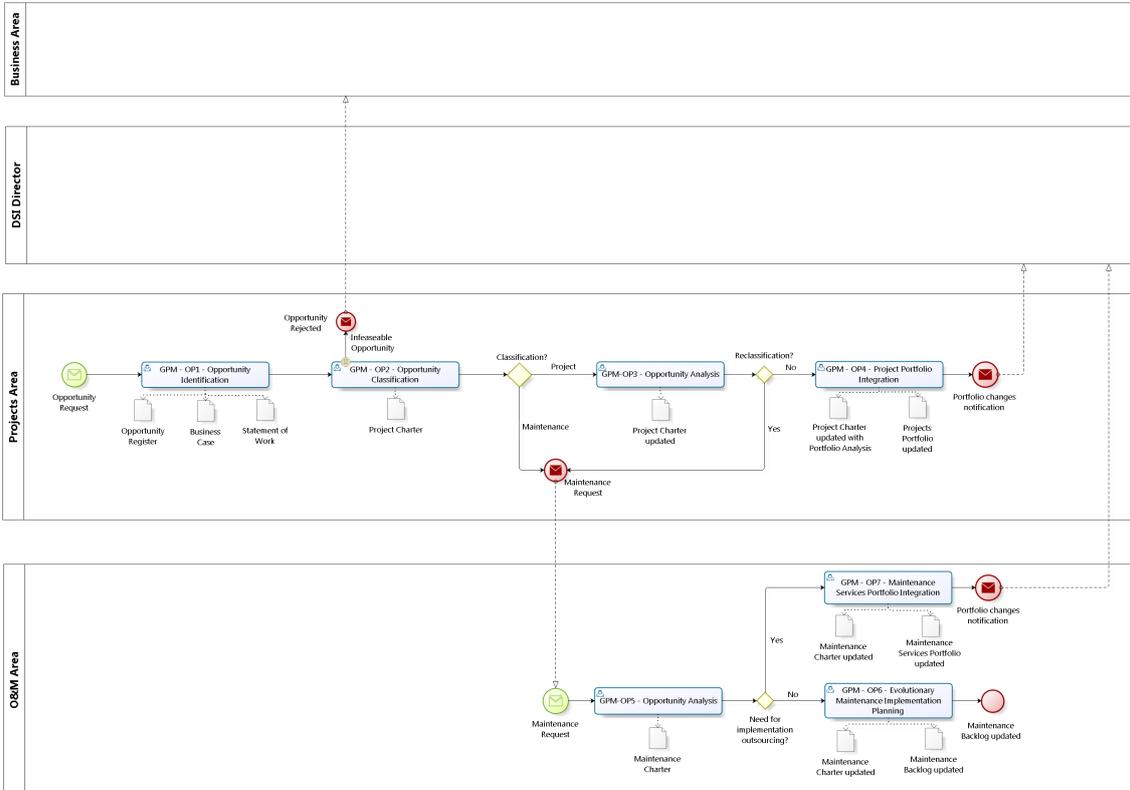


Fig. 4. Process flow for the opportunity phase.

Considering the responsibilities view, the key participants in the opportunity phase are the projects and O&M areas, performing all activities with the assistance of planning and control area in budget issues, of DSI director in decision-making, acceptance and classification of opportunity and of business area in presenting the opportunity to the information systems administration.

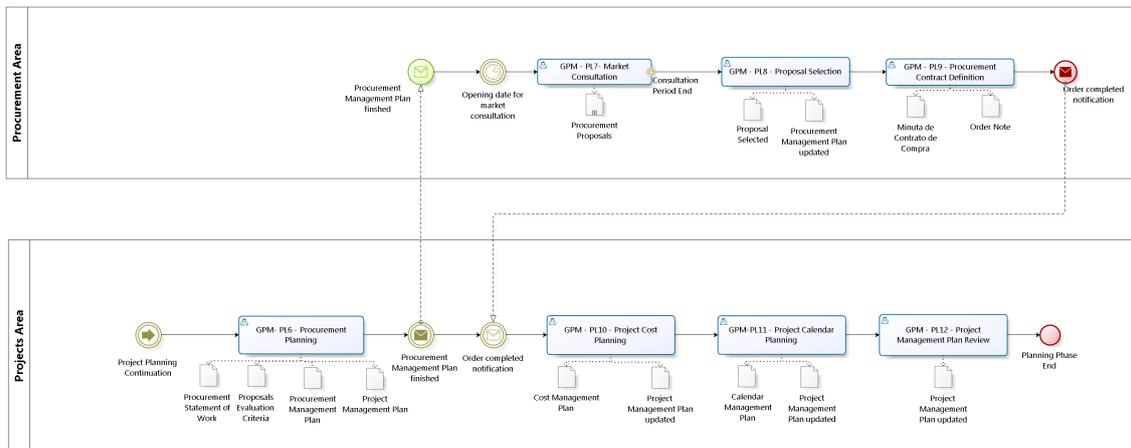
The main documents that support the opportunity phase are the opportunity register, that presents the first business point-of-view of the opportunity, the business case, that presents the opportunity in terms of investment and business opportunity and the statement of work that is targeted to the expected results, identifying the products or services required to address one particular business need.

The project charter and maintenance charter are, respectively, project and maintenance pre-plans, corresponding to a multi-level analysis and being used for obtaining acceptance of the opportunity. The projects and maintenance portfolios are also considered, bringing together a number of opportunities managed together to achieve strategic objectives for the organization.

All documents at this phase are created by projects or maintenance areas because they are unique to the opportunity received, with the exception of projects and maintenance portfolios that are common to all maintenance and projects carried out by the information systems department.

## 8.2 Planning Phase

The planning phase begins with an analysis review of the opportunity and the definition of stakeholders, communications and risk management plans. The procurement process for the project implementation is carried out in this phase, being defined the procurement plan and held the market consultation, the selection of the proposal to award and the contract definition. When the procurement process is over, it is defined the calendar and cost management plans. At the end of this phase the project implementation and control process phase is initiated. Figure 5 shows the procurement process, the calendar and cost management plans definition and the project management plan review.



**Fig. 5.** Process flow for the procurement, calendar and cost management processes and the project review activities in the planning phase.

Throughout this phase, the projects area has the leading role in all activities and is responsible for executing and controlling the progress in the stakeholders, communication, risks, cost and calendar management plans. The procurement process presents a distinct responsibilities definition, where the responsibility of executing and control all activities is assigned to the procurement area. This is the area that has specialists in all procurement activities, from the selection of partners to the definition of contracts.

The planning phase is characterized by the project charter closure and the definition of the project management plan, which will include all management plans defined throughout this phase.

In project planning review it is conducted the review and inclusion of all information from the project charter in the project management plan.

In terms of the interactions concerning the supporting documents, the main interactions of document creation and update are performed by the projects area, being also updated by the procurement area in the procurement process. The other entities involved in the process have consulting interactions as they are elements that need to know all the information regarding the project.

### **8.3 Implementation and Control Phase**

The implementation and control phase starts with the beginning of implementation activities by the partner and the project control and monitoring activities by the projects area. This phase does not have a single flow, consisting of a set of individual processes that make possible the integrated control of the entire project. During every week, weekly meetings are conducted, from which may come new risks, issues and change requests to the project. It is also held, every month, a monthly meeting of the project, which has a more strategic objective and analyzes the risks, issues and changes with the greatest impact and priority. When new risks, changes or issues are identified, it is initiated risk, change or issues management processes, respectively. This phase ends with the project delivery made by the partner, being initiated the handover phase.

Considering the responsibilities view, projects area is responsible for executing and controlling all activities in the weekly project control, in collaboration with the partner and the business area, which are consulted for identifying risks, issues and changes and for controlling the budget, the calendar and the stakeholders and communication management plans compliance. In the monthly control, all entities are involved in control activities, being performed a long-term control and review for the the communication and stakeholders management plans. The budget forecast and contract milestones are also reviewed.

In terms of changes and risk management, the main participant is the projects area collaborating with the business area and the partner in the set of activities required to carry out these processes. In issues management it is possible to see a more volatile definition being possible to an issue to have origin in a set of activities performed during the project implementation and therefore requiring a more general responsibilities definition. The projects area is the main entity responsible for implementation and progress monitoring, although in the case of scaling an issue to the DSI director, it will be the responsible for implementation and progress monitoring activities.

The main supporting documents to consider are, beyond the project management plan that is present in every phase of the process, the logs resulting from change and issues management processes, the budget forecast and the weekly and monthly progress reports. The forecast corresponds to a budget draft until the project closure, considering all the activities performed in the project.

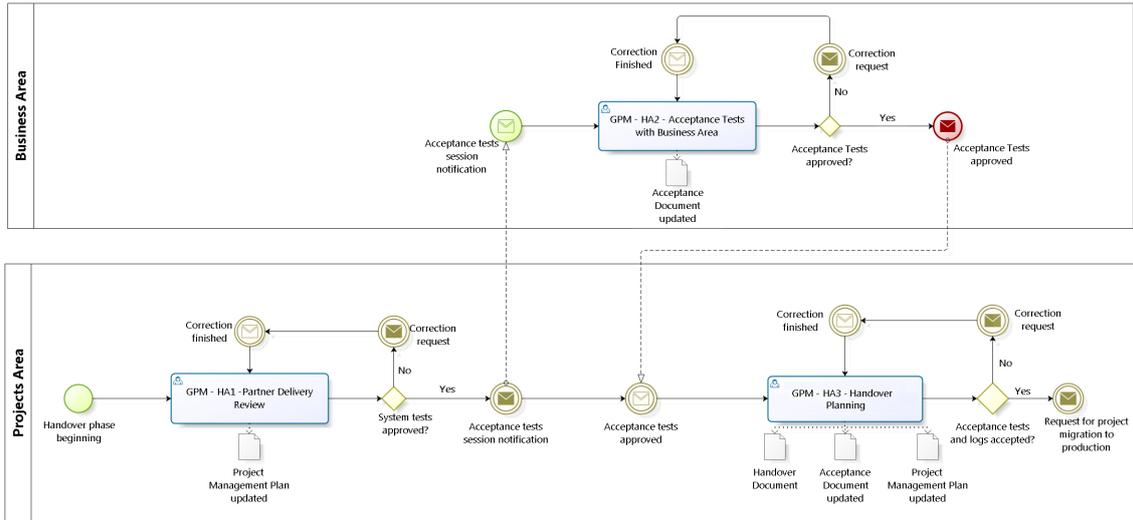
In terms of interactions, all documents are created and updated, with the exception of the project management plan that comes from the planning phase, by the projects area. The other parties have mostly consulting interactions, existing few situations of updates from other entities, such as in the case of an issue scaled to the DSI director, being him the entity responsible for updating the issues log.

### **8.4 Handover Phase**

In the handover phase the review of partner's deliverables is conducted according to technical specifications and system tests performed by the Project area. It is also performed the project acceptance by the business area for the final acceptance of the project and prepared the project delivery to the O&M area, which will be responsible for the project from this point. The process flow related to the project review, acceptance and the handover planning is presented in figure 6.

The O&M area is already responsible for migrating the project from quality environment to production environment, after which is held the closure of the project and completed the entire process flow.

The responsibilities view for this phase has special interest in this architecture as it defines how the project transition from the projects area to the O&M area, which will be responsible for it, is made. It is also at this phase that, after acceptance by the business area and the migration to



**Fig. 6.** Process flow for project review, acceptance and handover planning in the handover phase.

production environment, the participation of the partner ends, being necessary to ensure that all necessary procedures for its exit are executed.

Thus, the project area is responsible for performing the review of the partner's delivery and the acceptance tests with the business area, having the partner an auxiliary role in these activities, as it has a greater technical knowledge of the project. In the handover planning activities, the execution responsibilities are shared between the projects and O&M areas. Projects area is responsible for controlling the activities progress while O&M area is responsible for the risk, issues and changes logs acceptance and for formalizing the handover of the project with the signing of the acceptance document.

Upon project acceptance by the O&M area, the projects area requests the project migration to production environment, which is already held by the O&M area with the help of projects area and the partner. After this phase, the participation of the partner in the project becomes residual, being required only occasionally.

After the migration to production, O&M requests the project closure, which is performed by the projects and planning and control areas. The project area is responsible for the technical closure of the project activities with the preparation of project closure report and lessons learned to formalize the closure of the project. The planning and control area is responsible for the administrative closure, with the partner contract, budget and payment plan closure.

The acceptance document and the handover document stand out in information view, the first gathering all the information on the acceptance of the project by the business, project and O&M areas and the last gathering information from the project transition from the projects area to the O&M area. At the project closure are still created the project closure report and lessons learned, both gathering information on the project closure.

All previous documents are created and updated by the projects and O&M areas, while the project closure report and the lessons learned are also updated by the planning and control and procurement areas and the DSI director, all responsible for gathering information on project closure. Risk, issues and changes logs are closed by the projects area.

## 9 Evaluation

From the evaluation phase of DSRM method, the solution evaluation was performed according to two proposed methods: Evaluation with stakeholders and mapping with references methods. Considering the evaluation with stakeholders method and taking into account the alignment with the real case of an organization, it was necessary to consider the major stakeholders during the design of this architecture. We developed a document described as the process guide, which presents the entire architecture in accordance with the objectives and standards of the organization, through

an iterative process in which the architecture was evaluated and the feedback from that assessment used for new improvements.

The mapping with references method aims to demonstrate how compliance was guaranteed between architecture processes and the best practices in project and maintenance management. Thus, this method establishes a correspondence between the processes defined in the architecture and those that are identified in the set of analyzed references, ensuring the existence of concrete evidence of this conformity.

The opportunity phase, whose flow is presented in this document, is based on the processes presented by ISO 21500 and PMBOK, being also considered processes brought by COBIT regarding the portfolio management activities. The planning phase, where the procurement process is developed, is based on ISO 21500, COBIT and PMBOK. This phase corresponds to the core of all references, and is detailed in all of them.

The implementation and control phase has as the main references the ISO 21500 and the PMBOK, which have a big focus on control activities. In terms of risk management, ISO 31000 complements these two references. Considering issues management, only ITIL defines this process being the only reference considered.

The handover phase has COBIT as the main reference, which covers all aspects of project acceptance, handover to maintenance, migration to production environment and project closure. The ISO 21500 and the PMBOK superficially address some of these issues, like the closure of the project, being important to complement the processes presented in COBIT.

## 10 Conclusions and Future Work

The definition of a process architecture for project and maintenance requests in information systems departments was made considering two versions, one applied to real case scenario considered and presented by a process guide, and a generalized version of the architecture for a set of information systems departments, presented in this document.

The architecture has been divided into four phases, according to the life cycle of projects considered in this work. For each phase was defined the processes view, which shows the process flow in terms of activities to be undertaken, the responsibilities view, which identifies the main responsibilities in the process and the information view, which presents the supporting documents for the phase considered and the interactions performed by the participants.

The architecture evaluation has been performed through two methods purposed for this work: the evaluation with stakeholders ensures stakeholders requirements and objectives fulfillment, while the mapping with references method establishes a correspondence between the processes belonging to the architecture and those that are defined by the references considered.

A set of future work proposals were also identified, like the possibility of considering a large number of processes to define extensions to the architecture. One example are the quality and scope management processes, that have not been considered in this first version. Another extension to be considered is the definition of maintenance management process, with the identification of implementation, monitoring and delivery activities not defined in this architecture.

## References

- [1] E.S. Andersen, K. Grude, and T. Haug. *Goal Directed Project Management: Effective Techniques and Strategies*. Kogan Page, 2009.
- [2] Project Management Institute. *A Guide to the Project Management Body of Knowledge (PM-BOK® Guide)*. PMI Standard. Project Management Institute, Incorporated, 2013.
- [3] ISACA. *COBIT 5: Enabling Processes*. COBIT® 5. ISACA, 2012.
- [4] ISO. Risk management – principles and guidelines. ISO 31000:2009, International Organization for Standardization, 2009.
- [5] ISO. Guidance on project management. ISO 21500:2012, International Organization for Standardization, 2012.
- [6] ISO/IEC. Software engineering – software life cycle processes - maintenance. ISO/IEC 14764:2006, International Organization for Standardization and International Electrotechnical Commission, 2006.
- [7] ISO/IEC. Systems and software engineering – software life cycle processes. ISO 12207-1:2008, International Organization for Standardization and International Electrotechnical Commission, 2008.
- [8] ISO/IEC. Systems and software engineering - architecture description. ISO/IEC 42010:2011, International Organization for Standardization and International Electrotechnical Commission, 2011.
- [9] Great Britain. Cabinet Office. *ITIL Continual Service Improvement*. Best management practice. TSO, The Stationery Office, 2011.
- [10] Great Britain. Cabinet Office. *ITIL Service Design*. Best Management Practice. TSO, The Stationery Office, 2011.
- [11] Great Britain. Cabinet Office. *ITIL Service Operation*. Best Management Practice. TSO, The Stationery Office, 2011.
- [12] Great Britain. Cabinet Office. *ITIL Service Strategy*. Best management practice. TSO, The Stationery Office, 2011.
- [13] Great Britain. Cabinet Office. *ITIL Service Transition*. Best management practice. TSO, The Stationery Office, 2011.
- [14] Ken Peffers, Tuure Tuunanen, Marcus A Rothenberger, and Samir Chatterjee. A design science research methodology for information systems research. *Journal of management information systems*, 24(3), 2007.