

# ADAPTATION AND APPLICATION OF PROJECT MANAGEMENT ACCORDING TO THE PMBOK TO A SET OF IT PROJECTS IN A PUBLIC BODY

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## ABSTRACT

Project management provides a permanent advantage in the dynamic context of current organizations. It has evolved into a key role for the success of any project. Besides the PMI (Project Management Institute) already offers several versions of its guide: Project Management Body Of Knowledge PMBOK. Thus, this guide is fast becoming an indispensable tool for practitioners in all organizations and sectors. The main focus of the article is reserved for analyzing and modeling the PMBOK in order to reach a uniform model of project management. The obtained model will be projected on a set of projects within a Moroccan public department. Let's recall that the PMBoK defines the project management in terms of: integration, scope, time, cost, quality, human resources, communication, risk, procurement and the stakeholders of the project. We are also interested in the context of this work to the study of the application of all these knowledge areas in a real project of customer complaints management application.

**Key Words:** *IT project, Modeling, Project Management, PMBOK.*

## 1. INTRODUCTION:

In the contemporary context, the projects require a good command of resources. Thus the project management discipline was developed. It occupies great interest today, given the importance of the issues and limitations see the scarcity of resources [1].

Project management as an idea, has always played the same roles, applying technology to time management problems. Even today, when most people try to improve the management of web and software projects, they rarely lend importance to the experience feedback. However, history shows that most projects have several things in common. They have requirements, designs and constraints. Their success depends on communication, good decision making and the combination of creative and logical thinking. Projects usually involve a delay, a budget and a client. The main task of the project is to combine the work of different people in a single coherent and above all, useful to the customer [2].

## 2. PROJECT MANAGEMENT, GENERALITIES AND STATE OF THE ART

### 1.1. Project Definition

Historically, the word project comes from Latin projectare, throw forward. It has several meanings: The representation of a state which is believed to be achieved, or that it is intended to achieve. It is also synonymous with design, scheme, intention, direction, view ... [3], or a first state of a work or preparatory work. It stands for canvas, draft, sketch... [4]

These senses fit the description of a goal, a target but not to the period of its implementation and the actions planned to achieve this goal. On the other side, the Anglo-Saxon sense of the word "project" includes the path to follow to achieve the goal: "Set of actions to realize to achieve an objective defined in the context of a specific mission and has a beginning but also an end" [5].

The project management vocabulary defines a project as a unique process, consisting of a set of coordinated and controlled activities with start and

end date, aiming to complete a goal according to specific requirements, including constraints of time, cost and resources [6].

Following the increasing importance of project management discipline in all fields, draft standards have experienced the day to standardize definitions and vocabularies.... (AFNOR, 1993) (PMI, 2008). Thus, according to AFNOR, A project is a specific approach allowing methodically and progressively structure a reality to come. A project is defined and implemented to develop a response to the need for a user of a client or customer, and it involves a goal and actions to be taken with data resources. (AFNOR standard X50-106) [7].

The PMI defines a project as a temporary effort exerted in order to create a product, a service or a single result. The temporary nature of projects implies a beginning and a definite end (PMI) [8].

## 1.2. Project Management

Historically, projects were large and complex undertakings. Between the years 1930 and 1950, projects were carried out mainly at the public authorities initiative. The decision problems, formulation and realization of the objectives were more important than efficiency. The colonial projects later Third World, allow gathering of new knowledge. Carried by the conviction of the mastery of socio-economic development through projects, project management adds new dimensions to the 1960s; methods and project management techniques are gradually mastered [9]. Nevertheless, it's indeed the beginning of project management with a classical vision [10]. However, during the past 30 years, and soared with projects of all types, project management has become the ideal way to design, manage and execute successful projects [11, 12].

Furthermore, the adoption of a project management tool manages the work within the organization and implements the processes and methods to improve the quality of work and results. But it helps to build trust between customers and suppliers, by simplifying collaboration between both parties [2]. The choice of this tool should cover the short and medium term [13]. The management of any project depends not only on good planning, adequate resources, it also requires a clear and continuous communication through listening and understanding [62]. It brings together and optimizes the resources to complete the project successfully. These resources include the skills, talents and

cooperative efforts of a team; facilities, tools, etc [14].

Thus, project management involves the development, for each project, a total action plan, carefully defined. It includes the selection of teams, project budgeting, and setting a realistic, executable program [15].

## 1.3. Project Management In The Moroccan Context:

In the Moroccan context, the country is booming technically and economically, which causes the emergence of innovative and ambitious programs. And that does not usually result in the objectives set [16]. The project management principle is learned on the ground, with confusing between operation and project [17]. Now, project management culture is transverse. Overall, this culture is absent in the Moroccan context because of the dominance of the hierarchical structure, and the lack of control by the performance. In addition it differs from one department to another within the same organization because of the lack of a uniform formalism of working procedures [18, 19].

## 1.4. Institutions And Project management Schools

Following the use of project management concepts in various sectors, several professional organizations have emerged. In general, these organizations have helped to improve project management practices through the establishment of standards, guidelines and certifications. They had the privilege of making project management a recognized and respected profession. Among the best known, there is IPMA (International Project Management Association), AFITEP (Francophone Association for Project Management), APM Group (association for project management), the PMI (Project Management Institute), this last is the most important and most active among these organizations, it brought together all the knowledge, and best practices of the profession and in a document recognized as "Project Management Body of Knowledge (PMBOK)". It has been several updates to its improvement and adaptation to the needs of the profession. PMP certification (Project Management Professional) from PMI is among the most recognized certifications and most appreciated and credible domain [20].

## **1.5. State Of The Art Of IT Project Management**

The assessment of information technology projects has not been as successful as could be expected, even if the situation seems to be improving [21]. One reason for this improvement was greater emphasis on project management approach, to support the activities needed to develop and deliver quality products desired... [22]. An organization should consider adopting a project management system that can meet their needs and satisfy them in good conditions. By analyzing the literature of the field, multiple repositories to complete IT projects have been developed. They are used in particular to have a formal framework in the IT project management field.

### **1.5.1. Information and Technology Infrastructure Library: ITIL:**

Is currently at version 3 service oriented [23]. ITIL helps to [24]:

- prove that IT delivers value to the business,
- identify the company's business needs and adapt IT to these needs and not the reverse,
- focus on IT service quality,
- improve the perception of IT services by customers / users,
- ensuring the sustainability and development of the company by guaranteeing a suitable computing strategy.

### **1.5.2. Capability Maturity Model Integration: CMMi**

The essential purpose of CMMi is to measure the ability of projects to be completed correctly in terms of timing, functionality and budget [25]. CMMi focuses on improving processes in an organization. It contains the essential elements of effective processes for one or more disciplines and describes the improvement trajectory of the evolution of these processes [26].

### **1.5.3. Common Objectives for Business Information Technology: CobIT**

Is an audit and governance repository of information systems, scalable and aligned with the business and corporate strategy, resulting from best practices for controlling information technology [27]. COBIT provides best practices in a framework by domain and process and presents activities in a logical structure easy to understand.

### **1.5.4. Projects IN Controlled Environments: PRINCE**

The Prince repository is a structured method for effective project management [28, 29]. PRINCE2 project is based on tens of experiments, project managers and project teams successful or winless projects. PRINCE2 adopts the principles of good project management to avoid the problems which have been identified and helps to achieve successful projects.

### **1.5.5. Project Management Body of Knowledge: PMBOK**

This repository adheres to the standards expressed by the PMI Project Management Institute and tries to present users with a concise overview of the principles they will use for their projects manager [30].

The PMBOK repository has a more comprehensive framework in the project management field and incorporates both standards, methods, processes and practices established. The potential of the PMBOK standard led us to conduct a thorough work of this repository modeling, and achieve a uniform format for IT project management.

Moreover, PMBOK and CMMI are both a compendium of best project management practices. Both models share overlapping content regarding project management, but since they also have differences, each model offers different benefits [31]. In this context, an organization that intends to improve its project management practices may have some ambiguity in the choice of model to be adopted or, if we consider more, resulting in ineffective implementation with overlapping duplicate efforts [32]. Thus, COBIT is a unifying tool that combines within its approach inputs other standards such as ISO 9000, ITIL, CMMi and firm-specific characteristics. It nevertheless allows greater cohesion between IT and its business and has a gain in terms of reputation with third parties and regulators.

PRINCE 2 is structured for small projects.

The PMBoK repository remains among those with a comprehensive framework in the project management field and incorporates standards, methods, processes and practices established for the discipline. PMBOK standard potentials have led us to conduct a thorough job of modeling. The following section will focus on UML modeling of the main components of the PMBOK repository from which we intend to extract a simplified standard model, project management, adapted to projects of small and medium size.

## **3. STUDY AND MODELING OF REPOSITORY PMBOK**

PMBOK remains a world leader in project management. It is a formal repository that describes the standards, methods, processes and practices established in the project management field [33].

### 1. Descriptive Analysis Of PMBoK

To formalize and further deepen knowledge specific to this standard, we have undertaken a complete modeling of the various components of PMBOK (version 3 and 4). This model is made so that it is applied mainly to IT projects. It will indeed extract a simplified model of IT project management.

The approach proposed by PMBOK: According to PMBOK, a project is a temporary endeavor decided in order to create a product, a service or a single result. Indeed, every project has a beginning and an end sets. The end is defined when the objectives are completed or when it is obvious that they will not be met or the project is abandoned. Each project has certain characteristics that make it unique.



Figure 1: The important elements of a project

The project management approach according to PMBOK: Project management is the application of knowledge, skills, tools and technical project activities in order to meet the requirements. Project management is accomplished through the application and integration of project management processes grouped into: starting, planning, execution, monitoring and control, and closing. The project manager is the person responsible for the achievement of project objectives [34].

Project expertise areas: effective project management requires that the project management team understand and use knowledge and skills [35,36], at least five areas of expertise:

1. Corpus of project management knowledge,
2. knowledge of the scope, standards and regulations,
3. understanding of the project environment,
4. general knowledge and skills in management,
5. interpersonal skills.

Project Life Cycle and Organization according PMBOK: In general, a project is divided into a number of phases to have a very good control. All of these phases are the life cycle of a project [37-39]. In general, the life cycle of a project includes [40]:

- technical work to be performed in each phase,
- when the deliverables are to be generated in each phase, how to review them, verify and validate,
- participants in each phase
- the terms of control and approval of each phase.

The completion and approval of one or more deliverables characterizes a project phase. A deliverable is a measurable, verifiable work product such as a specification, a feasibility study report, detailed design document, or working prototype. For effective control, each phase is formally initiated to produce a given output of the boot process of this phase, which specifies what is allowed and expected for that phase [41] (see Fig. 2).

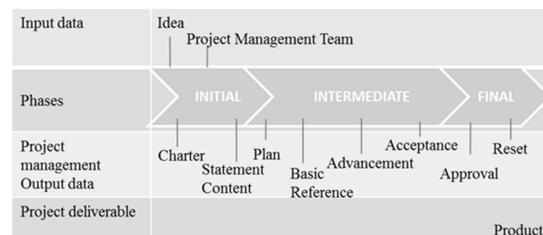


Figure 2: Séquence type de phases dans un cycle de vie du projet [33]

Project management process: Project management takes place through processes [37-39] using the knowledge, skills, tools and project management techniques, and receiving input data and generate output data [42].

This reference describes the nature of project management processes in terms of process integration between them, of their internal interactions and the goals they pursue. These processes are combined into five groups called project management process groups (see Fig. 3):

- Initiating process group,
- Planning process group,
- Executing process group,
- Monitoring and controlling process group,
- Closing process group.

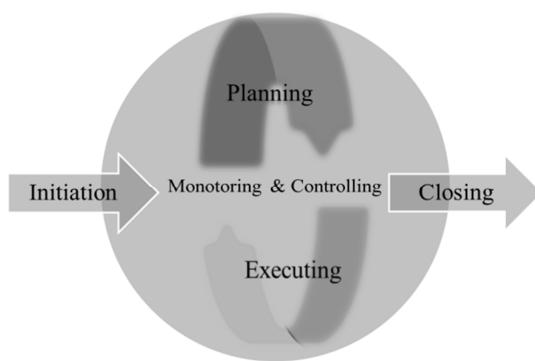


Figure 3: Groupes de processus de management de projet [37]

The project management process groups are linked by the objectives they produce. In general the output data of a process becomes an input data of another process or is a deliverable of the project.

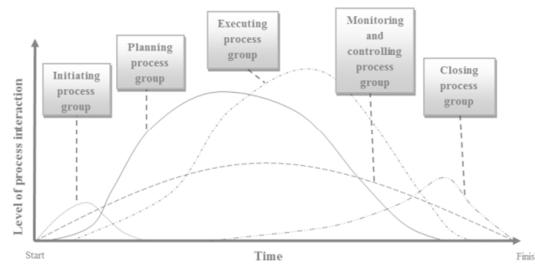


Figure 4: Interaction des groupes de processus dans un projet [38]

## 2. Project Management Knowledge Areas Modeling According To PMBOK

In this section we will present the knowledge areas of project management according PMBoK and we will proceed to their models in order to simplify them and make them usable and adaptable to all types of projects (average size, small,...)

The project management knowledge areas that PMBOK treats are:

- Project integration Management

- Project scope Management
- Project time Management
- Project cost Management
- Project quality Management
- Project human resource Management
- Project communications Management
- Project risk Management of the of the
- Project procurement Management

We are going to content with detailing the humain ressources knowledge management area to establish an UML model.

The management of the project includes human resources processes of organization and management of the project team. The project team consists of persons to which roles and responsibilities are assigned to lead the project to its completion.

The human resources management modeling allowed us to extract the following diagrams:



Figure 5: Human resource management use cases

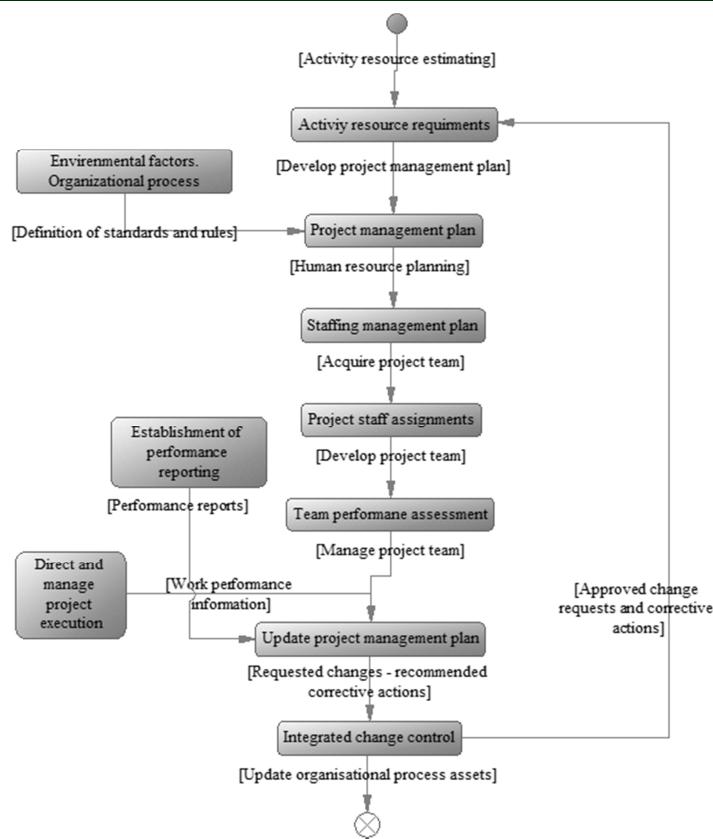


Figure 6: Transition state for human resource management

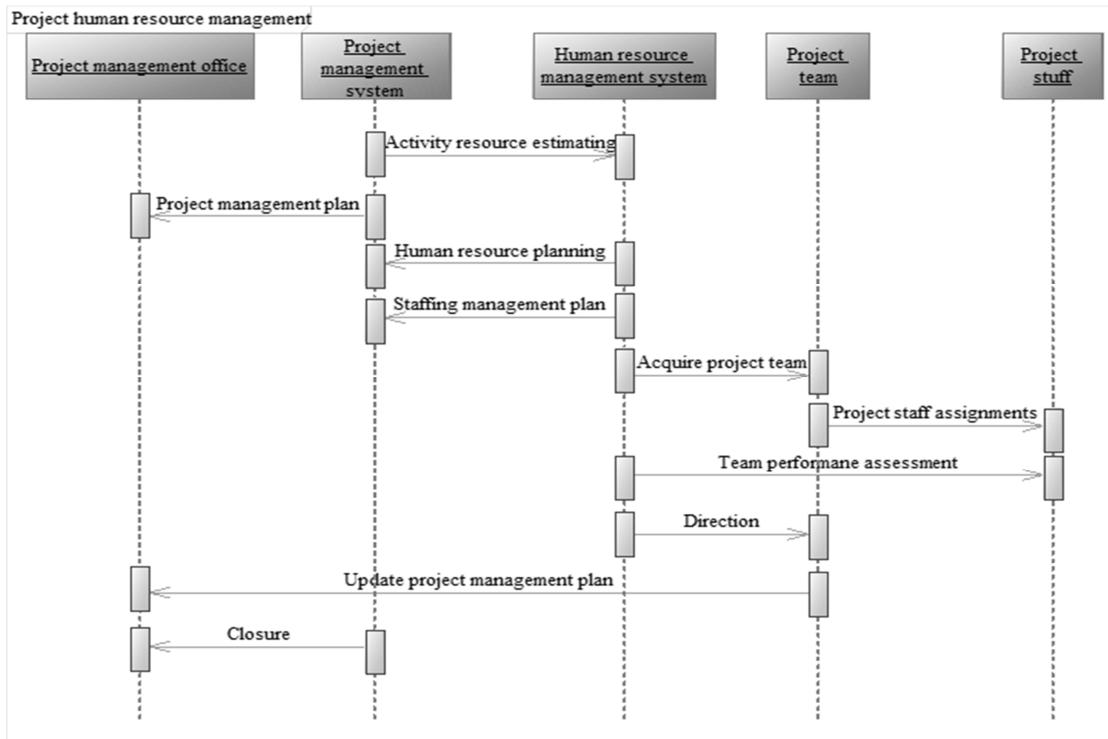


Figure 7: Sequence of the human resource management

Same as previous are defined the other knowledge areas of project management. We therefore present in figure 8 the UML class diagram,

Otherwise, we analyzed the different elements that compose the PMBOK knowledge areas.

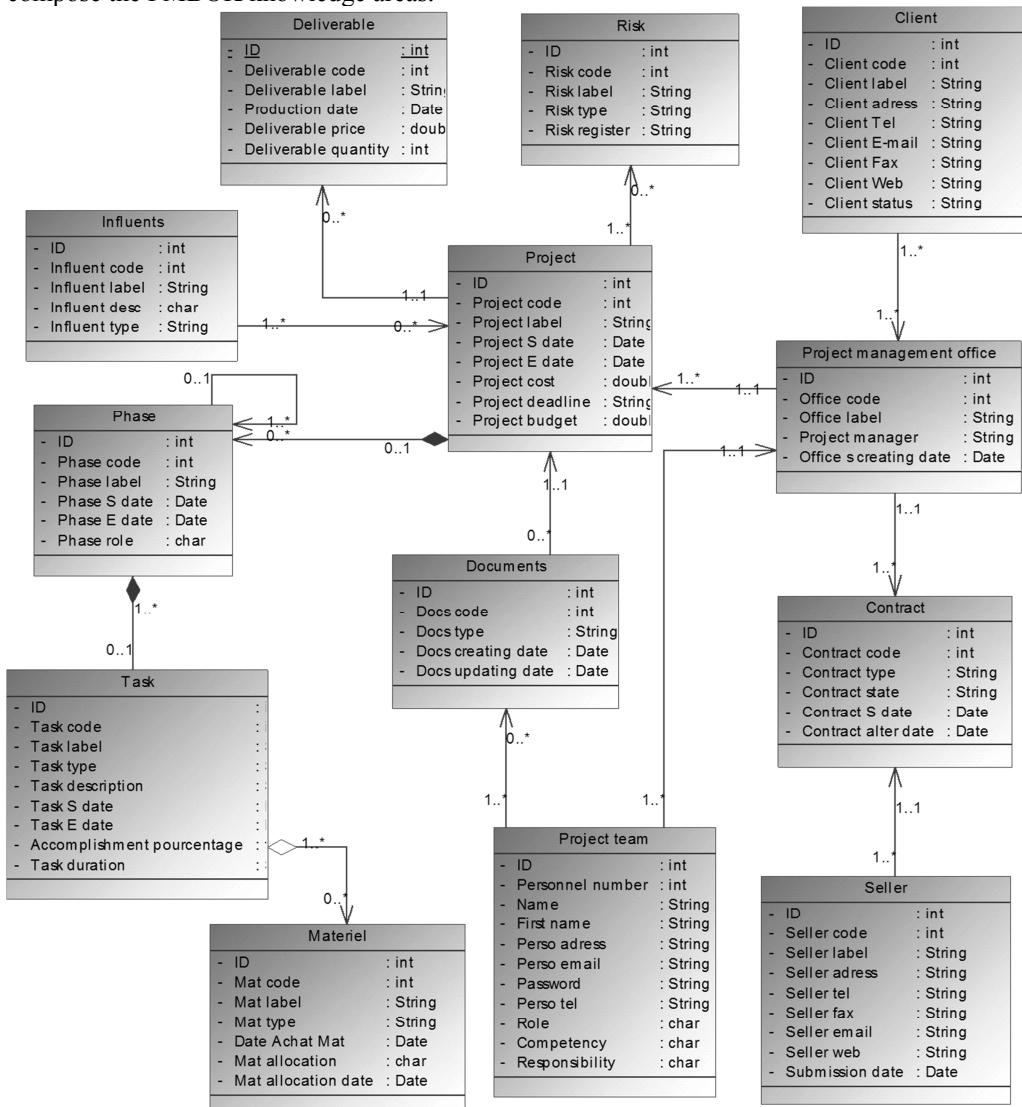


Figure 8: proposed PMBOK Class diagram

This diagram represents a model adapted to a set of computing projects in a Moroccan public body: an IT study project, a networks setting up project or an IT development project. We will develop them in the next section.

The results of our research have the advantage of treating a project from idea to its completion. In addition, they include the assets and liabilities of a project and the relationships that govern them.

#### 4. MODEL IMPLEMENTATION AND VALIDATION

To concretize this study, we applied this standard model on three projects in a Moroccan public department:

- A networking setting up project , that includes the wiring, the routing equipment installation, switching, security, traffic check as well as the assets configuration to have a homogenous and secured data flow.
- An IT development project, which starts from the customer's need expression, the project framework, the conception, the achievement

- and the implementation as well as deployment of the solution.
- An IT study Project that is the master plan of an information system : an evaluation plan designed to prepare the environment evolution and adaptation of the information system and IT infrastructure.
  - A project to build a data center, which includes servers, Switches, routers ... according to international standards that guarantee data security, equipment and staff.

For these projects, it was necessary to prepare several documents, including the QAP (Quality Assurance Plan), the SDP (work breakdown structure), Management Plan deadlines, risk management plan, deliverables document, project charter...

We are just going on this article to detail the IT development project and the methodology adopted to succeed. So, the global objectives of this project come as follows:

- Developing the institution action in the field of prevention of failures,
- Capitalize on failure history and claims to optimize the service and define maintenance and rehabilitation plans,
- Ensure good management and strict monitoring of the complaints received.

This application manages the claims of commercial and technical type. This system should, inter alia, ensure the establishment a significant improvement:

- its brand image through better relationships with customers;

- operational and financial results through more effective control breakdowns and malfunctions and the reduction in the average response time to the customer;

- The control of the claims process.

We proceeded to the preparation of project documents, including the quality assurance plan that has created the project office and the appointment of the director and project manager. Then it enabled the definition of the project team according to the tasks and functions to perform.

*Table 1: Project Data Sheet*

Project Name	Study, development and implementation of a claims management system
Sponsor	General Manager
Project manager	Safaa ERRIHANI
Project promoter	Project manager
Estimated budget in HT	200 000.00 DH
Proposed Start Date	July 4, 2012

Then we developed the project charter and the breakdown structure of the latter. Then we defined the time management plan and the risk management plan. The latter is as follows:

*Table 2: Risk Management Plan of project complaint*

N o.	RISK	Risk response strategy	Risk response plan
1	Risk due to specifications inconsistency	Avoid	continuous control
2	Absence of any previous experience for some development tools	Avoid	technicians training
3	Completion date of the project too optimistic or unrealistic	Avoid	monitoring mastered
4	Quality Risks	Avoid	continuous control
7	Non availability of internal resources involved in the project	mitigate	Planning management
8	Deliverable supply delay	Avoid	Respect the holding of the monitoring committees according to the identified frequency

Using the model classes we proposed in this project: figure 8, we established the following sequence of

<pre> classDiagram     class Project     class ProjectManagementOffice     class Client     class ProjectTeam      Project "1..1" --&gt; "1..*" ProjectManagementOffice     ProjectManagementOffice "1..1" --&gt; "1..*" Client     ProjectManagementOffice "1..1" --&gt; "1..*" ProjectTeam   </pre>
<ul style="list-style-type: none"> <li>Expression of the customer needs which is the user department: study, development and implementation of a claims management system. This project consists to develop an IT software solution that should allow automation, professionalization, standardization and security claims management process.</li> <li>Creating the Project Office and Project Manager designation and stakeholders: technical and commercial.</li> <li>Definition of the project from the start date till the end, the time and the budget allocated to the project. The project start date was scheduled for 04/07/2012 and had duration of 3 months. The project budget is 200 000 MAD</li> </ul>
<pre> classDiagram     class ProjectTeam     class ProjectManagementOffice      ProjectTeam "1..*" --&gt; "1..1" ProjectManagementOffice   </pre>
<ul style="list-style-type: none"> <li>Designation of the project team depending on responsibilities and tasks to be performed. Indeed, the realization of such a solution requires collaboration between different parts namely technical services and sales department who frequently receive customer complaints. The system should be able to meet the requirements of applicants and achieve the objectives set. The project team will consist of agents who master the functional aspect (types of claims, duration of response, working tools on the site ...) and a technical aspect for the development part. The project team constitutes the project committee. A steering committee is created for the validation phases of deliverables.</li> </ul>
<pre> classDiagram     class Project     class Phase     class Task     class Materiel      Project "0..1" --&gt; "0..*" Phase     Phase "1..1" --&gt; "1..1" Task     Task "0..1" --&gt; "0..1" Materiel   </pre>
<ul style="list-style-type: none"> <li>Each project can be divided into phases, and each phase can be in turn divided into tasks, all of the phases is the life cycle of the project. This project was also divided into four main phases:       <ol style="list-style-type: none"> <li>Initialization &amp; Functional Analysis           <ol style="list-style-type: none"> <li>Launching</li> <li>Detailed planning</li> <li>Working groups</li> </ol> </li> <li>Functional and Technical Design           <ol style="list-style-type: none"> <li>functional Design</li> <li>graphic design</li> <li>Engineering Design</li> </ol> </li> <li>Development and testing           <ol style="list-style-type: none"> <li>Development</li> <li>Documentation</li> <li>Reuse existing</li> </ol> </li> <li>Installation, training and support           <ol style="list-style-type: none"> <li>Production start</li> <li>Training</li> <li>Acceptance of the application</li> </ol> </li> </ol> </li> <li>Procurement of the necessary equipment to conduct the project, in particular the desktop tools (PCs, printers ..) and software such as database and development platform (SQL Server and Visual Studio)</li> </ul>
<pre> classDiagram     class Project     class Documents     class ProjectTeam      Project "1..1" --&gt; "0..*" Documents     Documents "0..1" --&gt; "1..1" ProjectTeam   </pre>
<ul style="list-style-type: none"> <li>Project plan description, and specification of project documents: the project charter, the estimated planning, the quality assurance plan which contains deliverables, the work breakdown structure and the management plan risks (see table 2) and deadlines.</li> </ul>

<pre> graph LR     Influents[Influents] -- "1..*" --&gt; Project[Project]     Project -- "0..*" --&gt; Risk[Risk]     Project -- "1..1" --&gt; Deliverable[Deliverable]     Deliverable -- "0..*" --&gt; Risk   </pre>
<ul style="list-style-type: none"> <li>Risks may arise during project implementation as validation deliverables delays due to the unavailability of the members of the steering committee. These delays can be avoided by forming the risk register and risk management project plan.</li> <li>The project is submitted by external or internal influences, especially the instability of IT tools (bugs) and the variety of programming languages and development tools as well as the introduction of free open source tools.</li> <li>The project deliverables are made at the end of each phase after their validation. The final deliverable is the claims management solution with user profiles, a reliable and robust database, summary output states and user-friendly interfaces:</li> </ul>
<p>Deliverables for Phase 1: Initialization &amp; Functional Analysis</p> <ul style="list-style-type: none"> <li>- Quality Assurance Plan,</li> <li>- Provisional planning of realization,</li> <li>- Project Charter,</li> </ul>
<p>Deliverables of Phase 2: Functional and Technical Design</p> <ul style="list-style-type: none"> <li>- Functional Specifications <ul style="list-style-type: none"> <li>o Reminder project boundary,</li> <li>o Reminder functionality,</li> <li>o First prototype of the application.</li> <li>o Management rules, procedures and output states</li> </ul> </li> <li>- Technical Specifications <ul style="list-style-type: none"> <li>o Architecture (application, hardware and software)</li> <li>o The business process modeling,</li> <li>o design application,</li> <li>o Detailed planning updated.</li> </ul> </li> </ul>
<p>Deliverables of Phase 3: Development and testing</p> <ul style="list-style-type: none"> <li>- Programs sources tested system</li> <li>- Plan unit testing &amp; integration test plan</li> <li>- Acceptance Report</li> <li>- Operating Manual <ul style="list-style-type: none"> <li>o Commissioning;</li> <li>o The regular operation;</li> <li>o The interruption or resumption of operation;</li> <li>o The instructions related to security.</li> </ul> </li> </ul>
<p>Deliverables for Phase 4: Installation, training and support</p> <ul style="list-style-type: none"> <li>- Procedure for installation and deployment</li> <li>- User Documentation.</li> </ul>
<pre> graph LR     PMO[Project management office] -- "1..1" --&gt; Contract[Contract]     Contract -- "1..*" --&gt; Seller[Seller]   </pre>
<ul style="list-style-type: none"> <li>The project office concluded contracts with suppliers for delivery of hardware, software necessary for the implementation of project benefits current.</li> </ul>

Thus, the project study, development and implementation of claims management solution enabled the mastery of complaints reported by customers. Indeed, the customer claims by telephone via the call center set up for this reason,

or by postal letter or depositing a written there, or presentation to the client wicket. Then the complaint is seized on site by reception staff on the system, according to its type. Managers of each business can consult real-time application and find the claims pending allocation. They should appoint

the team of technicians to move on-site to solve the problem and define the whole useful tools during the operation via a work order. The result of the procedure is subsequently informed about the application and is communicated to claimants.

Moreover, a statistical platform allows raising the details of claims according to several parameters. These statistics are used in decision making.

The adoption of the model class diagram in this project contributed to its success. First, the project achieved its objectives and meets the specifications of the contract documents; And enabled, among others, to organize the working procedure between the various entities. The deadlines have been met following the risk control and management time. The project cost reached 190 000.00 DH. The project is currently in exploitation. And raised statistics have enabled the mastery of time and resources given to teams to solve an intervention. Therefore, customers are satisfied with the quality of service provided.

Currently, we are carrying out the mobile version of this claims management system. It consists on an implementation of an intelligent tool on mobile devices that enables remote management of claims. This allows for rapid execution of tasks and reliable service.

## 5. CONCLUSION

A successful project management provides a permanent advantage in the dynamic context of current organizations. As the value of project management is more and more recognized, the PMBOK Guide is now an even more essential tool for practitioners in all organizations of different industries in different regions of the world.

Indeed, as part of this work, we were interested in the study of a set of project management standards. We focused thereafter on the PMBOK standard. After a thorough analysis of parts of the PMBOK and modeling in UML diagrams, we have learned a structural and formal framework of the management of IT projects suitable for public institutions.

The idea is to make uniform reference class diagram for the management of IT projects from the application of PMBoK repository on the computer network projects, software development and computer study in a public Moroccan institution. Moreover, during this study, and application of the model obtained on these types of projects, we could see the effectiveness of the implementation in terms

of cost, time and quality goals or over arbitrary management which can lead over budget, delays in execution or out of specification deliverables. This model can be referenced to manage IT projects (research, development, or networks).

However, the projects studied in this work are of medium size. We also plan to expand the research area to achieve at a suitable model for large IT projects in a structured Moroccan setting.

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