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**Modernization of project management information system
Case: Algérie Télécom**

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Abstract

Algérie Télécom is considered one of the most important organizations in Algeria which are economically characterized, one of its objectives is to provide telecommunication and network services on the entire Algerian territory. As it is the only provider of this service, it has multiple projects directed to professional customers when it faces several challenges both internally and externally in order to provide the best services to its customers. As information system is inevitable part of its projects realization, there are some obstacles to face in terms of the flow of information between the different stakeholders in project implementation.

Key words: Project management information system, telecommunications, information systems.

Résumé

Algérie Télécom est considérée comme l'une des plus importantes organisations présentant en Algérie a des caractéristiques économiques. L'un de ses objectifs est de fournir des services de télécommunication et de réseau sur l'ensemble du territoire algérien. En tant que seul fournisseur de ce service, il compte de nombreux projets destinés à des clients professionnels lorsqu'il doit relever plusieurs défis internes et externes afin de fournir les meilleurs services à ses clients. Comme le système d'information est une partie inévitable de la réalisation de ses projets, il existe certains obstacles à surmonter en termes de flux d'informations entre les différentes parties prenantes dans la mise en œuvre du projet.

Mots clés : système d'information de gestion de projet, télécommunication, système d'information.

ملخص

تعتبر مؤسسة اتصالات الجزائر من بين أهم المؤسسات ذات الطابع الاقتصادي، حيث تعمل على تقديم خدمات الاتصال و الشبكات على مستوى كامل التراب الجزائري، حيث تتنوع مشاريع المؤسسة في ميدان الاتصالات الموجه لمختلف المنظمات سواء كانت اقتصادية أو غير اقتصادية، وبما أنها الوحيدة التي توفر هذه الخدمة، فهي تواجه عدة تحديات سواء داخل المؤسسة أو خارجها من أجل تقديم أفضل الخدمات لربائنها في نظام الشبكات، حيث يلعب نظم المعلومات دورا مهما في إتمام مشاريعها و تقييمها باستمرار وهذا من خلال توفير كافة المعلومات الضرورية لمختلف المشاركين في مشاريع إنجاز نظام الشبكات وفق معايير ترضي ربائنها.

الكلمات المفتاحية: نظام معلومات إدارة المشاريع، خدمة الشبكات، نظم المعلومات

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To the memory of my grandfathers.

To my parents, my whole family and friends.

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List of abbreviations and acronyms

AT : Algérie Télécom

ATM : Algérie Télécom Mobile

ATS : Algérie Télécom Satellite.

BA: Business Analytics.

DBSM: Data Base System Management.

DSS: Decision Support system.

ESS: Expert System Support

ERMC : Etablissement Réseaux Multi-Core

ICT : Information Communication Technology.

IP: Internet Protocol.

IS : Information Systems.

IT : Information Technology.

LET : Laboratoire des Equipements des Télécom.

MIS : Management Information System

MSAN : Multi-Service Access Node.

NGN: Next Generation Network.

PMIS: Project Management Information system.

TPS: Transactions Processing System

UML: Unified Modelling Language

General introduction

In today's business, any organization cannot survive without the real exploitation of information, especially in this modern world where globalization requires the company to acquire advanced technological means to manage information flows to remain updated for competition and environment change. As a result, organizations should always guarantee the consistency of information in every managerial action. Information system is considered as the backbone of organizations and a necessary tool for managing and processing information flows in large numbers in organizations.

Our research in information systems was conducted at Algérie Télécom that is providing communication and network service in addition to offering a full range of voice and data services to particular and professional customers. Throughout our research, we have tried to identify the problems faced by the organization in its information system but focusing more precisely on its projects which are directed to professional customers. We have used many tools and techniques that eventually lead us to propose solutions for managers who have to manage different projects at the same time which is something challenging for them. Project management information system is one of the most efficient and recent tools in managing projects and assures relevant, information of quality, and make information available for every stakeholder from the initial phase to the realization of the project. In order to reach the purpose of our research, we have conducted multiple interviews with different internal actors within the organization to assess the current information system and trying to identify the obstacles that are faced by them.

To reach the objective of this work that is modernization of project management information system, we have adapted inductive scientific approach as a reference to guide our study.

In the first place, we have described our organizational context, objectives of our research and both academic and professional interests.

In the second chapter, we have assembled the literature review and the conceptual framework of our work. Also, mentioning previous studies in the field of information systems and project management information system was necessary to construct a reliable work.

Research methodology is a significant part of any research that explains the posture of the researcher and demonstrate the methodological framework, collection of data, and the guidance of followed to implement a project information system. All of that is pointed out in the third chapter.

The fourth and last chapter covers up the implementation and design of a new project information system following a success model for implementing a new information system.

CHAPTER I
RESEARCH PROBLEM

In this chapter, we will present the context and the purpose of our research. Then, the scientific pertinence of our research and interviews conducted. Furthermore, the organizational context “Algérie Télécom” which our research is taking place on, after that we will zoom on the Operational center.

1.Context and purpose of the research:

The current world is fully intertwined and connected to each other in many different ways and digitalization has been imposed on us almost in all our aspects of life due to the technological development. “Algérie Télécom” is a national and economically characterized organization that provides various products in data and voice services. Thus, the operational level and information system department are facing some challenges to quickly act and react to the external environment to deliver its projects respecting the time bound, quality and costs constraints with the determination of all stockholders interacting in these projects. The **purpose of our research** is to propose solutions to improve the effectiveness of the current information system to respond to the needs of users by providing the right information to the right individuals in the right time.

2.Interests of the research

2.1 Academic interests:

As a part of my research, it is suitable to show my interests in this work that is related to this field of study. Also, Business nowadays is confronting major challenge in technology usage which is decisive tool in creating value for customers and creating a sustainable competitive advantage. Digging deeper in theoretical aspect allows us to understand various disciplines and literature in information systems.

2.2. Professional interests:

Throughout my internship in Algérie Télécom, I have discovered many gaps and lack of using information systems. Accordingly, focusing on the flow of information and communication in the different project phases within the organization, I started conducting my work by using the knowledge acquired in information systems discipline. As a result, my professional experience allowed me to reflect this knowledge on the real world of business to solve contemporary problems faced by organizations in Algeria in information systems.

3. Question of the research

Most of our research took place at the operational center in Algérie Télécom, also in other departments such as information system, corporations' management division, and the technical division because of the nature of our research requires different information from various department in order cover the whole picture of the study and provide some credible solutions. The study focused on information systems. Specifically the information system adapted in projects, which are the backbone of the organization. As a result, I intended to contribute exactly in it, to observe and study the obstacles that are hindering projects in terms of communication and information systems to be delivered in time to customers. To tackle the subject we have constructed the followed **research problem**:

How to design a modern project management information system that responds to project stakeholders needs?

4. Organizational context:

Algérie Télécom is the leader in the Algerian telecommunications market, which is experiencing a strong growth. Offering a full range of voice and data services to residential and business customers. This position was built by a strong innovation policy adapted to customer expectations and oriented towards new uses. Its ambition is to have a high level of technical, economic, and social performance to sustainably maintain its leading position in its field, in a competitive environment. Its concern is also to preserve and develop its international dimension and participate in the promotion of the information society in Algeria.

4.1. Algérie Télécom missions:

- ✓ Provide telecommunication services such as data, voice, written messages, digital data, and audio-visual information;
- ✓ Develop, operate and manage public and private telecommunications networks;
- ✓ Establish, operate and manage interconnections with all network operators;
- ✓ Realize, directly or indirectly, the technical, technological, economic and financial studies related to its projects;

4.2 Algérie Télécom objectives:

- ✓ Increase the supply of phone services and facilitates the access to telecommunication services for the greatest numbers of users, especially in rural areas;

- ✓ Increase the quality of services offered and the range of services rendered and make telecommunications services more competitive;
- ✓ Modernization and development of the access network through the introduction of Next Generation Network (NGN) equipment;
- ✓ developing and securing transmission links, notably by increasing international capacity;
- ✓ Developing and provide new services in the market (FTTx, Prepaid, Wifi ...).

4.3 Subsidiaries of Algérie Télécom:

As part of the reinforcement and diversification of its activities, Algérie Télécom has implemented a plan to divest its mobile and satellite activities, which has resulted in its transformation into a group to which two subsidiaries are affiliated.

A. Mobilis

Mobilis, or Mobilis ATM (Algérie Télécom Mobile), is one of the three major Algerian mobile operators. Become autonomous in August 2003, Mobilis offers its customers: post and pre-paid offers, SMS / MMS, international roaming, messaging voice, consultation of the invoice on the Internet, free notification of the balance after each call, free call to one or more numbers favorite.

B. Algérie Télécom Satellite (ATS)

ATS is a Subsidiary of Algérie Télécom since July 2006; it participates today in the emergence of a company turned towards the future, through satellite solutions allowing developing various specialized services adapted to the needs of the companies in term evolution of low-medium-speed and high-speed information, communication and data communication systems.

C. Algérie Télécom Business Units:

The organization is the major player of telecommunications in Algeria with five business units:

- **Phone services:** with 2 million lines in service, and a WLL network in full expansion
- **Mobile services:** activity through a MOBILIS subsidiary, which holds a 13%.
- **Data transmission:** a data network activity for companies (LL, X25).

- **Internet access:** DJAWEB, FAWRI ADSL and lately EASY ADSL.
- **Satellite network:** telecommunications services based on VSAT, Inmarsatet the Thuraya network.

4.4. Organizational structure of Algérie Télécom:¹

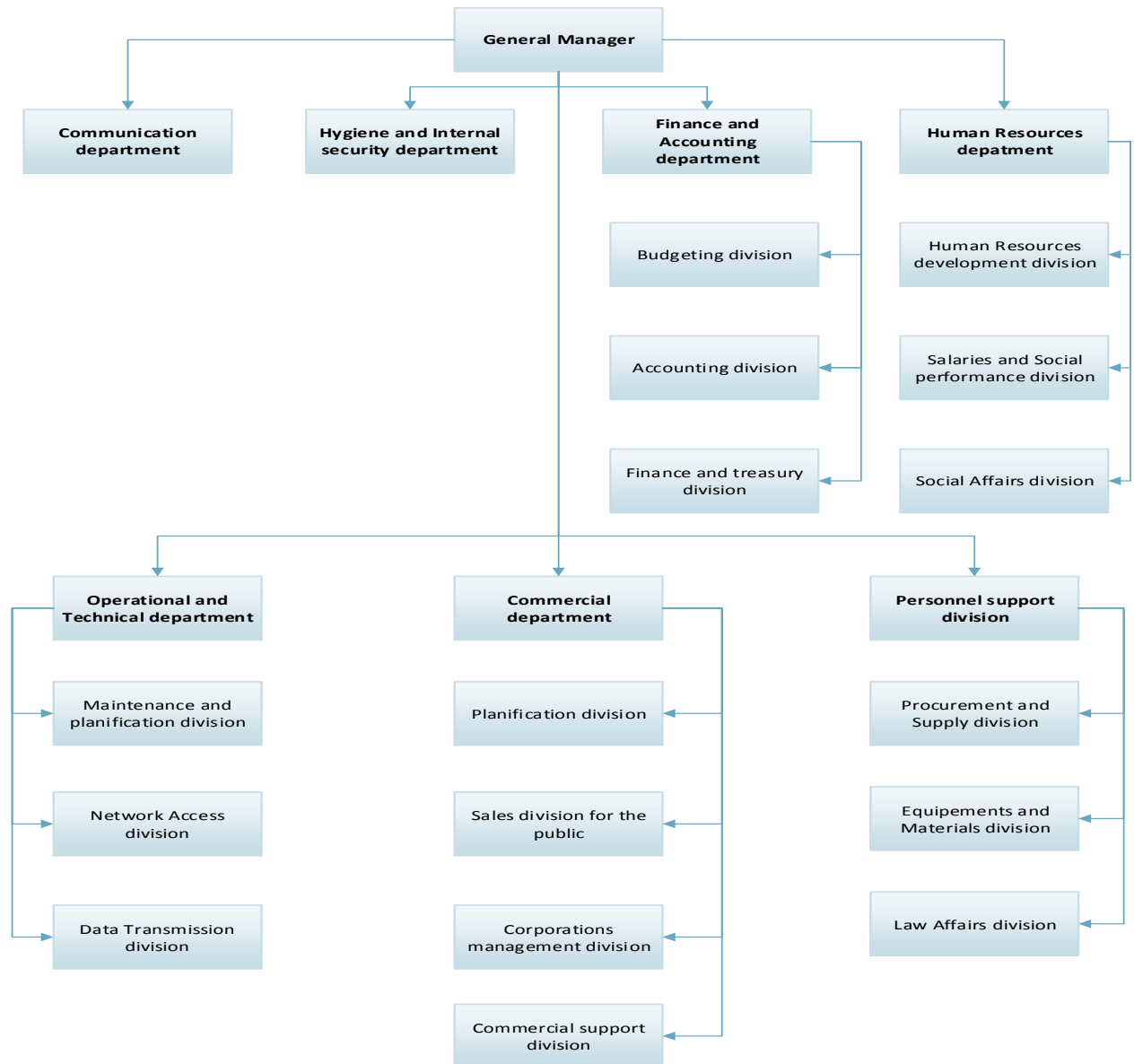
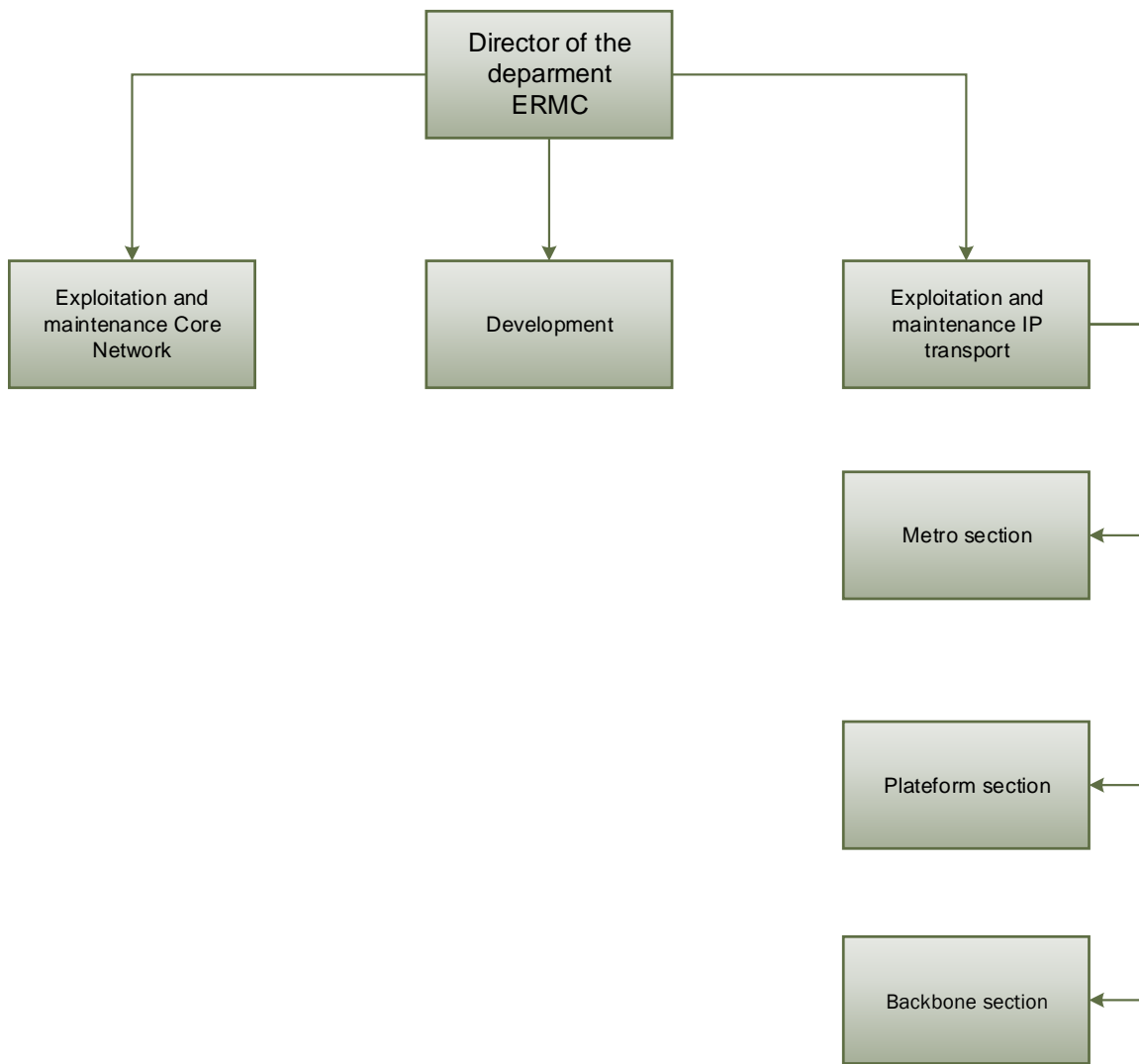


Figure 1.1. Organizational structure of Algérie Télécom

Figure 1.2. Operational department ERMC structure

¹ Internal document provided by human resources department.



Source : Operational department document ERMC

CHAPTER II

**LITERATURE REVIEW AND
CONCEPTUAL FRAMEWORK**

In this chapter, we will address the literature review of the subject relating to our research in information systems. On the other hand, we have assembled all concepts mentioned in our study in the conceptual framework part.

1. Literature review:

Interdependence between information technologies and project management has been reached its highest level since many years. It is perceptible in the increase number of project management packages and the adoption of various management solutions such as Executive Support Systems (ESS), Decision Support Systems (DSS), Knowledge Management System (KMS), Management Information Systems (MIS), Supply Chain Management (SCM), Business Intelligent Systems (BIS), virtual reality (VR), and risk management (RM) tools.

In the project management literature, the definition of project has been discussed by numbers of literatures, for instance, PMI (2000) define projects as 'a temporary (definitive beginning and definitive end) endeavor undertaken to create a unique (projects involve doing something that has not been done before) product or service'.

Dave Cleland and Lew Ireland (2004) describe a project as "a combination of organizational resources pulled together to create something that did not previously exist and that will provide a performance capability in the design and execution of organizational strategies». Some authors described Project Management tool as «software for project management" (Fox, Murray et al.2003), while others view them as "systematic procedures or practices that project managers use for producing specific project management deliverables" (Milosevic, 2003). Thus the core of a PMIS is usually project management software which involves wide alteration, configuration or customization before to its applied.

Besner C., Hobbs, (2009) declared that -projects nowadays are most often used in information technology (IT), software development, business process reorganization and research and development. Meredith and Mantel (2006) found that utilizing Information technology (IT) has major impact in solving all difficulties, which may appear during project life-cycle phases, by presenting a crucial computer application, project management software such as, which may help in decreasing the time and cost that are required to use precise clarifications for project planning, scheduling, monitoring, and controlling. Thus, retailers provided extra support for the key phases of the project life-cycle such as project risk management and created knowledge management to strength not only individual but the monitoring and controlling the whole organization (Ahlemann 2007).

Essentially, the task of Project Management Information System have been described as "subservient to the attainment of project goals and the implementation of project strategies", it supply project managers by "essential information on the cost-time performance parameters of a project and on the interrelationship of these parameters (Raymond L., 1987). In the information technology (IT) industry, Gartner Research estimates that 75% of large IT projects managed with the support of a project management information systems (PMIS) will succeed, while 75% of projects without such support will fail (Light M., et.al., 2005). However, the literatures still shows only a small number of researches on the utilization of PMIS that highlighting the demographics of project management tools management and to assessing particular functions of these tools to maintain a particular tasks during project management life cycle such as planning, communicating and reporting, managing risks, scheduling, estimating costs, and managing documents (Herroelen, 2005; Love and Irani 2003).

One exception from the literatures was by an author named Ahlemann (2008). He presented an extensive research about requirements of PMIS in which he recommends the M-model as a support for the requirement description in different phases of project life cycle. Wilcox and Bourne (2002) indicated that while ultimately all decision making is about the future, therefore if we are to use data to improve decision-making we need to build a model that provides some predictive support. It is insufficient for data to merely contribute to an understanding of current performance; it must also allow the development of predictive management capabilities. While Hemmingway (2006) confirm the need to build analytic capabilities in order to improve decision-making. Davenport and Harris, 2007 imply that there is research evidence suggesting that better use of information can improve decision making.

DeLone and McLean (1992), introduced the first IS success model which was based on Shannon and Weaver's (1949) theory of communication. DeLone and McLean's model present different features differentiated by the two essential concepts: system quality and information quality. The utilizing of the system has a clear impact on the way individuals accomplish their performance. This impact may eventually effect on theorganizational performance. The model that explores the impact of PMIS on PMDM uses DeLone and McLean's (2003) model as a source for the structuring the proposed PMIS conceptual model. Other models presented by other literatures were also estimated such as Sabherwal et al. (2006), Urbach et al. (2009), and Almutairi and Subramanian (2005). From these modules,

we agreed on the standard tasks of PMIS that ascertaining the usage states in which to assess the effective and efficient use of the decision making process during different phases of project life-cycle.

from the above literatures and complete structuring the conceptual research model, the researcher accomplished a qualitative research design through a number of interviews with different project management actors.

2. Conceptual framework

In this part, we will address all concepts and terminology related to the subject of our research in terms of information systems, project management information system and other concepts, which will be explained in details.

Information overload

Herbert Simon was among the first to realize that a surplus of information should be connected to a shortage of something else. He is famous for saying: ‘what information consumes is rather obvious: it consumes the attention of its recipients. Hence a wealth of information creates a poverty of attention, and a need to allocate that attention efficiently among the overabundance of information sources that might consume it’ (Simon 1971). In other words: attention deficit and information overload are two sides of the same coin. (HEIJDEN, 2009)

2.1. Definition of key concepts

People require information for many reasons and in varied ways. For instance, you probably seek information for entertainment and enlightenment by viewing television, watching movies, browsing the Internet, listening to the radio, and reading newspapers, magazines, and books. In business, however, people and organizations seek and use information mainly to make sound decisions and to solve problems—two closely related practices that form the foundation of every successful company. (KENNETH J.SOUSA, 2015)

2.1.1 Information

The definition of information is broad and every concept has its background depends on the discipline source. Thus, we will try to choose the most convenient meaning that is related to our research. The dictionary of Oxford defines information as: “What is conveyed or represented by a particular arrangement or sequence of things.” Ronsay (1975) proposed a definition of information as “The content of a message that is capable of triggering an

action”. In the same stream, March (1991) affirms: “Information gives its sense to a situation of decision”.

After those definitions, we can define information as an element used to improve the understanding of a particular situation, which is presented in different forms to assist managers in their decision-making process.

2.1.2. The nature of information resources

A. Structured information: this kind of information is usually considered to be facts and data. It is reasonably ordered, in that it can be broken down into component parts and organized into hierarchies. Your credit card company, for example, maintains your customer record in a structured format. It contains your last name, first name, street address, phone number, email address, and other data. It would also maintain your purchases, each with a transaction date, description, debit or credit amount, and reference numbers. Straightforward relationships among the data elements are also relatively easy to identify. A customer’s order would be related to the customer record, and the items purchased as part of the order would be related to the order itself. This kind of information is the heart of an organization’s operational information systems, with electronically stored customer records, orders, invoices, transactions, employee records, shipping tables, and similar kinds of information. It is the kind that databases are designed to store and retrieve. (WALLACE, 2015)

B. Unstructured information: has no inherent structure or order, and the parts can’t be easily linked together, except perhaps by stuffing them in a manila folder or box. It is more difficult to break down, categorize, organize, and query. Consider a company involved in a touchy lawsuit. The information related to that could include letters, emails, Twitter feeds, post-it notes, text messages, meeting minutes, phone calls, videos, Facebook posts, resumes, or photos. Drawing information out of unstructured collections also presents challenges. A catering business might have a back room stacked with boxes containing unstructured information on hundreds of contracts. If the owner wants to know which contracts went over budget, and then see who handled those, every box would have to be opened. Because unstructured collections have no means to enforce rules about what types of information must be included, the owner may find little to go on. (WALLACE, 2015)

C. Semi-structured information: This type includes information that shows at least some structure, such as web pages that have dates, titles, and authors. Spreadsheets can also be semi-structured, especially when they are created by different people to keep track of the

same kind of information. One salesperson, for instance, might put a contact's work phone and mobile phone in different columns labeled "Work Phone" and "Mobile," but another might keep them in the same column under the heading "Phones." Resources like these don't have the strong structure, enforced by advance planning, to clearly define entities and their relationships, and they lack controls about completeness and formatting. Nevertheless, such data are easier to query and combine than the unstructured variety. (WALLACE, 2015)

2.1.3. Characteristics of useful information

- ✓ **Relevant:** Information must pertain to the problem at hand. Relevant information might be that the person has so many years of education in mechanical engineering and so many years of experience. The information must also be presented in a way that helps a person understand it in a specific context. (KENNETH J.SOUSA, 2015)
- ✓ **Complete:** Partial information is often worse than no information. For example, marketing data about household incomes might lead to bad decisions if not accompanied by vital information on the consumption habits of the targeted population.
- ✓ **Accurate:** Erroneous information might lead to disastrous decisions. For example, an inaccurate record of a patient's reaction to penicillin might lead a doctor to harm the patient while believing that she is helping him. (KENNETH J.SOUSA, 2015)
- ✓ **Current:** Decisions are often based on the latest information available, but what was a fact yesterday might no longer be one today. For example, a short-term investment decision to purchase a stock today based on yesterday's stock prices might be a costly mistake if the stock's price has risen in the interim. (KENNETH J.SOUSA, 2015)
- ✓ **Economical:** In a business setting, the cost of obtaining information must be considered as one cost element involved in any decision. For example, demand for a new product must be researched to reduce risk of marketing failure, but if market research is too expensive, the cost of obtaining the information might diminish profit from sales. (KENNETH J.SOUSA, 2015)

2.1.4 The information flows within an organization

Organizations must treat information as any other resource or asset. It must be organized, managed, and disseminated effectively for the information to exhibit quality. Within an organization, information flows in four basic directions.

- ✓ **Upward:** Upward information flows describe the current state of the organization based on its daily transactions. When a sale occurs, for example, that information

originates at the lowest level of the organization and is passed upward through the various levels. Along the way, the information takes on a finer level of *granularity*. *Information granularity* refers to the extent of detail within the information. At lower organizational levels, information exhibits fine granularity because people need to work with information in great detail. At the upper organizational levels, information becomes coarser because it is summarized or aggregated in some way. That is, strategic managers need sales by year, for example, as opposed to knowing the detail of every single transaction. (STEPHAN HAAG, 2009)

- ✓ **Downward.** Strategies, goals, and directives that originate at a higher level are passed to lower levels in downward information flows. The upper level of an organization develops strategies; the middle levels of an organization convert those strategies into tactics; and the lower levels of an organization deal with the operational details. (STEPHAN HAAG, 2009)
- ✓ **Horizontal.** Information flows horizontally between functional business units and work teams. The goal here is to eliminate the old dilemma of “the right hand not knowing what the left hand is doing.” All units of your organization need to inform other units of their processes and be informed by the other units regarding their processes. In general, everyone in a company needs to know everything relevant in a business sense (personal, sensitive data not included). (STEPHAN HAAG, 2009)
- ✓ **Outward/inward.** Information is communicated from and to customers, suppliers, distributors, and other partners for the purpose of doing business. These flows of information are really what electronic commerce is all about. Today, no organization is an island, and outward/inward flows can yield a competitive advantage. (STEPHAN HAAG, 2009)

2.1.6 Data

After talking about information, data is considered as an important component of information systems, yet it is used interchangeably with information but there is a difference between the two concepts.

James A. O’Brien and George M. Marakas (2011), the word data is the plural of datum, though data commonly represents both singular and plural forms. Data are raw facts or observations, typically about physical phenomena or business transactions (JAMES A. O’BRIEN, 2011)

According to Oxford dictionary fourth edition, data is defined as “information or facts to be analyzed, by a computer”.

Kenneth LAUDEN and Jane LAUDEN(2014), gives a their definition of data as : “ streams of raw facts representing events occurring in organizations or the physical environment before they have been organized and arranged into a form that people can understand and use. Joseph VALACICH and Christoph SCHNEIDER(2018), “Unformatted data, or simply data, are raw symbols, such as characters and numbers. Data have no meaning in and of themselves and are of little value until processed.”

After these definitions, we can conclude by “Data is the input or the raw material resources that are processed into meaningful information.” the figure 2.2 shows the difference between the two concepts.

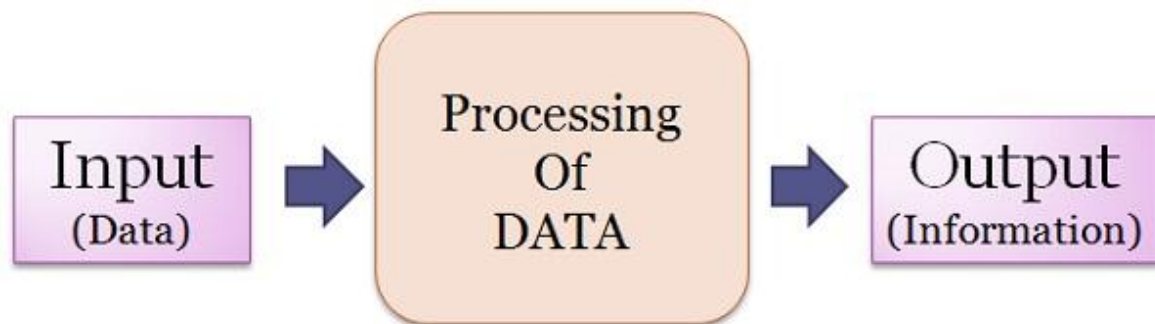


Figure.2.2: The difference between data and information.

2.2. Information systems

Before we define information systems, we need to begin with the definition of a system. The Austrian Ludwig Von Bertalanffy was the main instigator of systems theory, developing the idea for organisms in the 1930s, then applying it to thermodynamics in the 1940s, before developing general systems theory in the 1950s.

The essence of systems theory is indicated by these quotations from his book, General Systems Theory (1976): It is necessary to study not only parts and processes in isolation, but also to solve the decisive problems found in organization and order unifying them, resulting from dynamic interaction of parts, and making the behavior of the parts different when studied in isolation or within the whole. (DAVE CHAFFEY, 2005)

Jacques LESOURNE (2002): “A system is a set of elements interacting in a dynamic way”

According to project management dictionary (2010), a system is defined as: “A set of interactive elements, organized to attain one or more declared results”.

Another definition: “A system is an array of components that work together to achieve a common goal, or multiple goals, by accepting input, processing it, and producing output in an organized manner.” (KENNETH J.SOUSA, 2015)

We have to stress that not every system has a single goal. Often, a system consists of several subsystems—components of a larger system—with sub goals, all contributing to meeting the main goal. Subsystems can receive input from, and transfer output to, other systems or subsystems. (KENNETH J.SOUSA, 2015)

According to Gabriele PICCOLI and Federico PIGNI (2016): “Information systems are formal, sociotechnical, organizational systems designed to collect, process, store, and distribute information.”

Information system is: “A set of interrelated components that collect, process, store, and disseminate data and information; an information system provides a feedback mechanism to monitor and control its operation to make sure it continues to meet its goals and objectives.” (RALPH M.STAIR, 2018)

Also Kenneth J.SOUSA and Effy OZ(2015) define information system: “An information system consists of all the components that work together to process data and produce information. Almost all business information systems consist of many subsystems with sub goals, all contributing to the organization’s main goal.”

After all these definitions cited above we can say that: “an information system is set of tools and resources interacting with each other which allow enterprises to manage all sorts of information and their flow after receiving, process, store and distribute them to aid managers in their decisions.”

2.2.1. The components of an information system

In an organization, an information system consists of data, hardware, software, telecommunications, people, and procedures. An information system has become synonymous with a computer-based information system, a system with one or more computers at its center. In a computer-based information system, computers collect, store, and process data into information according to instructions people provide via computer programs: (KENNETH J.SOUSA, 2015)

- ✓ **Data:** Can take many forms, including traditional alphanumeric data, composed of numbers, letters, and other characters that describe business transactions and other events and entities; text data, consisting of sentences and paragraphs used in written communications; image data, such as graphic shapes and figures or photographic and video images; and audio data, including the human voice and other sounds. (JAMES A. O'BRIEN, 2011)
- ✓ **Hardware:** The physical components of a computer system such as its input devices, processor, memory, storage and output devices. (DAVE CHAFFEY, 2005)
- ✓ **Software:** The instructions or programs used to control a computer system through interaction with hardware (DAVE CHAFFEY, 2005)
- ✓ **Telecommunications:** consisting of both physical devices and software, links the various pieces of hardware and transfers data from one physical location to another. Computers and communications equipment can be connected in networks for sharing voice, data, images, sound, and video. A network links two or more computers to share data or resources, such as a printer. (KENNETH C. LAUDEN, 2014)
- ✓ **People:** People are the essential ingredient for the successful operation of all information systems. These include end users and IS specialists.
 - A.** End users (also called users or clients) are people who use an information system or the information it produces. They can be customers, salespersons, engineers, clerks, accountants, or managers and are found at all levels of an organization. In fact, most of us are information system end users. Most end users in business are knowledge workers, that is, people who spend most of their time communicating and collaborating in teams and workgroups and creating, using, and distributing information. (JAMES A. O'BRIEN, 2011)
 - B.** IS specialists are people who develop and operate information systems. They include systems analysts, software developers, system operators, and other managerial, technical, and clerical IS personnel. Briefly, systems analysts design information systems based on the information requirements of end users, software developers create computer programs based on the specifications of systems analysts, and system operators help monitor and operate large computer systems and networks. (JAMES A. O'BRIEN, 2011)
- ✓ **Processes:** It is a logical sequence of well-established activities with a specific business objective (François RIVARD, 2009)

We notice that there is a difference between information system and information technology. Thus, information system is broad and includes six major components in its composition and information technology is a primary actor in this composition especially with the technological development. We can conclude that, in order for any information system to operate in an optimal way, it is obligated to align between all components to create the expected value needed in organizations.

2.2.2. Major types of Information systems in organizations

Because there are different interests, specialties, and levels in an organization, there are different kinds of systems. No single system can provide all the information an organization needs. The organization is divided into strategic, management, and operational levels and then is further divided into functional areas, such as sales and marketing, manufacturing and production, finance and accounting, and human resources. Systems are built to serve these different organizational interests (ANTHONY, 1965)

A. Transaction Processing Systems (TPS)

Many organizations employ transaction processing systems (TPSs), which capture and process the detailed data necessary to update records about the fundamental business operations of the organization. These systems include order entry, inventory control, payroll, accounts payable, accounts receivable, and the general ledger, to name just a few. The input to these systems includes basic business transactions, such as customer orders, purchase orders, receipts, time cards, invoices, and customer payments. The processing activities include data collection, data editing, data correction, data processing, data storage, and document production. The result of processing business transactions is that the organization's records are updated to reflect the status of the operation at the time of the last processed transaction. A TPS also provides valuable input to management information systems, decision support systems, and knowledge management systems. Indeed, transaction processing systems serve as the foundation for these other systems. (RALPH M.STAIR, 2018)

B. Management Information Systems (MIS)

we define management information systems as the study of information systems in business and management. The term management information systems (MIS) also designates a specific category of information systems serving management-level functions. Management information systems (MIS) serve the management level of the organization, providing

managers with reports and often online access to the organization's current performance and historical records. Typically, MIS are oriented almost exclusively to internal, not environmental or external, events. MIS primarily serve the functions of planning, controlling, and decision making at the management level. Generally, they depend on underlying transaction processing systems for their data. MIS summarize and report on the company's basic operations. The basic transaction data from TPS are compressed and are usually presented in long reports that are produced on a regular schedule. (KENNETH C.LAUDEN, 2005)

C. Executive Support Systems (ESS)

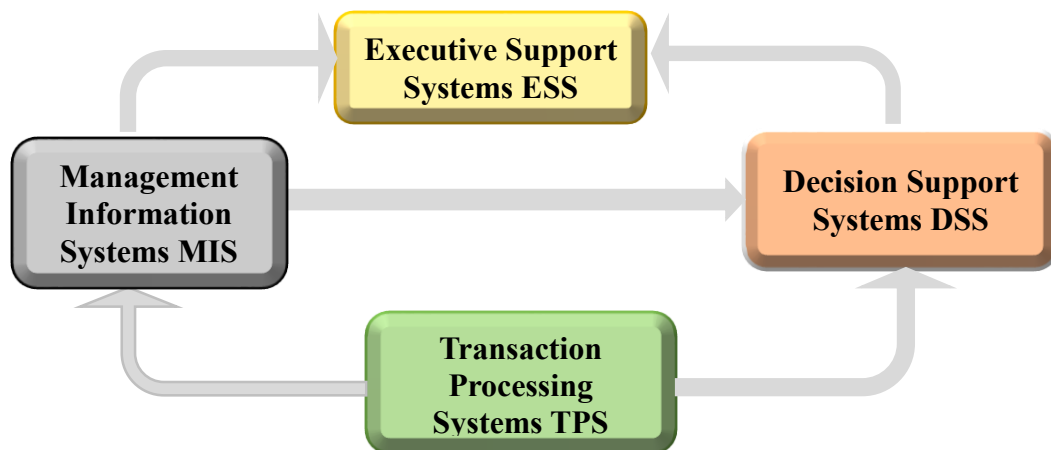
These are the systems used by senior management to assist in strategic decision-making. Typical examples of their use are in medium to long term forecasting and budgeting. (GRAHAM CURTIS, 2005)

ESS employ the most advanced graphics software and can present graphs and data from many sources. Often the information is delivered to senior executives through a portal, which uses a Web interface to present integrated personalized business content from a variety of sources. Unlike the other types of information systems, ESS are not designed primarily to solve specific problems. Instead, ESS provide a generalized computing and communications capacity that can be applied to a changing array of problems. Although many DSS are designed to be highly analytical, ESS tend to make less use of analytical models. (KENNETH C.LAUDEN, 2005)

D. Decision Support System DSS

Decision support systems are computer-based information systems that provide interactive information support to managers and business professionals during the decision making process. Decision support systems use (1) analytical models, (2) specialized databases, (3) a decision maker's own insights and judgments, and (4) an interactive, computer-based modeling process to support semi structured business decisions. (JAMES A. O'BRIEN, 2011) Unlike management information systems, decision support systems rely on model bases, as well as databases, as vital system resources. A DSS model base is a software component that consists of models used in computational and analytical routines that mathematically express relationships among variables. (JAMES A. O'BRIEN, 2011)

Figure 2.3: Interrelationships among systems



Source: Adapted from (KENNETH C.LAUDEN, 2005).p95

From the figure above, and after covering up all types of information systems, we can conclude that, transaction processing systems are designed to provide operational level with daily basis information needed, also considered as a source of information for management information systems MIS, executive support systems ESS, and decision support systems DSS. All the mentioned systems are connected, to assure the flow of information and aid both employees and executive to maintain the survival of their organization by providing information of quality to take the right decisions.

2.3. Information system activities

After giving different definitions of information systems and classifying them by level and core activity of each one. Now, we will introduce the basic activities of information systems within organizations. According to James O'BRIEN (2011), information system activities are composed of:

A. Input of data resources: Data about business transactions and other events must be captured and prepared for processing by the input activity. Input typically takes the form of data entry activities such as recording and editing. End users usually enter data directly into a computer system or record data about transactions on some type of physical medium such as a paper form. This entry includes a variety of editing activities to ensure that they have recorded the data correctly. Once entered, data may be transferred onto a machine readable medium, such as a magnetic disk, until needed for processing.

B. Processing of data into information: Data are typically subjected to processing activities, such as calculating, comparing, sorting, classifying, and summarizing. These

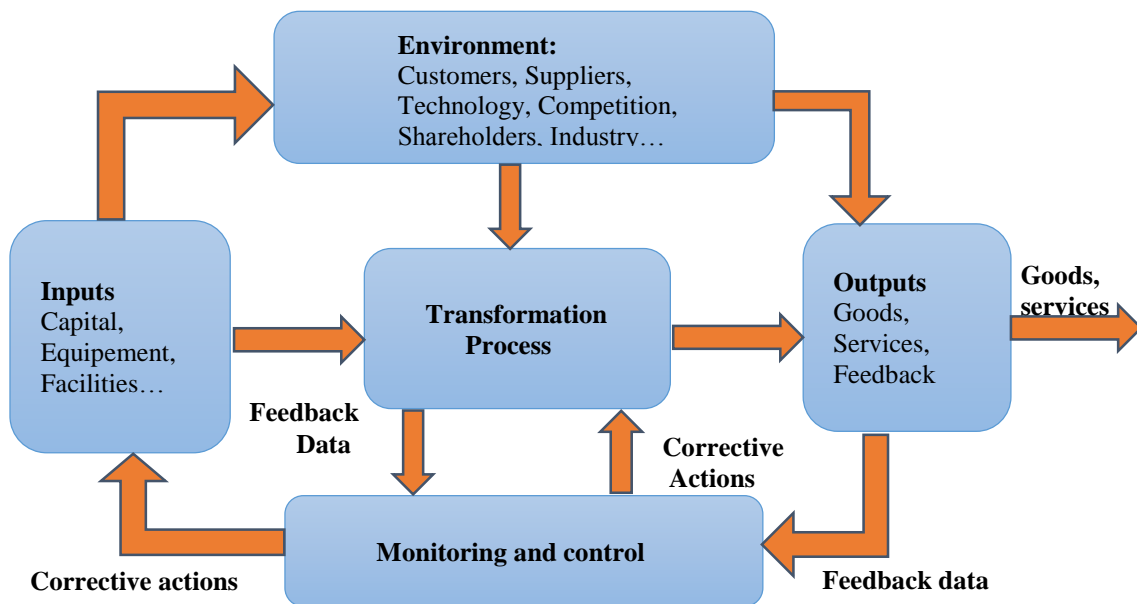
activities organize, analyze, and manipulate data, thus converting them into information for end users. The quality of any data stored in an information system also must be maintained by a continual process of correcting and updating activities.

C. Output of information: Information in various forms is transmitted to end users and made available to them in the output activity. The goal of information systems is the production of appropriate information for end users. Common information products include messages, reports, forms, and graphic images, which may be provided by video displays, audio responses, paper products, and multimedia. We routinely use the information provided by these products as we work in organizations and live in society. For example, a sales manager may view a video display to check on the performance of a salesperson, accept a computer-produced voice message by telephone, and receive a printout of monthly sales results.

D. Storage of data resources: Storage is a basic system component of information systems. Storage is the information system activity in which data are retained in an organized manner for later use. For example, just as written text material gets organized into words, sentences, paragraphs, and documents, stored data are commonly organized into a variety of data elements and databases. This organization facilitates their later use in processing or retrieval as output when needed by users of a system.

E. Control of system performance: An important information system activity is the control of system performance. An information system should produce feedback about its input, processing, output, and storage activities. This feedback must be monitored and evaluated to determine whether the system is meeting established performance standards. Then appropriate system activities must be adjusted so that proper information products are produced for end users. For example, a manager may discover that subtotals of sales amounts in a sales report do not add up to total sales. This conflict might mean that data entry or processing procedures need to be corrected. Then changes would have to be made to ensure that all sales transactions would be properly captured and processed by a sales information system.

Figure 2.4: General model of information system activities.



Source: Adapted from (RALPH M.STAIR, 2018),p47

2.4. Project management

For more than 50 years, project management has been in use but perhaps not on a worldwide basis. What differentiated companies in the early years was whether they used project management or not, not how well they used it. Today, almost every company uses project management, and the differentiation is whether they are simply good at project management or whether they truly excel at project management. The difference between using project management and being good at it is relatively small, and most companies can become good at project management in a relatively short time. (KERZNER, 2017)

According to PMBOOK GUIDE: “A project is a temporary endeavor undertaken to create a unique product, service, or result.”

2.4.1. Project deliverables

According to PMBOOK GUIDE, Projects are undertaken to fulfill objectives by producing deliverables. An objective is defined as an outcome toward which work is to be directed, a strategic position to be attained, a purpose to be achieved, a result to be obtained, a product to be produced, or a service to be performed. A deliverable is defined as any unique and verifiable product, result, or capability to perform a service that is required to be produced to complete a process, phase, or project. Deliverables may be tangible or intangible. Fulfillment of project objectives may produce one or more of the following deliverables:

- ✓ A unique product that can be either a component of another item, an enhancement or correction to an item, or a new end item in itself (e.g., the correction of a defect in an end item);
- ✓ A unique service or a capability to perform a service (e.g., a business function that supports production or distribution);
- ✓ A unique result, such as an outcome or document (e.g., a research project that develops knowledge that can be used to determine whether a trend exists or a new process will benefit society);
- ✓ A unique combination of one or more products, services, or results (e.g., a software application, its associated documentation, and help desk services).

2.4.2. Project attributes

Projects come in all shapes and sizes. The following attributes help to define a project further; (SCHWALBE, 2012)

- ✓ **Unique purpose.** Every project should have a well-defined objective. For example, many people hire firms to design and build a new house, but each house, like each person, is unique.
- ✓ **A project is temporary.** A project has a definite beginning and a definite end. For a home construction project, owners usually have a date in mind when they would like to move into their new home
- ✓ **.A project is developed using progressive elaboration or in an iterative fashion.** Projects are often defined broadly when they begin, and as time passes, the specific details of the project become more clear. For example, there are many decisions that must be made in planning and building a new house. It works best to draft preliminary plans for owners to approve before more detailed plans are developed.
- ✓ **A project requires resources, often from various areas.** Resources include people, hardware, software, or other assets. Many different types of people, skill sets, and resources are needed to build a home.
- ✓ **A project should have a primary customer or sponsor.** Most projects have many interested parties or stakeholders, but someone must take the primary role of sponsorship. The project sponsor usually provides the direction and funding for the project.
- ✓ **A project involves uncertainty.** Because every project is unique, it is sometimes difficult to define the project's objectives clearly, estimate exactly how long it will

take to complete, or determine how much it will cost. External factors also cause uncertainty, such as a supplier going out of business or a project team member needing unplanned time off. Uncertainty is one of the main reasons project management is so challenging, because uncertainty invokes risk.

2.5. Project Management Information System (PMIS)

The concept of a project management information system, or PMIS, is an important component of project communications management. A PMIS is an effective mechanism for enabling and facilitating communications. All processes and activities on a project center on it because the success of a project depends as much on the quality of data as it does on completing the works on time and within budget. Indeed, a persuasive argument can be made that if the PMIS fails or the quality of its basic elements does not meet a certain standard, then the likelihood of project failure from a cost, schedule, or quality perspective will increase. Accepting this argument means that establishing a PMIS is critical. (KLIEM, 2008)

2.5.1. Definition and components of PMIS

2.5.1.1 Definition of PMIS

According to Ahleman (2009) PMIS have become “comprehensive systems that support the entire life-cycle of projects, project programs, and project portfolios”. To support project managers in their planning, organizing, control, reporting and decision making tasks on the one hand and evaluating and reporting on the other hand, it seems to be essential to make use of PMIS (Raymond & Bergeron, 2008). Another complete and global definition is given by Kliem R.L (2008): “A PMIS is an integrated, interdependent set of processes, activities, techniques, and data used to define, plan, control, execute, and close a project to achieve optimum performance regarding cost, schedule, and quality.” (ALI JAAFARI, 1998) defines PMIS as: “A system which supports and facilitates the delivery of any project, particularly those which are complex, subject to uncertainty, and under market, time and money pressures, or otherwise difficult to manage.” After all those definitions cited we could simply conclude that: “Project management information system is a system that supports project managers throughout the project life cycle, and assure the flow of information between all stakeholders and actors interacted in a certain project.”

2.5.1.2 Components of PMIS

According to KLIEM (2008), the components of Project management information system are:

A. Repository: comprising data and information about a project. This data may be stored manually or electronically and provides various levels of access to the people needing it. It is important to note that the repository is more than just the database for a scheduling package. It also contains other data about a project, from a copy of the charter to a change management log.

B. Technology: consist of hardware, such as servers, and software, for example, a database management system (DBMS). This technology requires constant updating because of the rapid pace of development. However, the right hardware and software, provided training is available, can increase the power of a PMIS.

C. Methodology: A project management methodology determines—even dictates—the business rules for storing, accessing, and addressing a data repository under specific conditions. It can prove, however, to be an asset or a liability to a PMIS. For example, the rules of the methodology may be so detailed and cumbersome that people will not visit the repository, resulting in their taking short cuts by circumventing the PMIS.

D. Policies and procedures: They may go beyond the methodology, reflecting the requirements of a larger organizational infrastructure much greater than a project. Still, they may influence the deployment of a PMIS and its access for specific business reasons. An example is a companywide policy or procedure restricting certain project data and information from contractors.

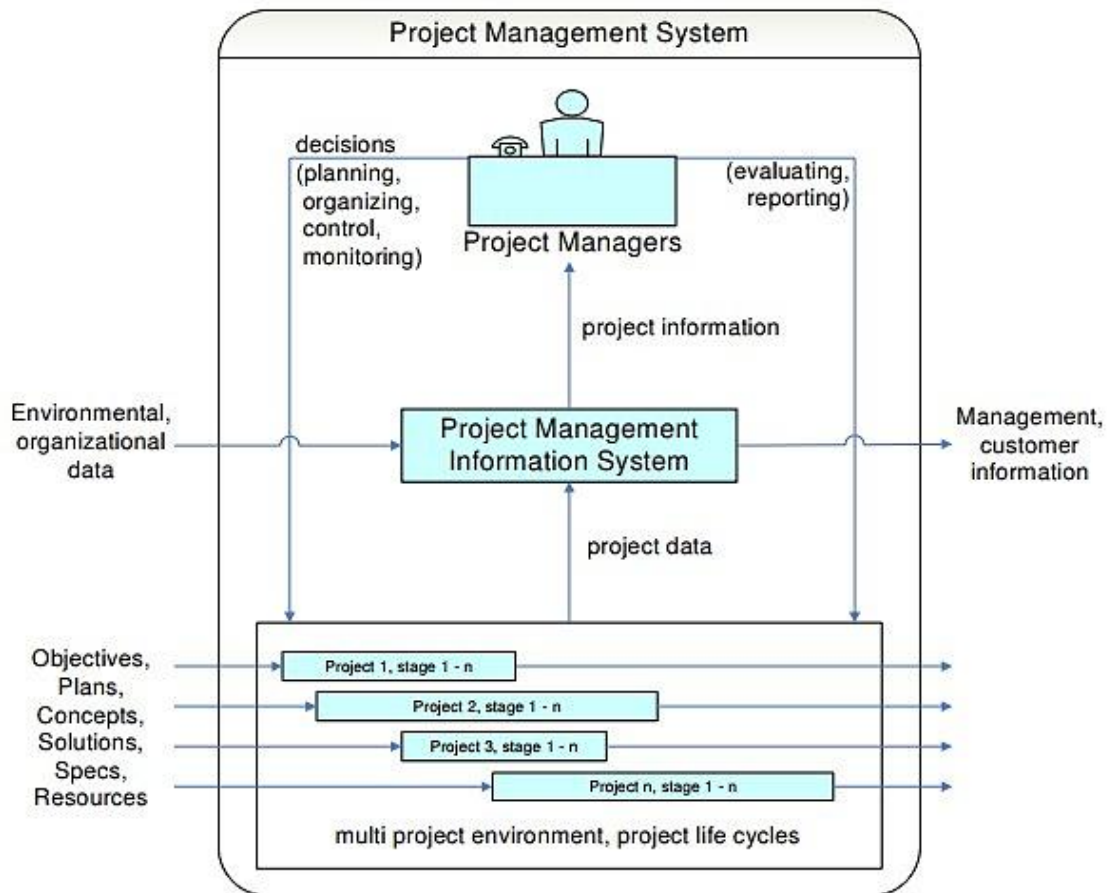
E. Stakeholders: are also important components. They, of course, are people or organizations having an interest in the outcome of a project. Many of the stakeholders, to varying degrees, will have an interest in using the PMIS to satisfy their own requirements.

F. Forms and reports: are critical components. Forms are used, of course, to collect data to populate the PMIS. Reports are necessary to provide information in a format and level of detail that satisfies the needs and wants of a stakeholder. The complication with forms is that sometimes they are used to collect more data than necessary; the complication with reports is that they sometimes generate more data than information.

G. The principles, techniques, and tools of project management: are components that are often overlooked. Yet, they vary from one environment to another and from one organization to the next. These principles, techniques, and tools will influence the quantity and quality of data in the PMIS.

H. The environment: is an often overlooked as a component of a PMIS. It can have a substantial influence on whether a PMIS will be deployable and how it will be deployed. Business conditions, management style, historical approaches toward managing projects, and available funding can influence the extent to which a PMIS will be deployed and utilized.

Figure 2.6: The role of PMIS in project management



Source: Adapted from (RAYMOND, 1987)

From the figure above, we can see the interaction between all stakeholders in a project and most importantly how can the stored data play a significant role throughout all project phases by providing the information needed for all project actors and by supporting project managers to make the best decisions. Furthermore, PMIS can enhance the performance of the current and the upcoming projects by integrating all stakeholders and project processes into one centralized database that facilitates the access of project actors to carry out their work by delivering the right information in the right time.

2.6. Information system modelling

Building a new information system is a complex process consisting of many steps, which have to be done before the final product is prepared for the customer. It is very important to meet customer needs and expectations to keep him for future projects. There are more approaches to develop new information system in which different strategy, methodology, modelling techniques or life cycle can be used. Usually the methodologies recommend using use case diagrams and UML language for this purpose (Kniežová, 2013)

2.6.1. Unified Modeling Language (UML)

According to HEIJDEN (2009), The origins of UML can be traced back to the rise of a movement in software engineering called object orientation. At the risk of oversimplifying, object orientation is an approach in software development that advocates the integration of data and functionality into small software compartments called objects. This is in contrast to the more traditional approach in which data is separated from functionality. Object orientation has benefits, one of which is the benefit of damage containment: when a software error occurs, it is easier to isolate the error and contain the damage. Martin FLOWER (2004) defines UML : “Is a family of graphical notations, backed by a single meta-model, that help in describing and designing software systems, particularly software systems built using the Object-Oriented style”. Another definition is given by Graham CURTIS and David COBHAM (2005) : “UML is defined as a language rather than a complete methodology. It does not prescribe how projects should be undertaken or managed. It does, however, provide a vocabulary and set of diagrammatic aids to allow developers to visualize, construct and document the development of a software system. After collecting these definitions, we can say, “UML is a modelling language use to develop software systems in their first stage by visualizing and illustrating the flow of data within systems.”

A. The use case diagram: Enable to identify the requirements that a system must fulfill. This diagram describes which users use which functionalities of the system but does not address specific details of the implementation. The units of functionality that the system provides for its users are called use cases. In a university administration system, for example, the functionality Registration would be a use case used by students. (MARTINA SEIDL, 2014)

B. The class diagram: According to Popkin Software (1998), the class diagram is the main static analysis and design diagram for a system. In the class, the structure of the system is specified, with relationships between classes and inheritance structures. During analysis of

the system, the diagram is developed with an eye for an ideal solution. During design, the same diagram is used, and modified to conform to implementation details.

C. The sequence diagram: Describes the interactions between objects to fulfill a specific task, for example, registration for an exam in a university administration system. The focus is on the chronological order of the messages exchanged between the interaction partners. Various constructs for controlling the chronological order of the messages as well as concepts for modularization allow you to model complex interactions. (MARTINA SEIDL, 2014)

Conclusion

After summarizing all the concepts and terminology related to our research project, which summarizes the role of effective information systems in the organization, and the manner agreed upon practitioners in the field of management information system, and also relying on some previous studies in project management information systems PMIS, which I found the need of Algérie Télécom to adopt this system in its project processes. Those studies are:

- ✓ “Towards a conceptual reference model for project management information systems” by Frederik Ahlemann (2009);
- ✓ “Project management information systems: An empirical study of their impact on project managers and project success” by Louis Raymond & François Bergeron (2008).

In order to get the work to a better level, we have implemented Unified Modelling Language UML as a tool to designing this system. As a result of that, We have decomposed the principal question into three sub questions:

- ✓ What are the characteristics of a project management information system?
- ✓ How to model new processes in the current information system?
- ✓ What are the benefits of implementing a project management information system PMIS that integrates all stakeholders within a project?

CHAPTER III
RESEARCH METHODOLOGY

In this part, we will present and justify the research methodology adopted in our study. Also, the research approach and methodologies chosen for it. In addition to, the tools that are used to collect and process the data. Finally, we will represent the organizational context of our work.

1. Research approach

In order to find the relationship between the information system and the different actors contributing into it such as clients, supplier, project manager, project members, and to find the problems faced by those actors from the initial phase the closure of the project, we have adopted the inductive research approach.

According to the nature of our work, we have decided to rely on The DeLone and McLean Model of Information Systems Success 2003 (MISS), respecting the followed steps:

- ✓ Diagnosis of the existent information system;
- ✓ Evaluation of the new information system;
- ✓ Designing and implementing the new information system.

Still, we have adopted the qualitative method, descriptive and analytic. Because we had the chance to organize multiple semi-directive interviews with different directors, in order to collect the required information for the research. In addition to, strengthening our work we have consulted some internal documents in coherence with some observations. The initial phase of any network telecommunication starts from high level of the organization, which is under the name of “Corporations management”. In operation department where I had most of my internship days, I concluded that this department is the backbone of all projects whether are oriented to particular or professional clients.

1.1 Epistemology

According Hannu Soini (2011) Epistemology deals with the means of production of knowledge, as well as skepticism about different "knowledge claims." The knowledge and its characteristics are defined by the way knowledge and the foundations of knowledge are found. There should be evidence of this kind for the knowledge to become generally accepted and public, truthful and believable. Traditionally, objectivity and truth are the classical criteria for evaluating knowledge. This brings us to the approach, which emphasizes the scientific method as a way to arrive at knowledge.

The interpretivist researcher enters the field with some sort of prior insight of the research context but assumes that this is insufficient in developing a fixed research design due to complex, multiple and unpredictable nature of what is perceived as reality (Hudson and Ozanne, 1988). The researcher remains open to new knowledge throughout the study and lets it develop with the help of informants. The use of such an emergent and collaborative approach is consistent with the interpretivist belief that humans have the ability to adapt, and that no one can gain prior knowledge of time and context bound social realities (Hudson and Ozanne, 1988).

2. Collecting information process

In order to have a reliable work, we have depended on different sources in our collection data process. The data processing will be guided mainly by the objectives of the research, objectivity is required as well as open-mindedness so as not to fall into the trap of losing neutrality. Thus, the techniques used to collect information are:

2.1. Participative Observation:

Observation is considered as an important tool of research, in our case this tool helped to observe the general structure of the information system used in the organization, the obstacles faced by individuals in terms of the flow of information. Also, multiple discussions with all project actors including information system department.

2.2. Semi-directive interviews:

It comes second as a support for our observations to give them more reliability and credibility. Our interview guide is composed of some questions, open certainly but also precise, in order to evaluate the current information system as security, functionality and performance. In addition, it is important to mention these characteristics from a managerial viewpoint.

2.3. Choosing interviewees:

The individuals who were concerned by the interviews are corporations' management division director, operational ERMC department director, Technical director LET, and the person responsible for information system support. To enrich our interviews, they have been conducted individually and estimated about forty minutes for each.

2. Presentation of primary project actors

As our study is revolves around project management information system, it is necessary to mention the different stakeholders interacting in these projects.

2.1. Corporation management division:

This division is related to the commercial department, its whole work is to manage all sort of professional clients like public institutions, banks, security institutions..etc. Also, this division is in charge of projects.

Objectives:

- ✓ Plan the different phases of the any telecommunication project;
- ✓ Estimates the cost and the risk of implementing projects;
- ✓ Guiding and monitoring ICT projects;
- ✓ Feasibility study of the project to determine the different needs of it.
- ✓ Review and approve all project phases,
- ✓ Manage all professional customers;
- ✓ Take decisions concerning ICT projects.

2.2. Operational department (EMRC)

The ERMC of Algérie Télécom is a multi-service network of new generation NGN, IP / MPLS. It offers the possibility of using packet transmission technology to build a common network for voice applications, video and data.

Objectives of EMRC:

- ✓ Offer a great protocolary aptitude;
- ✓ Implement and set up network infrastructure;
- ✓ Ensure interconnection and then migration of the existing systems;
- ✓ Guarantee the interoperability of heterogeneous systems;
- ✓ Realize the convergence of voice and data networks;
- ✓ Implement customized intranet to all t'ypes of organizations.

2.3. Technical division (LET)

This division is connected to the operational department, its occupation is to develop and monitor ICT projects until its execution.

Objectives:

- ✓ Prepare the network configuration of any extension;
- ✓ Study the dimensions of ADSL MSAN equipment;
- ✓ Development of XDSL-MSAN test and reception procedures;
- ✓ Set up the technical functionalities of ICT;
- ✓ Installation and maintenance network telecommunications.

CHAPTER IV

MODELING PROJECT

MANAGEMENT INFORMATION

SYSTEM

In this chapter, we have focused on the prior study conducted to identify the different gaps in the system in addition to the solutions proposed by the researcher.

1. Discussion of the existent

Algérie Télécom has witnessed a significant growth phase, in terms of workforce, clients, suppliers..etc. Something that requires it to put business processes control and management into a complex situation. Since it has a rapid growth in the telecommunications domain especially in the Algerian market, which has allowed the organization to evolve with in very fast speed. The organization needs to put its processes in a better and more organized way.

The current information system adopted is facing obstacles in terms of the flow of information that does not respond to all actors needs whether whose needs are functional or non-functional. After analyzing the current system, which is based on functional-oriented database that hinders other processes to contribute in the whole system especially in project management where our whole work is based on. As a result we have mentioned the consequences of the current system:

- ✓ Delay in communicating and sharing information internally according to the majority of the interviewees;
- ✓ Poor exploitation of resources and equipment according to especially ERM and LET divisions;
- ✓ Lack of projects visibility according to all project actors;
- ✓ Delay in decision making according to corporations management division;
- ✓ Entry error and overload of work for statistical and decision elements according to corporation management division
- ✓ Loss of data and information according to information system support responsible;
- ✓ Problem of estimating project cost and deadlines according to corporations management division;

According to our observations, we have concluded the following:

- ✓ Absence of project management coordination and control;
- ✓ Absence of document management tools;
- ✓ Lack of customers interactions;
- ✓ Information system not unified;
- ✓ Lack of consistency between the project actors.
- ✓ Poor control of deadlines and costs to ensure customer satisfaction;

2. Proposed solutions

Following the identification of gaps and problems, several actions were defined with clear and precise objectives. These actions consisted of implementing a project management information system with the integration of a central database that involves both customers and suppliers. This system is defined to allow all parties to share information and documents at a single entry point also to ensure the consistency between the stakeholders, to avoid the delays of transmissions, transformations and redundancy of data and even to minimize the time.

3. Use case diagram

A use case defines a way to use the system and describes its functional requirements. Each use case contains one or more scenarios that define how the system should interact with users (called actors) to achieve a specific purpose or a function of a job. An actor in a use case can be a human or another external system to the one we are trying to define.

3.1 System administrator

The system administrator, who is the user in the information system, who is responsible for managing the users and their access rights as well as managing all of the system's functionalities.

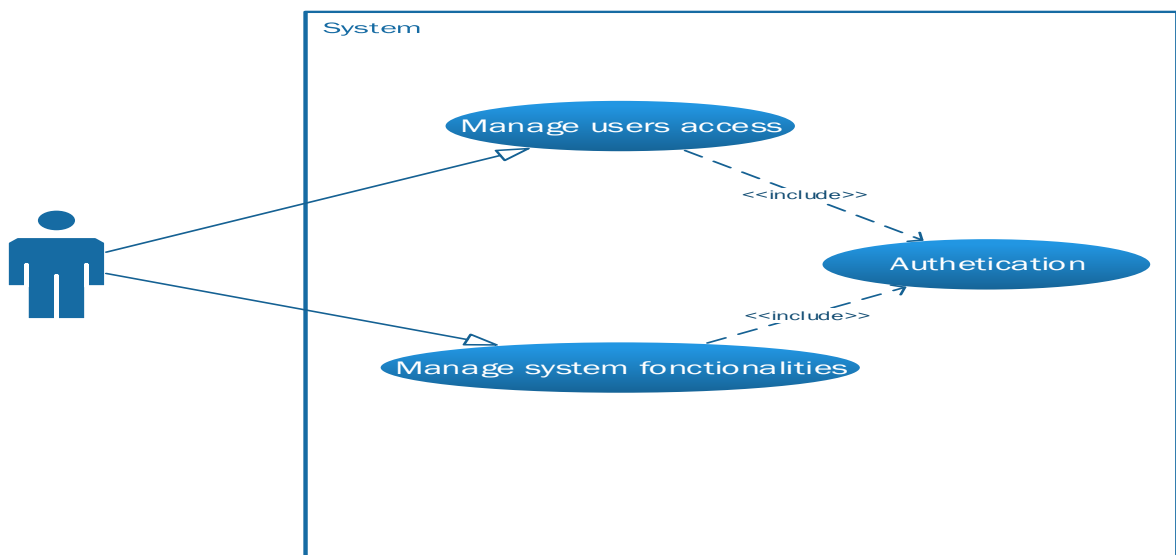


Figure 4.1: Authentication use case

The system administrator use case is translated into the following:

- ✓ Manage users access: Every user should have an account to access to the system with condition and some other privileges depends on their status;

- ✓ Manage system functionalities: Administrator manages the different functionalities of the system including personalization, workflow..etc;
- ✓ Authentication: It is considered as an obligation to realize system cases.

3.2. Supply management

This diagram describes the procurement task where supply manager can communicate with both project members and project manager. In addition, the supplier is included with limited access to provide what is necessary.

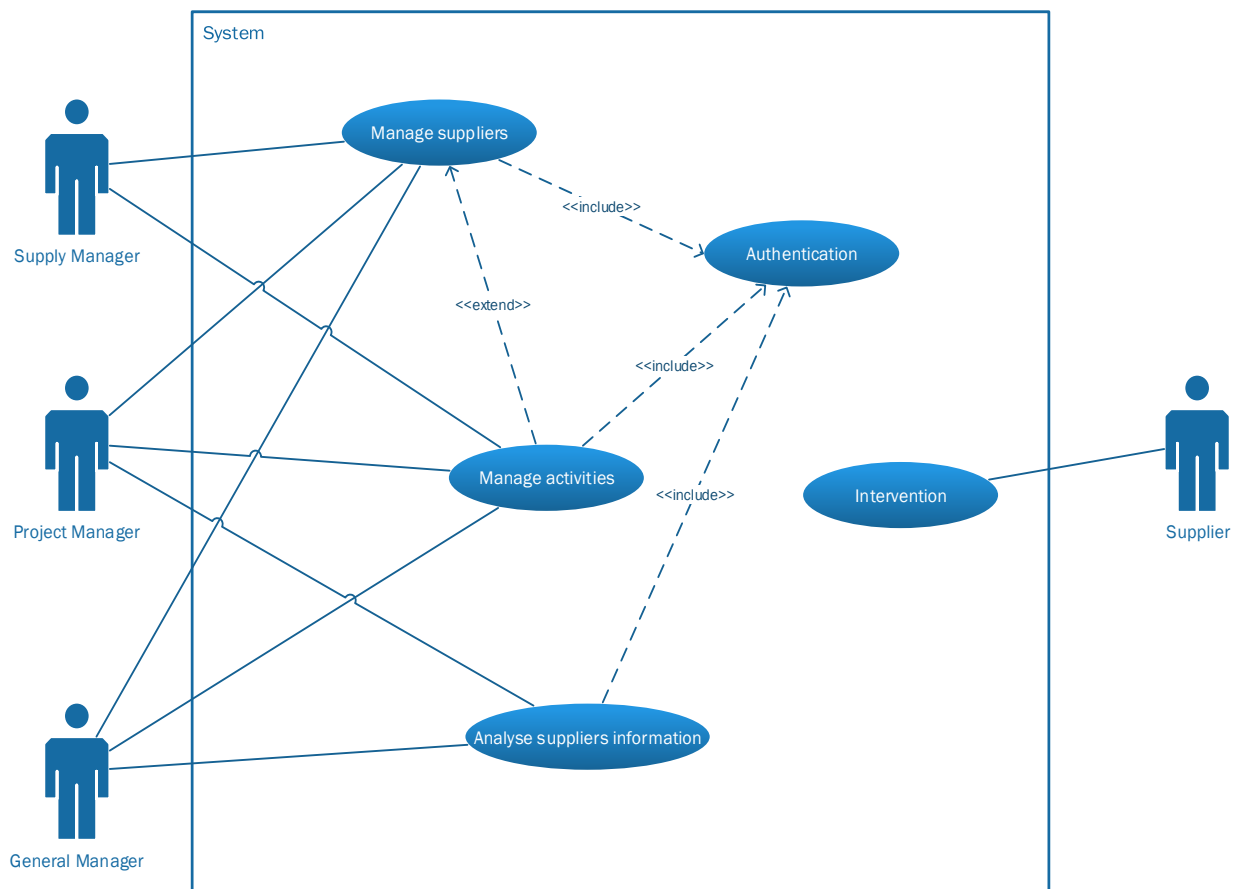


Figure 4.2: Supply management use case

The supply management use cases are translated into:

- ✓ Supply manager: Manage all sort of supplies including articles, raw materials, categorize suppliers, contact suppliers, plan needs of resources..Etc;
- ✓ Project manager: Guide and monitor supply tasks, manage activities related procurement such as the budget invested in resources...Etc
- ✓ General manager: Review and control the input of the project, analyze supply movement;

- ✓ Supplier: propose resources, availability of resources with limited access to the system.
- ✓ Authentication: it is limited only for those who have the access to the system.

3.3. Customer management

As customers are perceived as an important actor in any project, we have proposed to add them in the system, so they will not have difficulties to express their needs over the course of project implementation with a limited access because of their externally nature towards the organization.

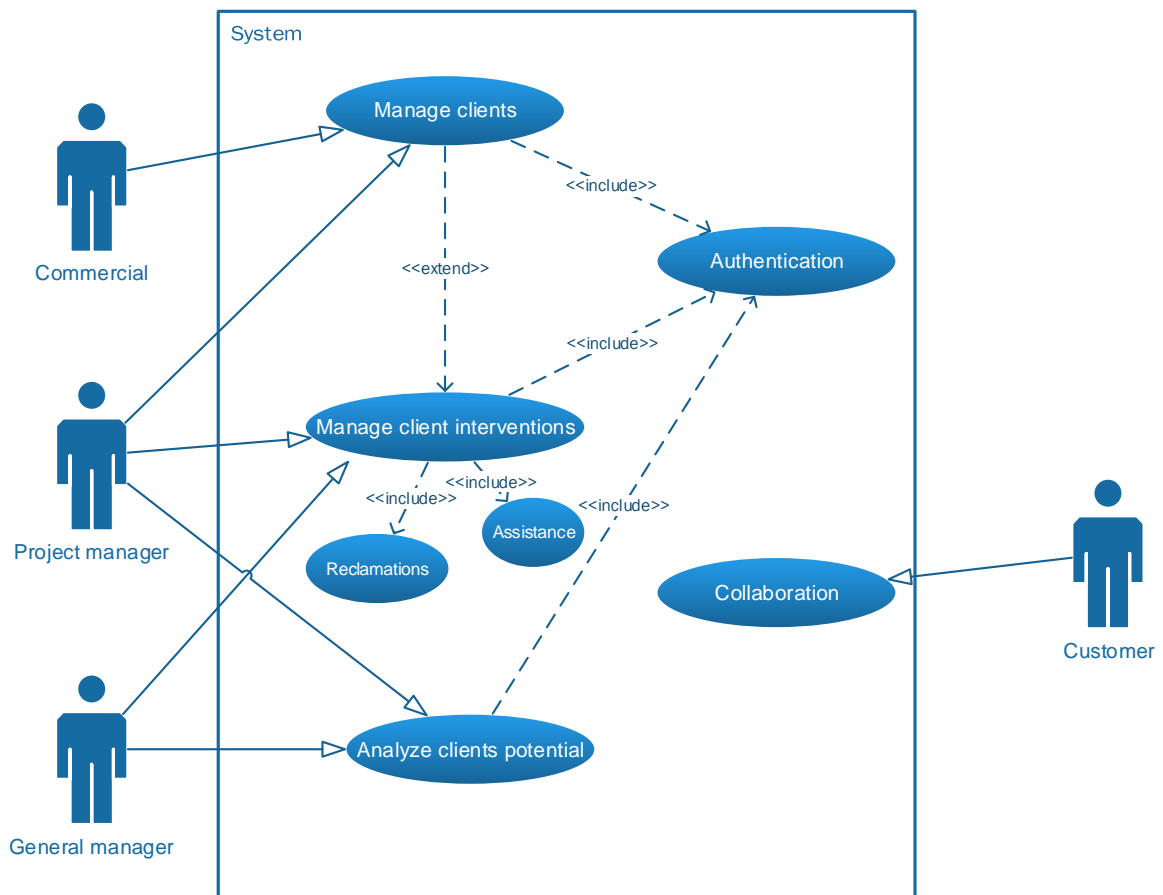


Figure 4.3: Customer management use case

The translation of customers' management use case is translated into:

- ✓ Commercial: Manage clients' needs, initial study of ICT implementation, manager offers related to customers;
- ✓ Project manager: manager all kind of interventions such as reclamations, assistance...Etc;

- ✓ General manager: Analyze customers potential, review and control customers satisfaction..Etc.
- ✓ Customer: ask for the service through the system; submit their needs, reclamations, collaboration in the whole phases of the project...Etc.

3.4. Project management

This use case diagram is the core of our system, because it relates all the different actors. Thus, the lack of effective interactions between them previously imposed another processes to facilitates this interaction which are shown below.

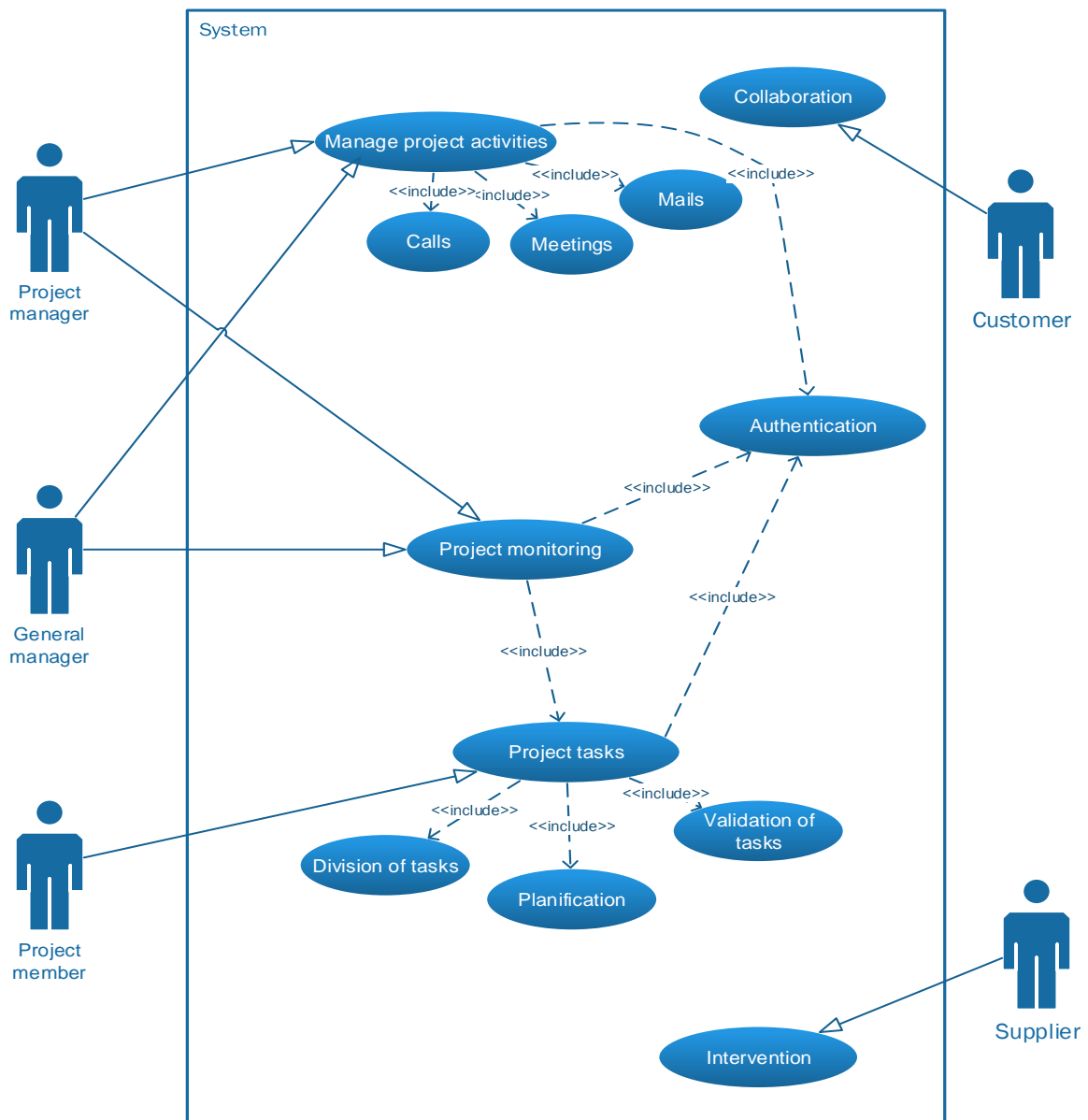


Figure 4.4: Project management use case

Description of the system:

According to our work, this is the final vision of project management information systems use cases are consisted of:

- ✓ Project manager: one of the principal actors that plays a big role in project success, manage different activities and the possibility to manage more than a project
- ✓ Project member: Project team members can interact in the system through management of activities (calls, meetings, mails), as well as the management of the entire project, such as planning, monitoring, assignment and delegation of tasks.
- ✓ General Manager: supervise all projects with all the necessary details for decision-making.
- ✓ Customer: The customer is integrated directly into the system to follow project realization, add reclamation, collaborate, and inquire assistance if needed.
- ✓ Supplier: In the new project system, the supplier is added to contribute in the project phases.

Functionalities are:

- ✓ Manage project activities: This case ensures collaboration between users by keeping a visible trace to the person concerned on calls, meetings or emails.
- ✓ Project monitoring: This case allows the manager to follow the progress of the project.
- ✓ Project tasks: This case allows to project member to assign their team with the tasks required to work on.
- ✓ Reclamations: This case allows clients to enter their claims directly on the project platform and follow their processing.
- ✓ Intervention: This use case allows suppliers contribute with their resources directly in the system.

In this part we have discussed the needs within the system by studying the existent, also we have the demonstrated those needs in use cases diagrams.

4. Modeling the system:

The phase of designing is crucial in the success of any information system project, because it designs the road map of the system before its final realization.

Class diagram:

is a type of static structure diagram that describes the structure of a system by showing the system of classes, their attributes, operations, methods, and relationships between the classes. Below, is the class diagram of project management information system:

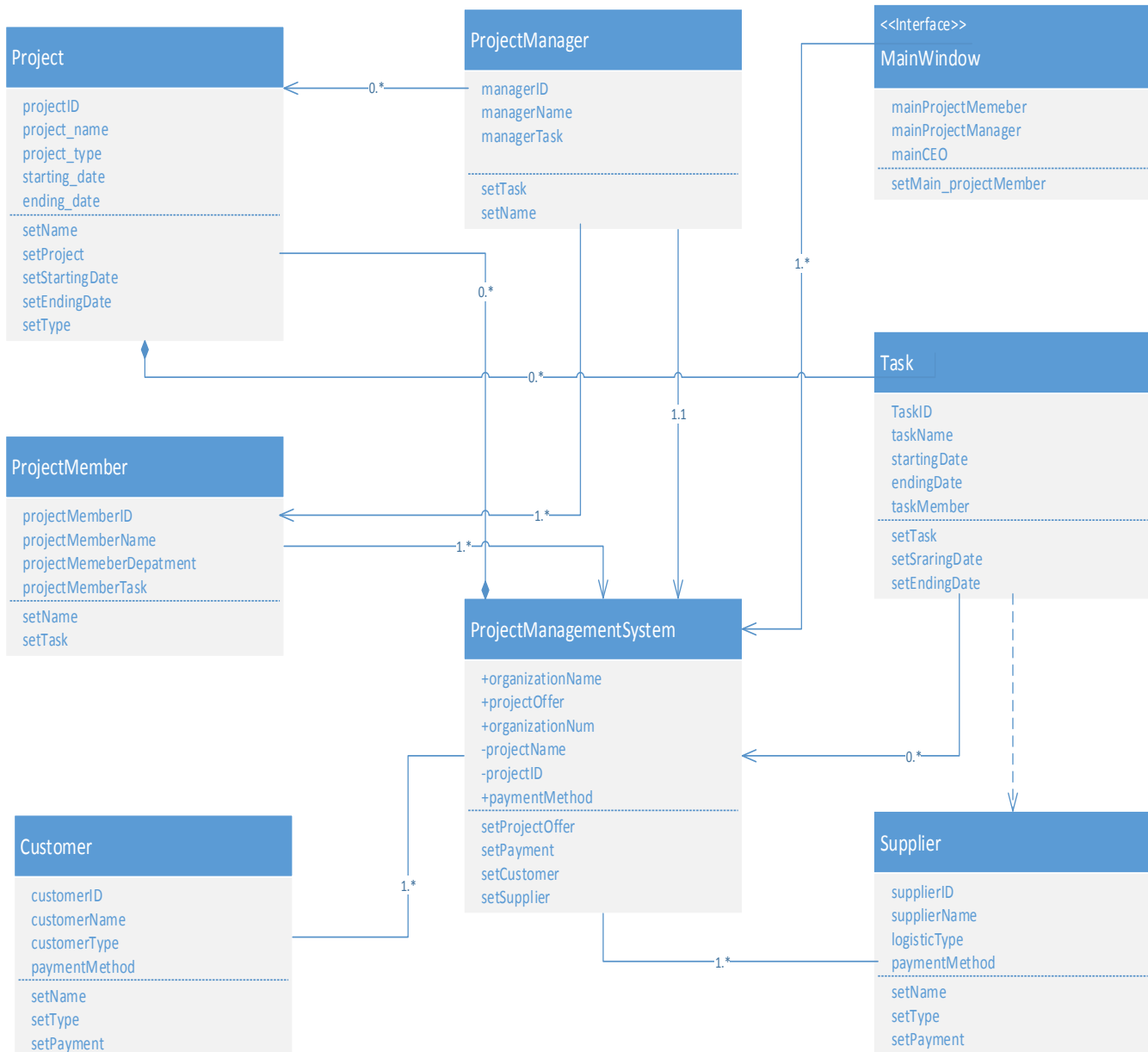


Figure 4.5: Project management class diagram

4.1. Authentication sequence diagram:

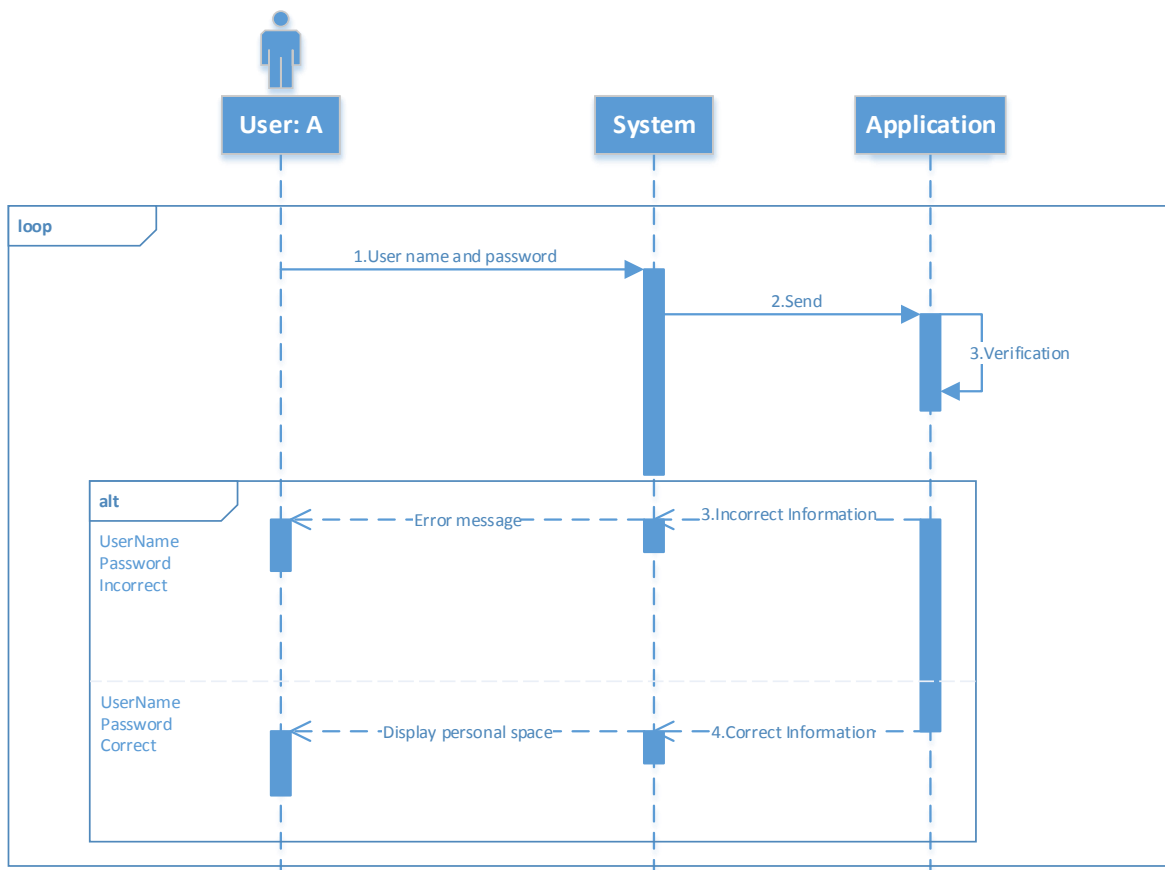


Figure 4.6: Authentication sequence diagram.

Possible scenarios:

- ✓ The user asks to log in the system
- ✓ The system displays interface and login space
- ✓ The user submit name and password
- ✓ The system displays error message if the name or password is wrong
- ✓ The system displays personal space if the name and password are correct

4.2. Supply management sequence diagram

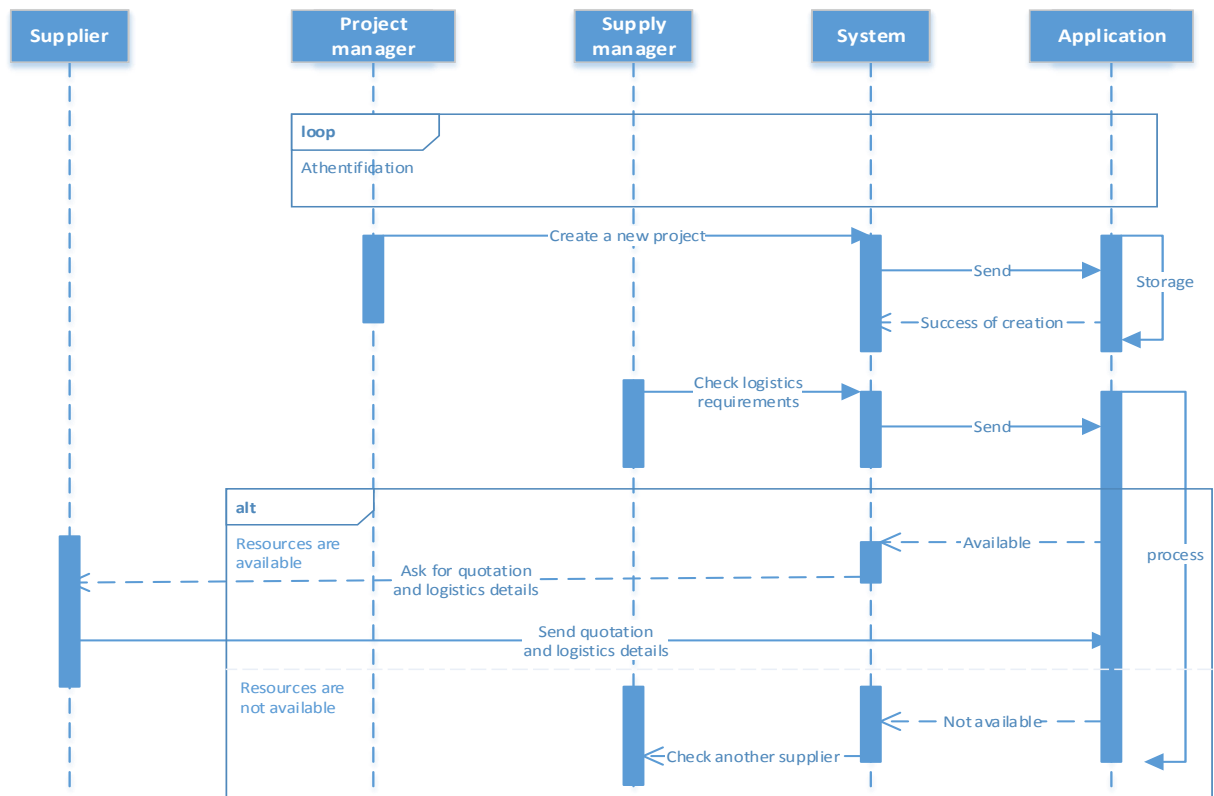


Figure 4.7: Supply management sequence diagram

Possible scenarios:

- ✓ Authentication of users.

If there is a project:

- ✓ Project manager starts a new project.
- ✓ Supply manager verify suppliers and contact them
- ✓ If the resources are available within certain supplier, the supplier will be informed, and logistics are validated.
- ✓ If the resources are not available, the supply manager will check another supplier.

4.3. Customers management sequence diagram

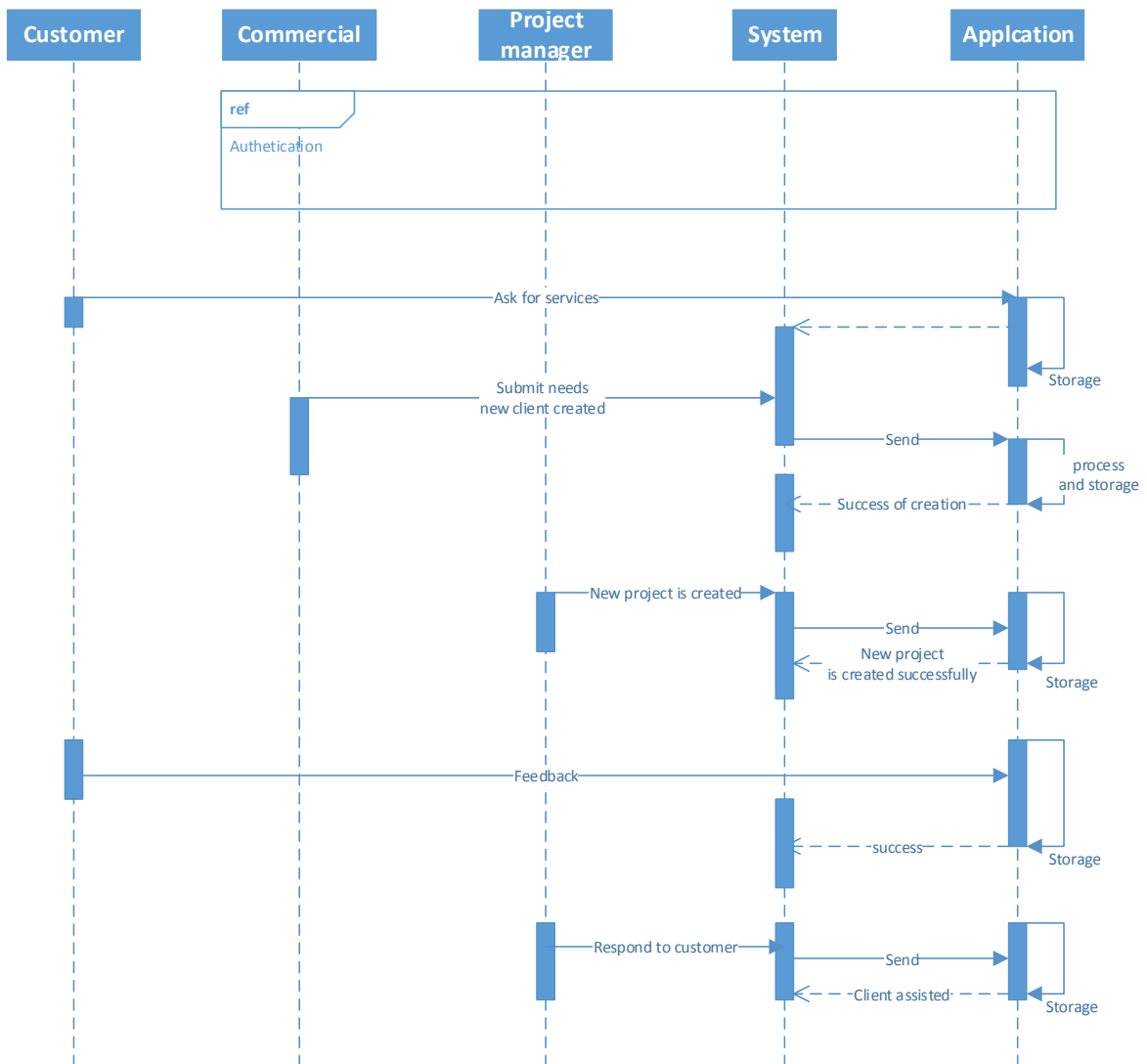


Figure 4.8: Customer management sequence diagram

Possible scenarios:

- ✓ Authentication of the users;
- ✓ The customer asks for the service;
- ✓ Commercial user submits client needs;
- ✓ Project manager launches a new project;
- ✓ The customer inquiries assistance or claims about the service (any kind of feedback);
- ✓ Project manager responds to the customer;

4.4. Project management sequence diagram

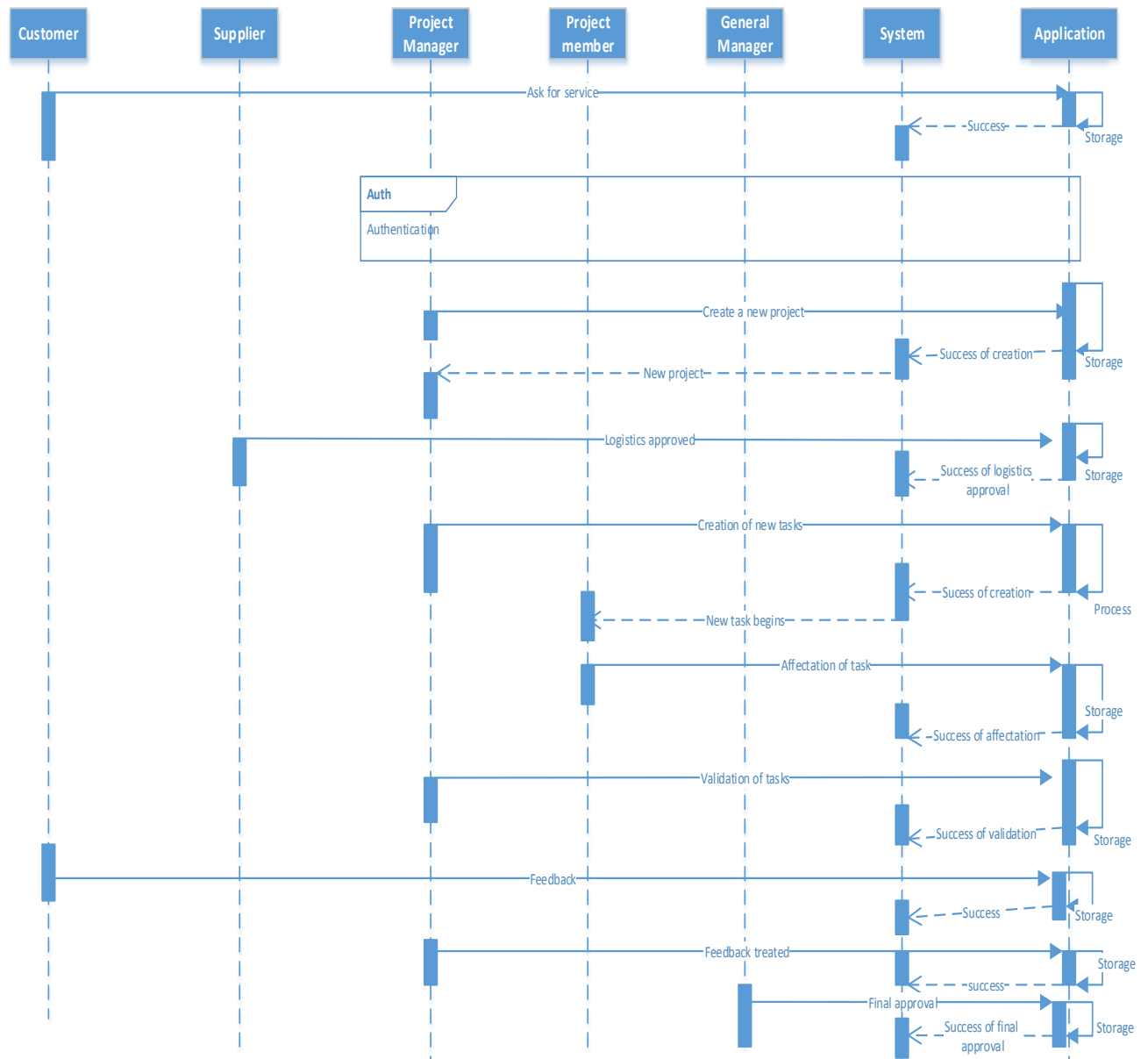


Figure 4.9: Project management sequence diagram.

Possible scenarios:

- ✓ The customer asks for the service through a unique database;
- ✓ Authentication of project actors;
- ✓ Project manager creates a new project and new tasks;
- ✓ Supplier approves logistics through database;
- ✓ Project member initially validates tasks;
- ✓ Project manager validates tasks;
- ✓ If there is a feedback, the customer will collaborate;

- ✓ Project manager treats the feedback;
- ✓ General manager approves the realization of the project

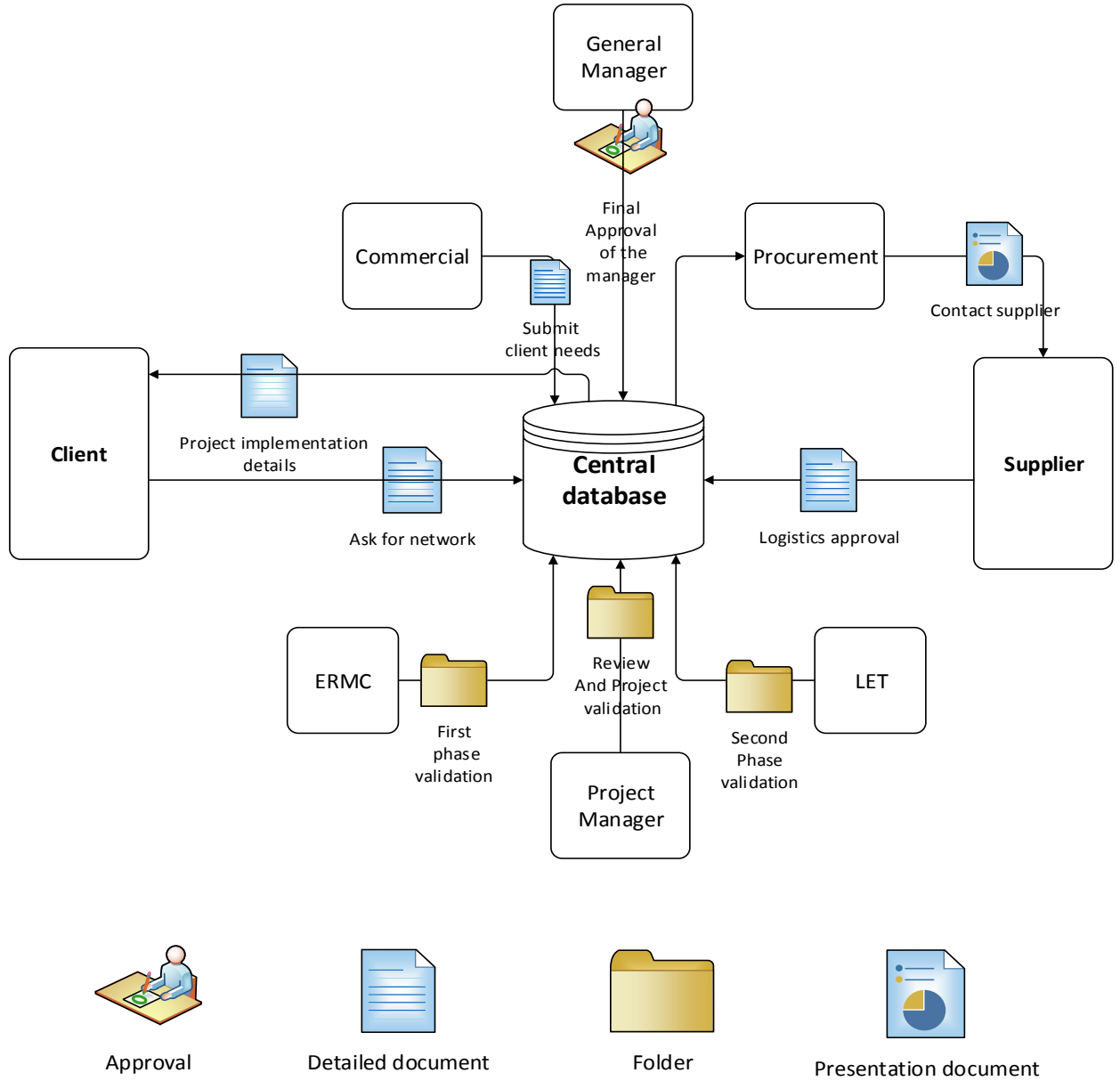
5. Project management information system business process:

In this part, we will conclude our study by demonstrating our system in a clear way by showing all the flow of information through business process mapping.

As it is crucial to assure the flow of information among stakeholder, a central data base is defined as a facility for the parties involved to submit standardized information and documents to a single “point of entry” to fulfill all formalities. As a result, a standard digital document must be completed containing the essential information about the stakeholders and which is coherent with the different collaborating institutions and this to avoid the delays of transmissions, transformations and redundancy of data and even to minimize the time. System administrators have the authority to manage this window and should be set up to ensure that participating members have access to information or that it is provided by the managing authorities; and from that we will guarantee the security and efficiency of the information.

Over the course of evaluating the current system, we have discovered that customers also are facing difficulties to collaborate from the beginning by expressing their needs, adding their feedbacks from time to time throughout the realization of phases. On the other hand, suppliers are facing the same problem that hinders them to interact when they are needed to supply project members by the required logistics and resources. All these interactions are shown in more details in the figure below.

Figure 4.10: Project management business process



General conclusion

Facing the challenge of information flow within projects. In terms of project management, there is always a delay in get them realized because of lack of relevant and convenient information. Treating all project lifecycle was necessary to identify all the needs and obstacles faced by managers. We have established a study and analysis of the current system while respecting the priorities of the needs mentioned by managers. As a result, many gaps had been identified through all project life cycle in Algérie Télécom, which are primary directed to other professional customers. The objective of our research was to study the information system of the organization, focusing more precisely on project management information system because it is the scope of our work. We started a preliminary study to present the targeted problematic and the purpose of the work, and also to identify the different actors interacting with the future system. So, it would be easy for us to find the major problems, afterwards we have identified the main modules to integrate and develop this system.

We have illustrated the functional and technical needs, this being done through the use of UML use case diagrams. The analysis and design phase is then started through the UML sequence and class diagrams.

We have presented the road map of information on diagrams in order to better identify the delays noted. Later, it was concluded that the best way of overcoming the problems is to propose a model that can solve the problem of distributed database, with a second crucial problem is the security of information given that the central database offered the sharing of information between the different divisions. Moreover, this has been solved by the privileges granted to the user of the unique entry of data according to their profiles and activities.

To conclude, project management information system offers all actors the visibility of information from the initial task of the project to the last one. In addition, the database of this system allows the extraction for the monitoring and evaluation in order to have a favorable view on the project to be realized and this on the dashboard of this system. Also both customers and suppliers had been included to better interact and support the project tasks.

REFERENCES

- AHLEMANN, F. (2009). Towards a conceptual reference model for project management information systems. *International Journal of project management*, 19-30.
- ALI JAAFARI, K. M. (1998). Towards a smart project management information system. *International journal of project management*, 249-265.
- DAVE CHAFFEY, S. W. (2005). *Business Information Management, Improving performance using information systems*. Essex: Pearson Education.
- EFRAIM TURBAN, E. M. (2005). *Information Technology for Management: Transforming Organizations in the Digital Economy*. Wiley.
- ELONEN, S. A. (2003). Problems in managing internal development projects in multi-project environment. *International journal of project management*, 395–402.
- FOWLER, M. (2004). *UML Distilled, A brief guide to the standard object modeling language*, 3rd ed. Boston: Pearson Education.
- François RIVARD, G. A. (2009). *The traverse information systems, New solutions for IS and Business performance*. London: ISTE Ltd and John Wiley & Sons.
- GRAHAM CURTIS, D. C. (2005). *Business Information Systems analysis, design and practice* 5th ed. Essex: Pearson Education.
- HEIJDEN, H. V. (2009). *Designing Management Information Systems*. New York: Oxford University Press.
- JAMES A. O'BRIEN, G. M. (2011). *Management Information systems* 10th ed. New York: McGraw-Hill/Irwin.
- KAUFFMAN, R. D. (2004). The Evolution of Research on Information Systems: A Fiftieth-Year Survey of the Literature in "Management science". *INFORMS*, 281-298.
- KENNETH C. LAUDEN, J. P. (2014). *Management Information Systems, managing the digital firm*, Thirteenth edition. London: Pearson Education.
- KENNETH C. LAUDEN, J. P. (2005). *Management information systems, managing the digital firm* 9th ed. London: Pearson Education.
- KENNETH J. SOUSA, E. O. (2015). *Management Information Systems, Seventh edition*. Stamford: Cengage Learning.
- KERZNER, H. (2017). *Project management metrics, KPI's, and Dashboards: A guide to measuring and monitoring project performance*, 3th ed. New Jersey: John Wiley & Sons.
- KLIEM, R. L. (2008). *Effective communications for project management*. Florida: Auerbach Publications.
- KNIEZOVA, J. (2013). *Modeling of Information system requirements*. Bratislava: E-leader Slovenia.
- MARTINA SEIDL, C. H. (2014). *UML Classroom, An introduction to object oriented modeling*. Heidelberg: Springer International Publishing.

- PMBOOK, G. (2017). A Guide to Project Management Body Knowledge, 6th ed. Pennsylvania: Project Management Institute.
- R. KELLY RAINER JR, B. P. (2014). Introduction to Information Systems, supporting and transforming business 5th ed. New Jersey: John Wiley & Sons.
- RALPH M.STAIR, G. W. (2018). Principles of Information Systems 13th ed. Boston: Cengage Learning.
- RAYMOND. (1987). Information systems design for project management: a data modeling approach. project management Journal, 94-99.
- SCHWALBE, K. (2012). An Introduction to Project Management, 4th ed. Minneapolis: Kathy Schwalbe, LLC.
- POPKIN SOFTWARE. (1998). Modeling Systems with UML. New York: Popkin Software & Systems.
- STEPHAN HAAG, M. C. (2009). Information Systems Essentials, 3th ed. New York: McGraw-Hill/Irwin.
- Sylvie Desq, B. F. (2007). La spécificité de la recherche francophone en Systèmes d'Information. Revue Française de Gestion, 63-80.
- WALLACE, P. (2015). Introduction to Information Systems, 2nd ed. New Jersey: Pearson Education.

ANNEX A

Interview guide

In order to finish our dissertation, we have evaluated the current information system to set up a new project management information system that responds the research question of how to design a modern project management information system?

Axis 1. Collecting information

How to collect and retrieve information?

What are the tools do you use to collect and retrieve information?

How relevant are the information you receive?

Axis 2. Information processing

How satisfied are you with the information received?

How good is the quality of information?

Axis 3. Information system

What are the characteristics of the current information system?

What are the obstacles do you face during project life cycle in terms of the flow of information?

What are the suggestions you can add to facilitate interaction between project stakeholders?

How central database can facilitates the interaction between the different actors in the project?

Axis 4. Modeling project management information system

What are the sort of problems do you face during project management processes?

How suppliers are categorized and being reached?

How customers interact during project life cycle?

How do you support the idea of information and document sharing during project implementation phases?