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# **Information Management for organizational learning in project-based organizations**

Dissertation made in the scope of the Master Degree of Information Science under  
the orientation of PhD. Professor António Lucas Soares

Faculty of Arts and Faculty of Engineering

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*"It is good to have an end to journey toward; but it is the journey that matters, in the end."*

*– Ernest Hemingway*



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## **Resumo**

Os projetos são entidades altamente dependentes de informação, o que os torna locais ideais para a criação de conhecimento. Porém, devido ao seu carácter único, temporário e veloz, a sedimentação de conhecimento é difícil e, quando uma equipa de projeto se dissolve, a informação fica também muito provavelmente dispersa, sem que ocorra a sua conveniente organização, registo e disseminação no seio da organização onde se inserem. Os projetos são também por norma contextos multidisciplinares, o que constitui outra barreira à disseminação de conhecimento, uma vez que, tipicamente, profissões diferentes possuem uma cultura e forma de trabalhar próprias. Deste modo, torna-se um grande desafio para as organizações que executam projetos a aprendizagem a partir destes, que permita uma disponibilização da informação e conhecimento criados em projetos para o futuro e para a organização como um todo. Uma Gestão de Informação eficaz assume-se como uma peça fundamental para apoiar essa partilha de conhecimento entre projetos e, conseqüentemente melhorar a aprendizagem organizacional.

Esta dissertação procura assim contribuir para um melhor entendimento de como a Gestão de Informação deve ser concebida neste tipo de organizações. Para isso, e após realizada a revisão da literatura, foram desenvolvidos dois estudos independentes e complementares. O primeiro tem como principal intuito saber mais acerca da forma como empresas Portuguesas orientadas a projetos levam a cabo a partilha de conhecimento e a aprendizagem a partir de projetos. A análise de 3 organizações de diferentes áreas resultou numa perceção mais clara e realista acerca da forma como estas documentam, organizam e partilham a sua informação de projetos e de que forma novas equipas de projeto reutilizam informação de projetos passados.

Em segundo lugar, procedeu-se a um estudo mais aprofundado num Instituto de I&D português – o INESC TEC – com o objetivo de analisar empiricamente a transferência de informação de projetos (onde a criação de conhecimento ocorre) para a organização como um todo. Através da análise de um conjunto de características de Gestão de Informação e dos mecanismos de partilha de conhecimento utilizados para disseminar informação de projetos foi possível chegar a um conjunto de recomendações, com base numa nova conceptualização da Gestão de Informação em

projetos, que abarca os aspetos mais sociais da partilha de conhecimento, que inevitavelmente influenciam e motivam a aprendizagem organizacional. Para este estudo foi utilizada a abordagem de Investigação-Ação, o que permitiu uma interação bastante próxima com as equipas de projeto, através da participação em reuniões e acompanhamento e registo das suas preocupações diárias.

Pelo reduzido número de publicações científicas que relacionem a Gestão de Informação com projetos, esta dissertação representa um importante contributo para um aprofundamento das necessidades informacionais dos atores de projetos e da relação entre a criação de conhecimento em projetos e a aprendizagem organizacional que pode e deve resultar destes. Espera-se que os resultados alcançados venham alavancar a investigação nestas temáticas, de forma a ajudar as organizações orientadas a projetos a tirarem o maior partido do conhecimento gerado seio dos seus mais variados projetos.

**Palavras-chave:** Gestão de Projeto, Gestão de Informação, Partilha de Conhecimento, Aprendizagem Organizacional, Organização do Conhecimento.

## **Abstract**

Projects are entities highly dependent on information and very suitable for creating knowledge. However, because of their unique and temporary nature, the sedimentation of knowledge is difficult, and when a project team dissolves information is likely to disperse, without its convenient organization, documentation and dissemination within the organization. Also, projects are typically multidisciplinary contexts which can be another barrier to knowledge dissemination, as typically, different professions have their own culture and ways of working. Therefore, it is a major challenge for project-based organizations to learn between projects by making project-level information available for other future projects and to the company as a whole. An effective Information Management can provide an important contribute for the sharing of knowledge across projects and to improve organizational learning.

Following this drive, this dissertation provides a better understanding of how Information Management should be conceived in such contexts. For that purpose, and after carrying out the literature review, two independent and complementary studies were performed. The first one intended to know more about how Portuguese project based organizations are facing knowledge sharing and learning by projects. The analysis of 3 enterprises from different fields provided clear insights about how these organizations are documenting, organizing and sharing project information and how the new project teams can learn through previous projects.

Secondly, we performed a deeper study within a Portuguese R&D Institute – INESC TEC – in order to empirically analyze the information and knowledge transfer from projects – where the knowledge creation takes place - to the organization as a whole. We observed the ICT tools used during a specific project, the information flows which created, stored and communicated information, the document management rules and techniques and the knowledge sharing mechanisms used to disseminate the project information to the organization. Finally, a set of recommendations were defined, concerning a new concept of Information Management in projects that include a more social perception of knowledge sharing, in order to improve organizational learning. In this second study Action Research was used, which allowed a closer

interaction with the project teams, by integrating meetings and monitoring and registering their daily concerns.

Because of the lack of scientific publications relating Information Management with projects, this dissertation means an important input for a deeper understanding about the informational needs of project actors and the relation between knowledge creation in projects and the organizational learning that can and should be driven from projects. We expect that the findings will leverage the investigation in these matters, and help project-based organizations to take the best of the knowledge they produce within the diversity of their projects.

**Keywords:** Project Management, Information Management, Knowledge Sharing, Organizational Learning, Knowledge Organization.

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# **Abbreviations**

AR – Action Research

CMS – Content Management System

ICT – Information and Communication Technology

IT – Information Technology

IM – Information Management

KS – Knowledge-Sharing

KM – Knowledge Management

KO – Knowledge Organization

KOP – Knowledge Management Problems

KOS – Knowledge Organization System

PBO – Project-Based Organization

PDF – Portable document Format

PMBoK – Project Management Body Of Knowledge

PMI – Project Management Institute

PMOffice – Project Management Office

R&D – Research and Development

SW - Software

UESP – Manufacturing Systems Engineering Unit



## Glossary

**Content Management System:** system that supports the creation, administration, distribution, publication and collection of information;

**Discussion forum:** virtual communication spaces structured by discussion threads. Threads begin with a message containing information, questions, requests or commentary. This message is followed by further messages replying, commenting and inquiring on the topic of the first message. Online forums are a many-to-many communication space where participants can post a new topic and reply to an existing one (Da Cunha and Orlikowski 2008);

**ICT Tools:** in project contexts, they refer to the “comprehensive systems that support the entire life-cycle of projects, project programs, and project portfolios” (Ahlemann 2009), most commonly known as Project Management systems, but also all systems in general that support Information Management, communication and publishing through projects, with the aim of sharing knowledge across the organization. They are often used as an extended synonym for information technology (IT);

**Information Management:** the management of processes and systems concerning the information lifecycle (creation, maintenance, organization, storage, distribution and use) with the goal of helping people and organizations to manage and process information efficiently and effectively (Detlor 2010);

**Information:** knowledge that has a body and is somehow expressed and documented and that can be, therefore, easily communicated, reused and shared with others. It is the main object of Information Management;

**Knowledge Organization:** designates a domain concerned with the “ordering of what is known,” particularly for information retrieval (Friedman 2013) and it addresses the nature and quality of the knowledge organizing processes as well as the knowledge organizing systems (KOS) used to organize documents, document representations and concepts (Hjørland 2008);

**Knowledge:** the mental processes of comprehension, understanding and learning that go on in the mind and only in the mind (Wilson 2002);

**Knowledge-Sharing Mechanisms:** in PBO they consist in “formal and informal mechanisms for sharing, integrating, interpreting and applying know-what, know-how, and know-why embedded in individuals and groups that will aid in the performance of project tasks” (Boh 2007). It can be follow a codification perspective, by codifying and storing knowledge in databases and documents, which allows many people to retrieve codified knowledge without having to contact the person who originally developed it (Hansen, Nohria, and Tierney 1999). The alternative is a

personalization approach, where knowledge is closely attached to the person who developed it and is shared mainly through direct person-to-person contacts (Boh 2007);

**Organizational Culture:** all the practices, values and assumptions that the members of an organization share, which is holistic and socially constructed (Ajmal, Takala, and Kekäle 2008);

**Organizational Learning:** in PBO refers to the process of making “newly created project-level knowledge available to the organization as a whole by sharing, transferring, retaining, and using it” (Bartsch, Ebers, and Maurer 2012). While projects are where knowledge creation takes place, the overall process of learning in project-based organizations involves the subsequent transfer, retention and use of this knowledge within the project-based organization;

**Organizational Process Assets:** include any or all process related assets, from any or all of the organizations involved in the project that can be used to influence the project’s success. They include formal and informal plans, policies, procedures, and guidelines. The process assets also include the organization’s knowledge bases such as lessons learned and historical information (Project Management Institute 2008);

**PMOffice:** organizational body or entity assigned various responsibilities related to the centralized and coordinated management of those projects under its domain (Aubry, Hobbs, and Thuillier 2007);

**Project Management:** the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements (Project Management Institute 2008);

**Project:** temporary endeavor undertaken to create a unique product, service, or result. The temporary nature of projects indicates a definite beginning and end. The end is reached when the project’s objectives have been achieved or when the project is terminated because its objectives will not or cannot be met, or when the need for the project no longer exists (Project Management Institute 2008);

**Project-Based Organizations:** refer to a variety of organizational forms that involve the creation of temporary systems for the performance of project tasks;

**Wiki:** simple to use asynchronous, web based collaborative hypertext authoring systems that allows the constant evolution of content (Sauer et al. 2005).

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# 0. Introduction

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## **0.1. Goals and motivation**

For the last decades, Project Management became an important instrument for companies to deal with new challenges and keep their competitiveness in the market. Project-based organizations (PBO) refer to a variety of organizational forms that involve the creation of temporary systems for the performance of project tasks (Thiry and Deguire 2007). A project is defined as a temporary endeavor undertaken to create a unique product, service or result (Project Management Institute 2008); and is normally a mean of achieving larger goals within the organizational objectives. Because of their flexibility and quickness, different from the usual organizational tasks and operations (which are heavier and predictable), projects became an interesting informational issue: they are temporary, which means that information flows occur very quickly, and most of the times without platforms or tools appropriate to the management, storage and dissemination of the information produced. A project is fast and unpredictable and the information that is produced and managed during its temporary lifecycle might be stuck within the project when it closes. Projects are also typically multidisciplinary contexts and its members can be unknown one from each other, which can be a barrier to an effective Information Management, as typically, different professions have their own culture and ways of working which can be conflicting with the other participants or project culture (Ajmal, Takala, and Kekäle 2008). At the same time, project teams move from one project to another very fast, and usually without the time to conveniently assimilate and document all the knowledge that was acquired during the project. We consider that to be an important challenge to the project managers and project teams: to manage the information flows and the knowledge created in order to be registered in a way that will be available for other future projects and teams and, consequently, contributing for the organizational learning as a whole.

Literature says that Information Management (IM) has an important role in organizations and has been already largely explored in the related literature. Detlor (2010) defines it as the management of processes and systems concerning the information lifecycle (creation, maintenance, organization, storage, distribution and

use) with the goal of helping people and organizations to manage and process information efficiently and effectively. Detlor also considers three Information Management perspectives: the librarian, the personal and the organizational. Since we are dealing with projects within organizations and their contribute for the organizational learning, we will follow the organizational perspective. Applying Information Management in projects, because of their specific characteristics, highlighted above, becomes an interesting challenge to explore. Also, empirically there is a strong evidence that knowledge and informational practices can influence the success of projects and the effective sharing of knowledge across projects will reduce the organizational costs of duplicating efforts for the same problem-solving (Reich and Wee 2006).

On the other hand, literature in Project Management shows that there has been a substantial improvement over the past 20 years in the quality and rigor of Project Management research (Turner 2010). However, and although citations are made to a much wider range of journals outside the field, meaning that Project Management is drawing on and contributing to a wider range of other disciplines, research about managing information/ knowledge in particular is still very little. There is some recent research work done to connect projects with the knowledge management concepts, and some findings suggested that project managers lack the guidelines needed to successfully manage knowledge-based risk (Reich 2007; Reich and Wee 2006). Also, while Project Management early research was mainly focused on the achievement of individual project goals and accordingly with largely studied project techniques and tools (Turner 2010), more recent literature points out the organizational learning as a key performance driver in project-based organizations (Blindenbach-Driessen and Van den Ende 2006) and as very relevant to the project success (Reich 2007). Knowledge creation seems to be closely related with organizational learning, because as knowledge is created and captured, learning takes place and the knowledge is hopefully applied and embedded within individual and organizational processes. Projects are highly dependent on information and very suitable for creating knowledge, but the temporary nature of projects may inhibit the sedimentation of knowledge, because when the project dissolves and participants move on, the created knowledge is likely to disperse (Bakker et al. 2011). Difficulties in learning from projects arise due to this unique and irregular nature of projects which creates some barriers that hamper the knowledge

transfer from projects to the organization as a whole.

The main part of this investigation will take place in the author's workplace, which is INESC TEC, an important Portuguese Research Institute working with R&D and consultancy projects of many kinds. The author's everyday tasks relate closely with the informational issues in projects (for instance, maintaining document templates and rules for projects usage and managing the ICT platforms of several projects). What can be observed in projects of this organization is that many times a project is finished without the proper assimilation of the knowledge that was acquired (whether is a final meeting with the project team to talk about lessons learned or documentation in some ICT document or tool). Also, when projects are made with several organizations, Information Management becomes a lot more difficult, because of the lack of common Information Management practices, as every organization has their own culture and ways of working. Because of that, sometimes project teams work with many different ICT tools (for information creation and sharing within the project team and other stakeholders) what creates an information overload difficult to manage. We consider that this is an interesting context to explore, in order to comprehend and analyze the main Information Management problems in projects and how are they hampering the organizational learning (i.e. the information and knowledge transfer from projects – where the knowledge creation takes place - to the organization as a whole). Finally, we will define some useful recommendations about Information Management in projects for the purpose of a better sharing of knowledge through the organization, in order to improve organizational learning.

The subject has a high level of relevance firstly because of the lack of scientific publications focused in Information Management in projects. This dissertation work will provide important details about how information is managed in projects, which tools and platforms are used to do it and how that information creates knowledge than can directly “supply” the organizational learning. It means an important input to the beginning of a deeper understanding about the informational needs of project actors and the relation between knowledge creation and codification in projects and the organizational learning that can and should be driven from projects. We expect that the findings will leverage the investigation in these matters, in order to help project-based organizations to manage project information more efficiently and effectively and

improve their organizational learning processes.

It will also be taken into account that nowadays there are emergent information and communication technologies (ICT) that have permanently changed the more traditional view of Information Management; collaborative platforms, social networks or enterprise portals are examples of new and innovative tools to manage information and communicate knowledge in organizations. The impact of these new tools and the perception of knowledge itself as increasingly socially constructed are also considered in our study of project contexts.

Finally, it is our belief that this dissertation also empowers the recognition Information Management practices in organizations, particularly the project-based ones. By identifying the most frequent needs and requirements of Information Management in projects and their relevance to the enterprise innovation and learning, organizations may realize the changes needed to achieve a high level of performance in their projects and, therefore, maintaining their competitiveness, by improving their ICT tools and techniques.

## **0.2. Research Questions and Goals**

The general goal of this investigation is to develop a deeper understanding of the relations between Information Management and the organizational learning in project contexts. The line of reasoning followed in this dissertation is based upon the idea that knowledge is the most important and strategic resource of today' organizations; knowledge relies in peoples' minds and is disseminated by different knowledge-sharing mechanisms across the organization, but it can be codified in informational assets relying in the organization ICT tools, which need to be coherently managed and organized.

By aligning with the mentioned goal, we intend to address three important concerns: the contribution of this dissertation for the academic investigation, both in the Information Management and Project Management research; the empowerment of information and knowledge sharing practices as they are viewed by organizations in general and finally the contribution for the Project Management practices of UESP (the

organizational unit of INESC TEC where the study will occur) in particular, in order to improve organizational learning.

Following is the research question for this dissertation and the required objectives related with the developing subject.

**RQ: How can Information Management support knowledge sharing in projects and improve organizational learning in PBO?**

- **G1: Characterize how current Portuguese Project-Based Organizations manage project information and share project-resulting knowledge in the overall organization;**
- **G2: Identify the Information Management practices and tools in INESC TEC Projects;**
- **G3: Identify the knowledge-sharing mechanisms used in INESC TEC for the purpose of organizational learning.**
- **G4: Develop recommendations towards a concept of Information Management which can improve knowledge sharing and a better organizational learning in INESC TEC.**

Based on these goals, we intend to obtain the following generic results:

- Empirical studies about the Information Management tools and strategies and knowledge-sharing mechanisms in project-based organizations;
- Recommendations for a better Information Management that can be aligned and contribute to the organizational learning through projects.

### **0.3. Theoretical and methodological approach**

As it was said before, the main goal of this dissertation is to contribute to a better understanding of how Information Management can improve organizational learning in project contexts. First, it is crucial to identify what the literature has to say about the subject, and since this specific line of research is it still somehow unexplored, we had to

investigate also its constituent parts, particularly: information and knowledge management, knowledge organization, organizational learning and Project Management. This initial investigation allowed the author to acquire important knowledge about the subject in hands and to better criticize what it will be observed and analyzed during the subsequent studies.

Following the literature review, two independent methodological approaches were performed:

- STUDY A: Exploratory interviews in Portuguese project-based organizations of different fields, in order to identify the main informational concerns, the ICT tools used and the informational needs in their organization's projects. This provided clear and realistic insights about how Portuguese project teams manage project information and if they consider that their tools and techniques are contributing to the organizational learning. Since the literature regarding the issues this dissertation is dealing with is still quite small and new, this study allowed to confirm and criticize the aspects already developed in research papers;
- STUDY B: Action Research Study at an INESC TEC organizational unit, with the purpose of analyze the main Information Management problems in projects and how are they hampering the organizational learning. We addressed the ICT tools used during a specific project, the Information Management rules and techniques and the knowledge sharing mechanisms that the unit is using to disseminate project knowledge. The results obtained allowed to gather significant recommendations for Information Management in projects, always relating the organizational learning concerns.

#### **0.4. Dissertation Structure**

This dissertation is organized in 5 chapters. Following this introduction, chapter 1 addresses the literature review, where we start by introducing the 2 main areas of our study – Project Management and Information Management – and then we check how they crosslink, by addressing the more current highlights of Information Management

and Knowledge Sharing in project contexts. Chapter 2 presents the research approach and methods used in the two independent studies performed, with particular concern with the Action Research approach of the second study. Chapter 3 develops and analyses the results of the 2 studies performed. Study A is addressed briefly and in a more global view, because it has the main purpose of verifying the characteristics of IM and KS (gathered during the literature review) in Portuguese Project-Based Organizations, providing a more concrete perspective of those contexts in the Portuguese reality. Study B consists in an in-depth study in INESC TEC which makes the diagnosis of the current situation and a clear identification of the main IM and KS problems (during a project execution and across projects). In order to improve the organizational learning with concrete inputs, we develop an action plan in the form of practical recommendations to be applied in INESC TEC, which is aggregated in chapter 4. Such recommendations also reflect a wider and more holistic concept of Information Management, more suitable for contexts of strong collaboration and social interactions among people.

The last chapter is dedicated to main conclusions and contribution of this dissertation by pointing out the limitations of the present study and future research directions.

# 1. Literature review

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This chapter presents the literature review related with the dissertation's main subjects, particularly regarding Information Management and Project Management and the intrinsically related concepts of knowledge creation and organizational learning in project-based organizations. Since the area of Information Management and Project Management has already been vastly explored in the related literature, we will address them briefly and then directly deal with the specific aspects related with Information Management and knowledge sharing in project contexts and project-based organizations.

The literature review is mainly supported by a research of papers from the last 10 years in the most important and renowned publications in the Information Management, knowledge organization and Project Management areas of study. Also, specific Project Management concepts in the first chapter are presented as they are conceived in the PMBoK Guide, which is the most important and worldwide recognized body of knowledge about Project Management.

## **1.1. Projects and Project Management**

In recent decades, Project Management has become a strong instrument for companies to face new challenges and maintain their competitiveness in the market. Project-based organizations (PBO) refer to a variety of organizational forms that involve the creation of temporary systems for the performance of project tasks. Project-based organizations have received increasing attention in recent years as an emerging organizational form (Thiry and Deguire 2007) and projects are nowadays the most important delivery vehicle for products and services in a global economy, characterized by a strong competition and radically shrinking lifecycles. With this new configuration, companies seek to implement changes in their business processes that make them faster and more effective, so as to seize the opportunities that arise in the market and to decrease the obstacles. In a constantly changing scenario, companies have to deal with a number of external requirements, such as the ferocity of the market, the restrictions

and requirements related to the updating of standards and legislation, new technologies or new ways of working.

“Management by projects” is, therefore the central management strategy for the “new” project-oriented company. Project-oriented companies carry out small and large projects, internal and external projects, and unique and repetitive projects to cope with new challenges and potential in a dynamic business environment (Gareis 1991). New ideas, challenges and learning gained in projects should be transferred to the PBO. PBO has to ensure effective knowledge sharing and integration within and between projects to avoid the risk of reinventing the wheel and so repeating the same mistakes (Pensel and Wiewiora 2013). Furthermore, projects are becoming more complex, requiring the integration of diffuse partners who are often physically separated and from different cultural backgrounds, and precision, timeliness and congruence of communicated meanings become increasingly important and challenging. (Jackson and Klobas 2008)

First of all, it is important to clearly define the object we are dealing with – a project. Multiple definitions are presented by the literature, and it is hard to tell when this concept first came out. For an objective definition of project (as well as other key related concepts) we will follow the concepts established by the PMBoK Guide – Project Management Body of Knowledge. This is the most important international referential recognized for the professionals of Project Management, which establishes the methods, processes and good practices for the purpose of Project Management. As a powerful management solution, Project Management is becoming more and more popular in varied industrial sectors after PMI (Project Management Institute) published the PMBoK Guide in 1987, where a clear body of knowledge of Project Management was outlined, which has been accepted by many companies and professionals as a useful manual to manage their projects. No longer just a sub-discipline of engineering, the management of projects is now the dominant model in many organizations for strategy implementation, business transformation, continuous improvement and new product development (Shi 2011).

According to PMBoK Guide, a project is a *“temporary endeavor undertaken to create a unique product, service, or result. The temporary nature of projects indicates a definite beginning and end. The end is reached when the project’s objectives have been achieved or when the project is terminated because its objectives will not or*

*cannot be met, or when the need for the project no longer exists.* “ (Project Management Institute 2008). Its temporary nature differs, therefore, from organizational operations, which are repetitive and continuous and generally follow an organization’s existing procedures. In contrast, because of the unique nature of projects, there may be uncertainties about the products, services, or results that the project creates.

Key characteristics of projects are: the significant interdependence of different kinds of knowledge and skills, the complexity and unpredictability of many tasks and problems, and the time-delimited nature of project goals and, often, of employment. However, there are substantial variations in the kinds of products and services produced as well as the inputs used (Ajmal, Takala, and Kekäle 2008).

Projects are undertaken at all organizational levels and can involve a single person, a single organizational unit, or multiple organizational units. Usually, projects are used as means of achieving the goals of the strategic plan of an organization, and strategic considerations such as: market requirements, business needs, customer orders, technological advances, legal requirements, etc. (Project Management Institute 2008).

A project can be considered as a sub-system of a company, differing by their specific values and norms of other subsystems (such as other projects or departments). This new conceptualization of a project is characterized by Gareis (1991) not only for its unique character, but also because it is a social system with dynamic borders with the ability to learn and self-organize. According to him, project-oriented management aggregates and should take into account three crucial aspects: the organizational culture and structure, the management of the project itself and the management of the various connections between the various projects.

PMBok also defines Project Management as *“the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements”*. Managing a project typically includes identifying requirements and addressing the various needs, concerns, and expectations of the stakeholders, i.e., persons or organizations (customers, sponsors, the performing organization, or the public), who are actively involved in the project or whose interests may be positively or negatively

affected by the performance or completion of the project (Project Management Institute 2008). PM also includes balancing the competing project constraints including (but not limited to): Scope, Quality, Schedule, Budget, Resources and Risk.

Project Management is now well developed and has been established as a domain for the exercise of professional expertise and as an area for academic research. Numerous methods and techniques cover now all aspects of managing projects from their genesis to their completion. On the other hand, Project Management is increasingly concerned with taking systems and processes that originated in the conventional paradigm of Project Management and applying them to general organizational theory. In fact, whereas Project Management was previously regarded as a specialized management process with specific planning, monitoring, and control techniques that were applied to the operations of a few project-oriented industries, it has now come to be regarded as an inclusive concept that can be integrated into a general organizational effort to provide better quality to customers through effective intra-organizational integration and the optimal utilization of limited resources. As a result, Project Management is now positioned as a complex managerial process among other organizational processes that ensures an optimal balance between the internal organizational design of a firm and its emerging strategies (Ajmal and Koskinen 2008).

Despite all this, Project Management remains a highly problematical endeavor, and many projects exceed their budgets, run late or fail to meet other objectives (White & Fortune, 2002). As we will develop later, Information Management can play a massive role in addressing some of the current Project Management problems.

### **1.1.1. Organizational Process Assets**

PMBok defines organizational process assets as including any or all process related assets, from any or all of the organizations involved in the project that can be used to influence the project's success. These process assets include formal and informal plans, policies, procedures, and guidelines (for instance, work instructions or templates), and also the organization's knowledge bases such as lessons learned and historical information or about the results of previous projects. We conceive these organizational assets as closely related with the concept of intellectual assets describe in Information Management; as "*the codified, tangible or physical descriptions of*

*specific knowledge to which the company can assert ownership rights”* (Sullivan 1998, quoted in Choo, 2000). This is a form of knowledge, codified as intellectual assets which are valuable to the organization; Information Management should therefore play a key role in keeping the organizational assets updated with the project outputs (Choo, 2000).

### **1.1.2. Project Management lifecycle**

Due to its temporary and restricted nature, projects are developed within a specific time that is called the project lifecycle. A project lifecycle is a collection of generally sequential and sometimes overlapping project phases whose name and number are determined by the management and control needs of the organization or organizations involved in the project, the nature of the project itself, and its area of application (Project Management Institute 2008). The project lifecycle provides a basic structure for the Project Management, regardless of the specific work that is involved, which could lead to results and deliverables. Regardless their size or complexity, all projects can be mapped to the following life cycle structure:

- Starting the project;
- Organizing and preparing;
- Carrying out the project work;
- Closing the project.

According to the PMBoK Guide that we have been following, Project Management is performed through processes, using Project Management knowledge, skills, tools and techniques. These processes typically fall into one of two main categories:

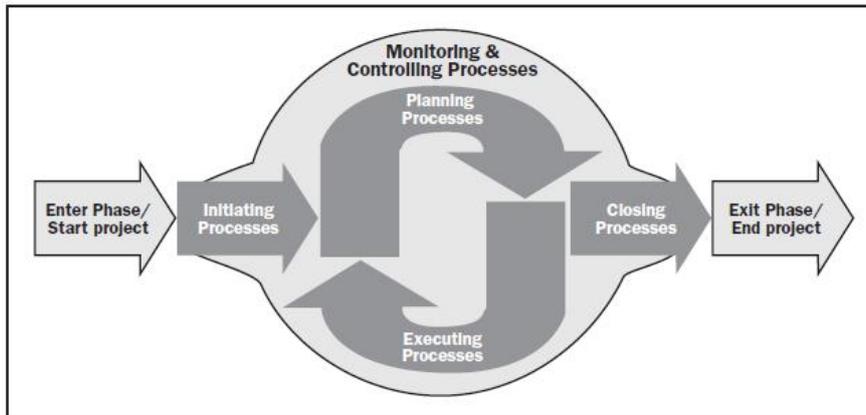
- **Project Management processes:** ensure the effective flow of the project throughout its existence. These processes encompass the tools and techniques involved in applying the skills and capabilities described in the PMBoK guide.
- **Product-oriented processes:** specify and create the project’s product. Product-oriented processes are typically defined by the project lifecycle and

vary by application area. The scope of the project cannot be defined without some basic understanding of how to create the specified product.

Project Management processes are grouped into five categories known as Project Management Process Groups:

- **Initiating Process Group:** Processes performed to define a new project or a new phase of an existing project by obtaining authorization to start the project or phase.
- **Planning Process Group:** Processes required to establish the scope of the project, refine the objectives, and define the course of action required to attain the objectives that the project was undertaken to achieve.
- **Executing Process Group:** Those processes performed to complete the work defined in the Project Management plan to satisfy the project specifications.
- **Monitoring and Controlling Process Group:** Those processes required to track, review, and regulate the progress and performance of the project; identify any areas in which changes to the plan are required; and initiate the corresponding changes.
- **Closing Process Group:** Those processes performed to finalize all activities across all Process Groups to formally close the project or phase.

*Figure 1* presents the typical lifecycle of a project and illustrates how the process groups interact and the level of overlap at various times. If the project is divided into phases, the Process Groups interact within each phase. A more complex project may consist of several phases in which each one of them will include all process groups, which are repeated for each phase. The groups and their constituents are like a guide for the application of the appropriate Project Management knowledge and techniques.



**Figure 1 - Project Management Process Groups**

## **1.2. Information Management**

This subchapter addresses the main concepts related with Information Management in order to support the following developments that will specifically deal with the project contexts and problems.

There have been a couple of decades now since Information Management became a well debated subject in literature. Managing information is also a common expression in today's organizations, which are focused on improving their competitiveness by using more flexible and sophisticated ICT tools and techniques. With a quick bibliographic analysis, however, it's visible the existence of multiple perspectives and concepts that vary with the author's positioning and it is important, therefore, to identify the approaches that will guide us through this dissertation work.

Detlor (2010) defines Information Management as the management of the processes and systems that create, acquire, organize, store, distribute, and use information. According to him, the main goal of Information Management is to help people and organizations access, process and use information efficiently and effectively. Doing so helps organizations operate more competitively and strategically, and helps people better accomplish their tasks and become better informed. Information Management plays an important role within the intelligent organizations in determining an organization's capacity to grow and adapt. Organizations search for and evaluate information in order to make important decisions and use information

strategically in order to generate new knowledge through organizational learning (Choo 1996). According to this, new knowledge is then applied to design new products and services, enhance existing offerings, and improve organizational processes.

The conceptualization of Information Management from a process perspective emerged in the 90's with Davenport (1993); this approach defends that the process model of Information Management encompasses all or some parts of the information value-chain or lifecycle. Many authors have followed this approach by proposing a set of constituent parts of that Information Management lifecycle (Choo, 2003; Detlor, 2010; Wilson, 2002); we give Detlor example of Information Management lifecycle as encompassing the predominant information processes of: information creation, acquisition, organization, storage, distribution, and use. According to the same author, there are 3 different Information Management perspectives: the organizational, librarian and personal perspectives. The organizational perspective deals with the management of all information processes involved in the information lifecycle with the goal of helping an organization reach its competitive and strategic objectives. The library perspective recognizes the unique role of information provision organizations, such as libraries, whose central mandate is to provide their clientele with access to information resources and services. The personal perspective deals with the management of information of relevance and concern to the individual. Since we are dealing with projects that aim to reach the competitive goals within an organization, we will follow the organizational perspective, where associated terms like information systems management, data management and content management have relevance (Detlor, 2010).

### **1.2.1. Information and Knowledge**

The object of Information Management is obviously the information, which, for the purpose of this dissertation, we will address as a synonym of knowledge, but with some particular differences, as we will explain below.

A threesome approach commonly relates information, data and knowledge, where data are "raw facts" that reflect the characteristics of an event or entity and information is viewed as "meaningful data" where data have been converted into a meaningful and useful context (Detlor 2010). Information only becomes "knowledge"

when it is put into a logical and understandable context which we can verify and recall from our experience. Information only becomes knowledge when it meets a need to finish an assignment or to solve a problem (Gunnlaugsdottir 2003). According to the knowledge hierarchy, the three manifestations of information are understood and presented as logically related whereby data evolves to information and information to knowledge as a natural progression towards becoming more valuable, useful, meaningful, and comprehensive. That knowledge is all-inclusive and the most useful form has also made knowledge to be the desired form towards which emphasis should be directed (Kebede 2010).

From an information science perspective, Wilson (2002) describes knowledge as follows:

*'Knowledge' is defined as what we know: knowledge involves the mental processes of comprehension, understanding and learning that go on in the mind and only in the mind, however much they involve interaction with the world outside the mind, and interaction with others. Whenever we wish to express what we know, we can only do so by uttering messages of one kind or another - oral, written, graphic, gestural or even through 'body language'. Such messages do not carry 'knowledge', they constitute 'information', which a knowing mind may assimilate, understand, comprehend and incorporate into its own knowledge structures. These structures are not identical for the person uttering the message and the receiver, because each person's knowledge structures are (...) 'biographically determined'. Therefore, the knowledge built from the messages can never be exactly the same as the knowledge base from which the messages were uttered.*

This reevaluation of the concept of knowledge has brought a distinction, in the literature, between implicit and explicit knowledge. Implicit knowledge is the “*knowledge used by every members of an organization which has not been documented but is nevertheless often of great value to the organization. As an example, there is the work experience of employees, how things are done, knowledge of customers and their needs, various personal contacts and so on*” (Gunnlaugsdottir 2003). Some authors address it as tacit knowledge, as “*based on experience, thinking, and feelings in a specific context, and comprised of both cognitive and technical*

*components. The cognitive component refers to an individual's mental models, maps, beliefs, paradigms, and viewpoints. The technical component refers to concrete know-how and skills that apply to a specific context*" (Popadiuk and Choo 2006).

This knowledge is implicit and not codified but it can be documented and registered so that other members can access it easily. That's what is called as explicit knowledge, as *"knowledge that is expressed formally and that can be easily communicated and shared with others"* (Choo, 2000). Explicit knowledge serves a number of important purposes in an organization because they encode past learning in artifacts and rules; they create the "intellectual assets" as *"the codified, tangible, or physical descriptions of specific knowledge to which the company can assert ownership rights"* (Sullivan, 1998, quoted in Choo, 2000).

We can use an iceberg as a metaphor for knowledge, where explicit knowledge is the tip of the iceberg; it is visible, articulated, measureable and objective. On the other hand, implicit knowledge is the unseen part of the iceberg, which is surely larger than the visible part on the surface, but that is difficult to measure or manage.

Analyzing the several distinctions of knowledge, we conclude that what was perceived, with Wilson, as simply knowledge, is also referred as implicit knowledge as *"the mental processes of comprehension, understanding and learning that go on in the mind and only in the mind"*. On the other hand, explicit knowledge can be perceived as information, as the author states: *"Whenever we wish to express what we know, we can only do so by uttering messages of one kind or another - oral, written, graphic, and gestural or even through 'body language'. Such messages do not carry 'knowledge'; they constitute 'information'"*.

For the purpose of the Information Management activities that we will address later, we will follow Wilson perspective of information as knowledge that has a body and is somehow expressed and documented and that can be, therefore, easily communicated and shared with others<sup>1</sup>. For that same reason, we will talk about

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<sup>1</sup> In fact, Wilson suggests that there is no such thing as knowledge management, because it is impossible to manage something that only happens in the mind. We can only manage information, as codified and tangible assets. KM might be, according with this author, the result of a "search and replace marketing phenomenon", in order to get a new concept to sell by consultancy companies, but that in the end has the same characteristics of information management.

Information Management instead of knowledge management, even knowing that sometimes they overlap or refer to the same management processes. Following Kebede (2010), “*the main added dimension of KM (knowledge management), is its focus on managing tacit knowledge that exists in the form of experience, know-how, insight, expertise, competence and so on*”<sup>2</sup>. Here tacit knowledge is seen as “*that aspect of human knowledge which cannot be expressed in explicit, objective form*”. Therefore, as we will explain later and related with our project contexts and needs, our focus, for the Information Management purposes of our study, will be on the expressed and codified knowledge that we will address as being information, which can be organized and managed by Information Management tools and technologies, and that can help to codify tacit knowledge that navigates through the organizations. In fact, this “tacit knowledge” is hidden in our heads and is “fed” by our feelings, experiences and beliefs, shaped by our social environment, and it is socially created and shared with others. Information, as explicit, codified and tangible assets should help people to create and share knowledge, allowing important learning to take place, as we will explain in further detail later.

Furthermore, we also want to distinguish between structured and unstructured information. Despite the organizations are now putting more emphasis on managing information that is structured and formalized (i. e., information that is organized in databases, numbers, which is recovered easily), the amount of unstructured information usually far exceeds the amount of structured data and information. Unstructured information is the type of information that can be found in reports, documents, email messages, and PowerPoint presentations, among others (Detlor 2010). ICT tools such as word processing, spreadsheets, presentation tools, templates, web editors and email, have definitively created an explosion of unstructured information. Organizations need to store this information, make it accessible and

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<sup>2</sup> For some authors, information management tools are a subset of knowledge management tools. “*IM tools allow organizations to generate, access, store, and analyze data, usually in the form of facts and figures. Information management tools enable the manipulation of information but do not capture the complexity of context and the richness of knowledge. While knowledge management systems may include tools that also handle data and information, data and information management tools are not robust enough to truly facilitate knowledge management*” (Kebede 2010). We envisage in this study a perspective of IM where not only data and information are included, but also knowledge, because they are inescapably connected. IM, by facilitating information codification, sharing and dissemination, also contributes for the knowledge creation processes and improves the way we access to it. Therefore, IM is considered in a wider and inclusive perspective, as it will be explained in the course of this dissertation.

ensure that it is safe, as well as ensure the distribution, publication and appropriate consumption. Usually, the unstructured information is managed through content management systems; they “*support the electronic capture, storage, distribution, archiving and accessing of documents. These systems typically provide a document repository where documents can be housed, indexed, and accessed. In these repositories, meta-data information is maintained about each document that tracks each document’s editorial history and relationships to other documents*” (Baltazan et al, 2008, quoted in Detlor, 2010).

### **1.2.2. Knowledge Organization**

Focusing upon the organization of knowledge with regard to codified information, we will now explore how knowledge can be organized and classified, for the purposes of retrieving and subsequent dissemination and usage. Knowledge organization (KO) designates a domain concerned with the “*ordering of what is known,*” particularly for information retrieval (Friedman 2013) and it addresses the nature and quality of the knowledge organizing processes as well as the knowledge organizing systems (KOS) used to organize documents, document representations and concepts (Hjørland 2008). Knowledge organization can be seen in a narrow sense, within the library information science and Information Management areas, where is especially concerned with information in bibliographical records, (related, for instance, with documentation databases or records in archives), or also, in a wider perspective, related with full-text documents and Internet documents and their representation for retrieval (Hjørland 2008). Outside those areas, and in a broader sense, KO is about how knowledge is organized in, for example, scientific disciplines, higher educational institutions, encyclopedias, dictionaries, languages, genres, theories, minds etc. Here, we find an interesting viewpoint of Mai (2010) which divides knowledge organization research and practice into three sets of knowledge organization problems (KOP’s):

- **Big KOP:** *This is the organization and representation of large quantities of information for unrecognizable many people; people with varied interests, beliefs, positions, knowledge, expertise, etc. The web is the prototypical example of such a KOP, large academic and many public libraries are also Big KOPs.*

- **Medium KOP:** *These are information collections for particular, stated, clear, objective, and specific purposes to be used by people with particular, similar interests, beliefs, positions, knowledge, expertise, etc. which can be known, understood, and articulated by those in charge of the collection or service. A company's intranet, a web portal, a store, and some special libraries are typical examples.*
- **Small KOP:** *This is individuals' Information Management challenges and collections. These KOPs are particular to an individual's (or a few individuals') personal information collection and will typically be managed by the same individual(s). The information could be e-mails, documents, files, photos, etc. which will be collected, searched, and used by individuals for their own usages.*

This categorization of knowledge problems also leads us to the existence of different theoretical KO perspectives, which are related to different viewpoints of knowledge, cognition, language, and social organization. According to the retrieved literature about the subject, and also with regard to the characteristics of our project contexts of knowledge creation and organization, we will follow the domain-specific perspective (which can also be linked with the Medium KOP). According to Hjørland (2008), this is a sociological-epistemological perspective, where *“the indexing of a given document should reflect the needs of a given group of users or a given ideal purpose. In other words, any description or representation of a given document is more or less suited to the fulfillment of certain tasks. A description is never objective or neutral, and the goal is not to standardize descriptions or make one description once and for all for different target groups”*. According to this, there is no universal or neutral way of organizing knowledge; we need to balance different perceptions and develop a *“point of view that is in accordance with the goals and values of the organization for which the system is developed”*.

The domain-specific approach differs from the more traditional perspectives, expressed by classification systems used in libraries and databases (including UDC), which followed that *“the sciences tend to reflect the order of Nature and that library classification should reflect the order of knowledge as uncovered by science; it is assumed that knowledge is neatly classified into logical categories, and that these*

*categories are accessible and knowable in a fashion in which it is possible to replicate the structure in a single classificatory structure that can be used to organize all information for all purposes” (Mai 2010). Organizing and classifying knowledge was, therefore, based upon the principle of ordering from general subjects to specific subjects, by using controlled vocabularies, and assuming that “what is being classified exists independently of humans and that the work of classificationists and classifiers is to discover the real essences and represent the kinds and phenomena as they really are, to represent what documents are actually about” (Mai 2011). As the author states, in opposition to this dominating view it could be argued that classification work involves some sort of “interpretive flexibility” in which the distance between what is classified (the object) and those who classify (the subject) is not kept at an artificial distance. Domain classification follows this drive, as it approaches the questions regarding subjectivity and objectivity: “DA is the only approach to KO which has seriously examined epistemological issues in the field, i.e. comparing the assumptions made in different approaches to KO and examining the questions regarding subjectivity and objectivity in KO” (Hjørland 2008). According to this, subjectivity based on the individual differences is of minor importance, as they cannot be used to create guidelines for KO; on the other hand, what seem more relevant are the collective views shared by many users.*

### ***Information classification***

Knowledge Organization Systems (KOS) include a variety of schemes that organize, manage, and retrieve information: classification, thesaurus, ontologies, and also the most famous glossaries and dictionaries, from specific areas and, the majority, related with libraries and other Information Management organizations. (Tristão, Fachin & Alarcon, 2004). As we already stated, information classification has long been related with the more traditional perspective of “*finding the one perfect system that works for everyone, everywhere*” (Miksa, 1998, quoted in Mai 2010), but the fact is that organizing and managing information today is much more social and collaborative than it was in the past, and classification need to be aligned with this new perception of knowledge as intensively socially constructed.

Classification structures are of utmost importance for the management of digital information in particular; they create a type of metadata which provides essential information about the content for the purpose of information retrieving. In digital environments, the concerns in managing information store are not those of arranging the material (as it was in the traditional and “physical” environments), but rather of adequate object description (labeling the items to support subject retrieval), providing search tools that support browsing, navigation and retrieval, and, to a more limited extent, the presentation of results (Broughton 2006). Here, we can apply, for instance, a simple taxonomy structure. The word “Taxonomy” is often used in this area to refer to the *“classification used in organizing information entities at enterprise level. In the context of taxonomy’s use in browsing, they are usually organization or domain specific, produced by the needs and interests of a specific community, and do not have the broader scope of a well-known classification scheme”* (Uddin and Janecek 2007).

On the other hand, a more complex solution, as a faceted classification, can also be applied. Faceted classifications have clearly gained importance in the past years as playing an integral part in many methods for information classification and retrieval, particularly in the world wide web. Broughton (2006) states that they are being used as powerful navigational devices in web sites of all sorts (and with special importance in the more commercial ones). Faceted classification consists basically in a group of facets that when combined are able to describe objects from a specific domain. It allows benefits as the capacity to express synthetically the complexity of subject content that is typical of digital documents, using a logical structure compatible with machine manipulation at whatever level and also the facility through variation or rotation of the citation order to allow approaches from a number of angles (i.e. cross domain searching) (Broughton 2006). In website architectures, specifically, one benefit of faceted classification is that users may have a very precise understanding about the domain content even though they are unfamiliar with website content. A faceted classification structure *“overcomes the limitations of hierarchical classification by classifying digital documents into multiple categories organized from the bottom-up into a multidimensional taxonomy. The facet categories are determined by analyzing the domain content while the hierarchies are made by arranging content related metadata predicting user preferences to access them. This requires some human intervention, such as creating facets (orthogonal sets of categories) and using indexer*

*assigned metadata (the classification data on a particular item) to make the taxonomies. The result is a multidimensional faceted taxonomy used to classify and organize the documents to provide guided navigation, browsing, and searching.*" (Uddin and Janecek 2007).

The work of Denton (2003) provide some clues about when it is appropriate to make a faceted classification and when a simple hierarchic tree, for instance, will be enough. "*Hierarchies and trees are best when the entities in question are viewed in such a way that they have one dimension of classification. Hierarchies divide and re-divide things into groups where each new group is a sub-species of its parent group; everything that Is true of a group is also true of its sub-groups and so on down*" On the other hand, facets will be useful for handling three or more dimensions of classification: "*When, for the purposes of the classification, it is possible to organize the entities by three or more mutually exclusive and jointly exhaustive categories, then facets are probably the appropriate classification*". Once again, we need to have in mind the way users will use classification and for what purpose: "*Remember the purpose of the classification and the users. Who will use it? Why? Will they search it, browse it, or both? How well do they know the subject?*".

At this point we agree with Mai (2011) when he says that a robust theory of classification is "*one that does not separate between how things really are and people's cognitive constructions of how things are; it is one that does not separate between the ontology of things and the epistemology of how we get to know about things*". Classifying information depends largely on the context of work, user expectations and needs and the specific KOPs that the classification should address. For instance, medium KOPs, as being domain-specific, should involve their users directly in the development of the classification structure and will surely rely on a domain-specific organization of knowledge. We believe that project contexts we are dealing with are suitable in this perspective, as the indexing strategies should reflect the needs of its members and the fulfillment of their shared unique and temporary purposes.

The concerns about the production, organization, storage and dissemination of codified information, as the main instrument for knowledge sharing and dissemination, are therefore very dependent on their organization. As we have previously stated, the

cyclical dimension of knowledge organization is closely related with the cyclical dimension of information, since documented knowledge should be organized in a way that can generate new knowledge that, therefore, can also be registered, codified, becoming information and being recovered by other users and subsequently generating more new knowledge. Classification systems should address these concerns by providing the right information to users, based on the fact that the systems themselves are already part of existing conversations and activities, as knowledge and information are socially achieved, generated and trusted (Mai 2010).

### **1.3. Information Management and knowledge sharing in project contexts**

As we pointed before, Information Management in organizational contexts has been already largely explored in the related literature. Also in the field of Project Management, there has been a substantial improvement over the past 20 years in the quality and rigor of Project Management research (Turner 2010); citations are made to a much wider range of journals outside the field, meaning that Project Management is drawing on and contributing to a wider range of other disciplines. Although the articles cover now a much broader range of topics, research about managing information/knowledge in particular is still very little. There is some research work done to connect projects with some knowledge management concepts, and some findings suggested that project managers lack the guidelines needed to successfully manage knowledge-based risk (Reich and Wee 2006; Reich 2007). However, a holistic view may be necessary to relate the highly conceptual organizational learning and Information Management literatures and the more practice-oriented Project Management literatures.

Conceptually, a project can be a difficult informational problem. Teams of strangers work together under time and budget constraints to produce a new product, process, or service. Several researchers have described new product development as a knowledge-intensive activity, as new product development often involves cross-functional linkages, where different participants join a team with differing viewpoints. In fact, a project normally involves several participants from different fields. Typically, different professions have their own culture and ways of working which can be

conflicting with the other participants or project culture (Ajmal, Takala, and Kekäle 2008). From this perspective, one might say that a project manager's primary task is to manage the knowledge bases of the team members and stakeholders so that they combine in the best possible way to successfully accomplish their assignment (Reich and Wee 2006).

A project requires a strong directional culture that concerns a synthesis of cultures requiring appropriate modes of cooperation and communication for the project at hand (Ajmal, Takala, and Kekäle 2008). Learning must be integrated with current tasks, not only to meet present goals, but also to develop and retain knowledge for future organizational needs. (Fong 2003).

In addition, the massive use of information and communication technology (ICT) in projects may have imposed further challenges to project managers. ICT tools in today's organizations are responsible for the exchange of information and knowledge as well as work execution by integrating information, documents and employees and project managers have to "*handle the existing overly loaded information. This is due to the decrease ability of managers in getting the relevant, timely, and accurate information, and in managing information and knowledge flows for future utilizations and developments*" (Karim and Hussein 2008).

What practical implications can an efficient Information Management have for the typical project manager? In a survey of White and Fortune (2002), sent to 995 project managers about the current practice of Project Management, the three critical success factors of a project that were most frequently mentioned were: clear goals/objectives, support from senior management and adequate funds/resources. Information Management can help improve communications and provide more and better information to the project manager and the project team. Therefore, the objectives can be better understood, articulated and shared with the team.

Following this drive, a recent study about the Information Management barriers in R&D projects (V. R. O. Santos 2012) had shown that the major Information Management barriers in projects, as they were recognized by project managers and project team were: documentation control, inadequate IT support and, finally, information overload. The study focused on particular contexts – multi-organizational

and multi-national complex R&D projects, where the degree of collaboration is very high. The study emphasizes the importance of applying innovative strategies that can reduce the effort of planning and implementing processes and strategies of Information Management and knowledge sharing, connected with the dynamics of the informational agents (project managers and teams) and their organizational context.

Projects, as a specific context for Information Management, can be seen as an organization subsystem which also differentiates itself by particular rules and procedures as a result of Project Management standardized practices (i.e. PMBoK guide). Projects are used to reinvent business processes, support customer-focused global strategies, and coordinate information and decision flows among organizations. The success of individual projects, and the creation of organizational project competency, is often critical to organizational renewal, survival, and success (Reich and Wee 2006).

Following Reich (2007), we consider that Information Management in projects should have the same purpose of applying “*principles and processes designed to make relevant knowledge available to the project team*”. Information Management in projects aims at improving the creation and sedimentation of knowledge, minimizes knowledge losses, and fills knowledge gaps throughout the duration of the project. Here we are clearly focusing on the codified knowledge, i.e. information, related with projects, which will allow new knowledge creation and sharing by its members, and that should be efficiently organized, stored and shared with all the participants. Some important outputs of an Information Management strategy will be, for instance, the lessons learned from comparable projects, because they provide to the team both important knowledge of the project’s problems and risks and the opportunity to share information about the ways these risks could impact the project goals.

Another important role of Information Management in projects is also to ensure that the organizational resources receive the knowledge created in individual projects (in the form of explicit, codified assets), providing information of value to future projects and ultimately to organizational learning as a whole. As we will explain later, knowledge creation in projects leads to the organizational learning, which is crucial for the company to remain innovative and competitive in the market. Project-based organizations face substantial obstacles to be overcome in capturing knowledge and in

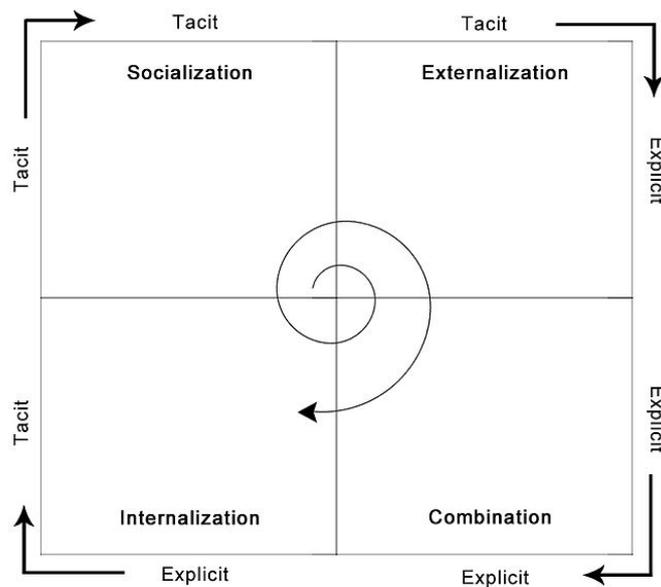
the re-cycling of project-based learning that stem from the relatively self-contained, idiosyncratic and finite nature of project tasks (Bresnen et al. 2003). Information Management strategies, in such contexts, should, therefore, provide the necessary tools, procedures and guidelines to manage the “*processes of information creation, organization, storage, distribution and use*” (Detlor 2010) in projects and across projects, in order to overcome the barriers mentioned above.

In short, all the information produced and consumed by projects (inputs and outputs) needs to be managed for the benefit of the project, and the management of information should enhance the research, selection, processing, delivery, storage and dissemination of information required for the project development. At the same time, Information Management should contribute to empower the “intellectual assets” (Choo 2000) that encode past learning in artifacts and organizational rules, or the “organizational assets”, defined by the PMBoK as all assets related to the procedures, strategies and policies governing the work in an organization, and also the corporate knowledge base that is derived from the lessons learned from previous projects.

We can now conclude that Information Management in projects is closely related with two other concepts: knowledge creation and organizational learning. As organizations become more reliant on projects for transformation and renewal, the outcome of a particular project may be less important than an overall increase in the ability of an organization to implement projects successfully. For instance, if project managers fail to capture lessons learned, they prevent team-level learning and hinder opportunities to improve organizational competency in managing and completing projects. Also, empirically, there is strong evidence that knowledge practices can influence the success of projects (Reich and Wee 2006); and the effective sharing of knowledge across projects will reduce the organizational costs of duplicating efforts for the same problem-solving. Information Management should, therefore, address these issues by supporting the specific project needs and contributing for a better performance and knowledge creation. Once the project finishes, the knowledge created should then be transferred to the organization as a whole, for the purpose of organizational learning, and contributing in this way for a common knowledge-basis across projects.

### 1.3.1. Knowledge creation

The ability to create new knowledge is at the heart of an organization's competitive advantage. Knowledge transfer is the most common term in the literature to describe knowledge exchange processes (Wilkesmann and Wilkesmann 2011). According to our definitions of information and knowledge presented before, knowledge creation means the creation of new knowledge through the exchange of information. Creation of new knowledge hardly has any value if it is not shared with others, thus, knowledge sharing is of utmost importance to the performance of knowledge creation and in leveraging knowledge for greater organizational performance (Mishra and Bhaskar, 2011). In fact, in the last decade organizations have been very concerned about executing strategies that are more knowledge friendly and introducing effective knowledge management initiatives by embedding knowledge sharing practices in their work processes.



**Figure 2 - Modes of Knowledge Creation (adapted from Nonaka, 1994)**

Nonaka (1994) most influential model of organizational knowledge creation (Figure 2) is still appropriate; it explains the creation of organizational knowledge as a cyclical process about continuous transfer, combination, and conversion of the different types of knowledge (implicit and explicit knowledge), as users practice, interact, and learn. Through this model, he states that the process starts at an individual level and it

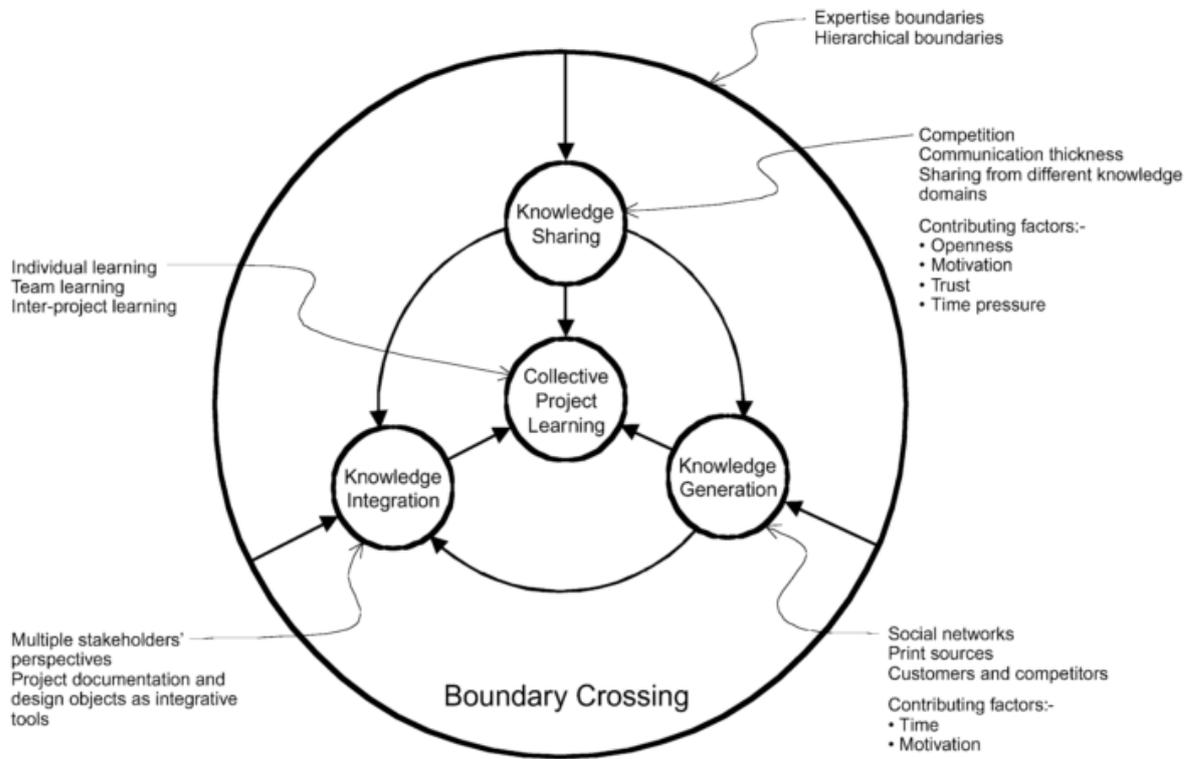
can reach inter-organizational levels. In the individual level, there's an accumulation of implicit knowledge obtained by performing several tasks. The sharing of tacit knowledge is done through acts of socialization with other individuals and consequently occurs a combination of the exchanged knowledge with the existing knowledge in order to create new knowledge. The process of knowledge conversion on a wider scale amplifies the ideas and knowledge from individuals to other groups and individuals in the organization, and crystallizes knowledge as part of the knowledge network in the organization. This transforms individual knowledge into collective knowledge. Four models of knowledge conversion were identified:

<p><b>1. Tacit to Tacit (Socialization)</b></p>	<p>This dimension explains Social interaction as tacit to tacit knowledge transfer, sharing tacit knowledge through face-to-face or share knowledge through experiences. For example, meetings and brainstorm can support this kind of interaction. Since tacit knowledge is difficult to formalize, it can be acquired only through shared experience, such as spending time together or living in the same environment. Socialization typically occurs in a traditional apprenticeship, where apprentices learn the tacit knowledge needed in their craft through hands-on experience, rather than from written manuals or textbooks.</p>
<p><b>2. Tacit to Explicit (Externalization)</b></p>	<p>Between tacit and explicit knowledge by Externalization (publishing, articulating knowledge), developing factors, which embed the combined tacit knowledge which enable its communication. For example, concepts, images, and written documents can support this kind of interaction. When tacit knowledge is made explicit, knowledge is crystallized, thus allowing it to be shared by others, and it becomes the basis of new knowledge.</p>
<p><b>3. Explicit to Explicit (Combination)</b></p>	<p>Explicit to explicit by Combination (organizing, integrating knowledge), combining different types of explicit knowledge, for example building prototypes. The creative use of computerized communication networks and large-scale databases can support this mode of knowledge conversion. Explicit knowledge is collected from inside or outside the organization and then combined, edited or processed to form new knowledge. The new explicit knowledge is then disseminated among the members of the organization.</p>
<p><b>4. Explicit to Tacit (Internalization)</b></p>	<p>Explicit to tacit by Internalization (knowledge receiving and application by an individual), enclosed by learning by doing; on the other hand, explicit knowledge becomes part of an individual's knowledge and will be assets for an organization. Internalization is also a process of continuous individual and collective reflection and the ability to see connections and recognize patterns and the capacity to make sense between fields, ideas, and concepts.</p>

**Table 1 - 4 models of Knowledge Conversion (Adapted from Nonaka, 1994)**

For the author, learning can be related to the internalization process which is but one of the four modes of conversion required to create new organizational knowledge. He explains that *“taken by itself, learning has rather limited, static connotations whereas organizational knowledge creation is a more wide-ranging and dynamic concept”*.

In the perspective of projects as multidisciplinary project teams, Fong (2003) presents an updated model of knowledge sharing, based in the Nonaka's one (*Figure 3*). A significant finding provided by his study is that the collaborative nature of multidisciplinary project teams is essential to create new knowledge and project team members from different knowledge domains are more likely to discuss and share information and knowledge. As he states: "*with a traditional focus on professional specialization, many facility projects may be managed with tasks being executed in parallel or in sequence, or by certain project team members in isolation. This is often counter-productive when projects are so designed that the success of creating new knowledge among diverse disciplines may suffer, with optimal value possibly not achieved*". He proposes a model of five processes of knowledge creation, including boundary-crossing, knowledge-sharing, knowledge generation, knowledge integration and collective project learning. Project teams need to cross boundaries related with the different professional disciplines and hierarchical divisions before genuine work or pertinent knowledge creation could occur. This boundary-crossing is crucial because otherwise team members could focus simply on their own disciplinary work without due regard for or collaboration with other disciplines.



**Figure 3- The interrelationships between multidisciplinary knowledge creation processes (Fong, 2003)**

### **1.3.2. Knowledge-Sharing mechanisms in Project-Based Organizations**

To enable effective sharing of knowledge across projects, knowledge-sharing mechanisms should be adopted, as the means by which individuals access knowledge and information from other projects.

We adopt Boh (2007) definition of knowledge-sharing mechanisms in PBO as “the formal and informal mechanisms for sharing, integrating, interpreting and applying know-what, know-how, and know-why embedded in individuals and groups that will aid in the performance of project tasks”. According with several authors (Hansen, Nohria, and Tierney 1999; Boh 2007; Liebowitz and Megbolugbe 2003 and others) knowledge sharing mechanisms can be analyzed upon a “codification versus

personalization” dimension, which distinguishes between mechanisms that enable the sharing of codified (i. e. explicit) knowledge *versus* tacit knowledge.

Codification is a good mechanism to store large amounts of knowledge and to create an organizational memory, because knowledge is carefully codified and stored in databases and documents, where it can be easily accessed and used by employees in the company. The richer the medium for communication, the better it enables the customization of information to suit the context and the more it enables interactions to seek clarification and aid further reinterpretation of the knowledge. Knowledge-sharing mechanisms are, in this perspective, the means of a “people-to-document” approach: it is extracted from the person who developed it, made independent of that person, and reused for various purposes. This approach allows many people to search for and retrieve codified knowledge without having to contact the person who originally developed it (Hansen, Nohria, and Tierney 1999).

On the other hand, by using personalization mechanisms, knowledge will be closely attached to the person who developed it and shared mainly through direct person-to-person contacts (Boh 2007). ICT tools are used to help people to communicate their knowledge, and not to store it, and organizations focus on dialogue between individuals, not knowledge objects in a database, transferring knowledge in brainstorming sessions and one-on-one conversations (Hansen, Nohria, and Tierney 1999). People will scan documents in order to get the crucial information in a particular area and to find out who has done work on a topic, and then approach those people directly.

Basically, in the codification strategy, managers need to implement a system that is much like a traditional library – it must contain a large cache of documents and include search engines that allow people to find and use the documents they need. In the personalization model, it is more important to have a system that allows people to find other people (Hansen, Nohria, and Tierney 1999).

The decision to use whether a codification or a personalization strategy depends on the organizational strategy and characteristics. But most organizations are currently using a combination of both approaches to knowledge management solutions as part of their enterprise-wide knowledge management strategy (Liebowitz and Megbolugbe

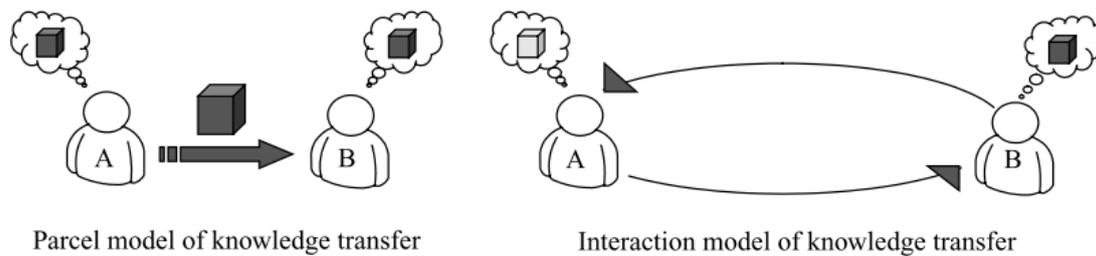
2003). In fact, Hansen, Nohria, and Tierney (1999) emphasized that effective firms excel by predominantly focusing on using either the personalization or codification mechanism for knowledge sharing, and using the other one in a supporting role. What determines which set of mechanisms to focus on depend on the task routineness of the organization, or the nature of their business. They stated that a codification strategy is more suitable in predominately routine environments (i.e. a company which provides a standardized product or solution) because it would leverage the ability to reuse the organization's knowledge, since they are dealing with similar problems over and over again. On the other hand, a personalization strategy is more adequate to organizations conducting tasks or encountering problems that are more unique in nature (Boh 2007) and that do not have clear solutions at the outset; hence they benefit more from personalization strategies, which allow them to engage their colleagues in discussions to seek a highly customized solution to each unique problem.

### **1.3.3. Organizational Learning in Project-based Organizations**

Knowledge creation is closely related with the concept of organizational learning. As knowledge is created and captured, learning takes place and the knowledge is hopefully applied and embedded within individual and organizational processes. Following this, a learning organization is "*an organization where creating and using knowledge to enhance competitive advantage occurs*" (Calcantone et al., 2002 quoted in Mishra and Bhaskar, 2011). Organizational learning aims at resulting in innovation, in which people continuously improve their capabilities, working together in order to make up for deep personal modifications, as they constantly questioning their mental models and create safe environments for others to do the same (Tomaél, Alcará, and Di Chiara 2005). The learning effect will create new knowledge which will then cycle through the data-information-knowledge-process transformation and iteration (Liebowitz and Megbolugbe 2003).

Despite a lack of agreement on a definition perspective, organizational learning generally follows three broad perspectives. The cognitive one is mainly concerned in how the organization gains and possesses knowledge and focused on the knowledge itself. The behavioral perspective focus in seeing a change in organizational actions or behavior as a result of learning. Lastly, in the sociological perspective, meaning and actions and learning (both individual and organizational) are a result of the

conversations and interactions of individuals within their socio-cultural settings, or, in simpler words, their collective and interpretive social practice. This social constructivist perspective provides a challenge to the traditional idea that learning occurs only within the heads of individuals, or in organizational systems and structures (Sense 2011). As an example of this social interaction affecting the learning process, Wilkesmann and Wilkesmann (2011) also explain how knowledge cannot be transferred intact because learning is an active process of constructing knowledge in the receivers mind; therefore, the knowledge which person A provides is never the same knowledge that person B obtains (*Figure 4*).



**Figure 4 - Interaction Model of knowledge transfer (Wilkesmann and Wilkesmann 2011)**

Organizational learning in project-based organizations commonly refers to the process of making “*newly created project-level knowledge available to the organization as a whole by sharing, transferring, retaining, and using it*” (Bartsch, Ebers, and Maurer 2012). While projects are where knowledge creation takes place, the overall process of learning in project-based organizations involves the subsequent transfer, retention and use of this knowledge within the project-based organization as a whole.

While Project Management early research was mainly focused on the achievement of individual project goals (Turner 2010), more recent literature points out the organizational learning as a key performance driver in project-based organizations (Blindenbach-Driessen and Van den Ende 2006) and as very relevant to the project success (Reich 2007). Organizational learning becomes a crucial performance driver in project-based organizations because previous projects present valuable experiences that could be applied in similar future projects or even generate

new knowledge about the organization's technology and market base that could lead to new business opportunities.

Organizational learning in project-based organizations can relate with many different outcomes, but it seems to exist three knowledge domains which are particularly significant with regard to the performance of project-based organizations. They are: entrepreneurial, technical and Project Management knowledge (Bartsch, Ebers, and Maurer 2012; van Donk and Riezebos 2005). Entrepreneurial is restricted to acquisition and learning about market conditions, as knowing its customers and competitors in order to find new market opportunities. Technical knowledge relates with products features and core technologies capabilities which enable the firm to stay up-to-date in the state-of-the-art developments in their field. Lastly, Project Management domain knowledge comprises the know-how and skills on Project Management techniques and real experience in conducting and managing projects, which improves the development of new projects by conducting them more efficiently and effectively.

Projects are highly dependent on information but they present what some authors call a “learning paradox”. Bakker et al. (2011) explain that “*on the one hand, through their transience and inter-disciplinary nature, project ventures are likely to be very suitable for creating knowledge in the context of its application. On the other hand, however, the temporary nature of projects by the same token seems to inhibit the sedimentation of knowledge, because when the project dissolves and participants move on, the created knowledge is likely to disperse*”. Difficulties in learning from projects arise due to this unique and irregular nature of projects which creates some barriers that hamper the knowledge transfer from projects to the organization as a whole.

Barriers are mostly related with the temporary and local nature of project work, because the team works in some kind of autonomous unit from the other colleagues from outside the project, and lacks opportunities to exchange experiences and knowledge. Also, project teams may have little motivation to make their knowledge available across project boundaries, because they may not fully understand the benefits of it, and also doubt that learning experiences and knowledge of a specific project can

be applicable and effective beyond the context in which they were generated (Bartsch, Ebers, and Maurer 2012).

In line with the different approaches of knowledge-sharing mentioned above, Prencipe and Tell (2001) refers to three types of learning processes, namely experience accumulation, knowledge articulation and knowledge codification. Experience accumulation is based on the assumption that organizational learning relies on historical experience and is stored on routines. Knowledge articulation means that members of the organization discuss knowledge by dialoguing and reflecting about it. Lastly, knowledge codification, as an extension of articulation, makes knowledge external and visible, by being written somewhere and codified for instance in manuals and procedures. They developed a  $3 \times 3$  matrix to categorize the various project-to-project learning mechanisms in project-based organizations and the main mechanisms adopted by them to accumulate experience, and to articulate and codify knowledge at the individual, project (or group) and organizational levels (*Figure 5*). The analysis of project-to-project learning mechanisms enables a detailed assessment of the type of approach that firms adopt to project-to-project learning.

Level of analysis	Learning processes		
	<i>Experience accumulation</i>	<i>Knowledge articulation</i>	<i>Knowledge codification</i>
Individual	<ul style="list-style-type: none"> <li>• On-the-job training</li> <li>• Job rotation</li> <li>• Specialisation</li> <li>• Re-use of experts</li> </ul>	<ul style="list-style-type: none"> <li>• Figurative thinking</li> <li>• “Thinking aloud”</li> <li>• Scribbling notes</li> </ul>	<ul style="list-style-type: none"> <li>• Diary</li> <li>• Reporting system</li> <li>• Individual systems design</li> </ul>
Group/Project	<ul style="list-style-type: none"> <li>• Developed groupthink</li> <li>• Person-to-person communication</li> <li>• Informal encounters</li> <li>• Imitation</li> </ul>	<ul style="list-style-type: none"> <li>• Brainstorming sessions</li> <li>• Formal project reviews</li> <li>• De-briefing meetings</li> <li>• Ad-hoc meetings</li> <li>• Lessons learnt and/or post-mortem meetings</li> <li>• Intra-project correspondence</li> </ul>	<ul style="list-style-type: none"> <li>• Project plan/audit</li> <li>• Milestones/deadlines</li> <li>• Meeting minutes</li> <li>• Case writing</li> <li>• Project history files</li> <li>• Intra-project lessons learnt database</li> </ul>
	Organisational	<ul style="list-style-type: none"> <li>• Informal organisational routines, rules and selection processes</li> <li>• Departmentalisation and specialisation</li> <li>• Communities of practice</li> </ul>	<ul style="list-style-type: none"> <li>• Project manager camps</li> <li>• Knowledge retreats</li> <li>• Professional networks</li> <li>• Knowledge facilitators and managers</li> <li>• Inter-project correspondence</li> <li>• Inter-project meetings</li> </ul>

**Figure 5 - Inter-project learning mechanisms (Prencipe and Tell 2001)**

Organizational learning is also much related with the organization's culture, i.e., all the practices, values and assumptions that the members of an organization share, which are holistically and socially constructed (Ajmal, Takala, and Kekäle 2008). An awareness of the organizational culture directly influences the success or failure of any learning strategy, also because, preferentially, learning should become a natural process in the organization. In order to do so, we must connect with and comprehend all the particularities of a company's culture which guides and motivates people, and it is important that its members are able to identify and recognize its tacit assumptions and beliefs in order to gain a better engagement with the learning process. In project-based contexts, this is highly complex because each project relies on people from different departments, fields or disciplines, bringing their own ways of working and different cultures which can be antagonizing with the others. That's why some authors point out the need of a strong directional culture, by synthesizing the existing cultures, which, on the other hand, requires strong mechanisms for cooperating and communication during the project execution (Ajmal, Takala, and Kekäle 2008). Here, the project manager will have a major role in balancing all this different variables by creating a project culture that makes easier the prosecution of the project goals and results and, consequently, contributes for a better project performance.

## 2. Research design

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This chapter presents the research design used to collect and analyze data from the two independent studies performed.

For this work we consider a multi-method approach, since we will use 2 different and independent methodologies:

- **Study A** – exploratory interviews with project managers and teams were conducted. This was done to gather clear insights about how Portuguese Project-based organizations deal with Information Management in projects and how they disseminate project knowledge to the organization as a whole;
- **Study B** – an action research study in INESC TEC was performed. This was done to empirically analyze the main Information Management strategies and choose and apply knowledge-sharing mechanisms in order to disseminate project knowledge to the organization as a whole.

These 2 studies are independent but complementary. The first one will bring us some generic but more realistic insights about how Portuguese organizations currently manage information and share knowledge from their projects and how learning is integrated within the whole firm. The second one will provide an in-depth study about how project knowledge in INESC TEC is managed and shared, and provide meaningful recommendations on how to improve learning across projects. Therefore, the first study aims at synthesizing what literature about those matters already told us, and also contribute to a better understanding and preparation for the second study, as we will become more aware of the real concerns and worries of project managers and teams “in the real world”.

Both studies intend to fill the gap in the literature about Information Management, knowledge organization and within the more specific fields of knowledge sharing and learning in projects, with regard to Portuguese contexts. Study 1 provides an overview of Portuguese contexts, since the literature concerning those subjects has not yet been explored here. Study 2 intends particularly to develop some real actions in

an organizational context (INESC TEC) with the aim of collaborating with its members, improve Information Management, knowledge sharing and learning from projects.

## 2.1. Study A

First study consists in some exploratory interviews with project managers and top management teams of Portuguese project-based organizations. This first study aims at specifically answer to the first research goal developed in the beginning of this dissertation: ***G1: Characterize how current Portuguese Project-Based Organizations manage project information and share project-resulting knowledge in the overall organization.*** By doing so, we will focus in the following tasks which determine our course of action:

- **T1.1:** Characterize how PBO manage information inside projects;
- **T1.2:** Characterize how PBO disseminate knowledge across projects;
- **T1.3:** Identify the main problems in learning from projects.

To achieve this goal, open interviews were performed in order to obtain the main concerns and opinions of different project managers and teams in Portuguese contexts. Here, it is important to mention that those interviews were made under the scope of a R&D project which was being developed in INESC TEC at the time. The project was related with Project Management maturity assessment in Portuguese organizations<sup>3</sup>. By integrating the team who has assessed those companies, we get the opportunity to gather an overall perspective about the way information is managed, knowledge is shared and the organizational learning occur, concerning their projects.

*Table 2* shows the data concerning the interviews performed within this study.

Company	Type	Number of interviewers			
		Management team	Project Managers	Project Team Members	TOTAL
C1	Research	3	5	3	11

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<sup>3</sup> Because of confidentiality issues, we cannot reveal the companies identity neither transcribe the interviews performed, since they were embedded within the face-to-face questionnaires the companies had answered for the purpose of that project.

	Institute				
C2	SW development Company	2	5	3	10
C3	Consultancy company	2	6	3	11

**Table 2 - Type of Companies and number of interviews**

As we can see, our scope of intervention covered top management teams, project managers and project team members. This three-layer interview design was planned to gather data on the same topics from different organizational roles in the firm. A similar approach was followed by Prencipe & Tell (2001); they also chose a three-layer interview design, interviewing representatives at three different hierarchical levels in order to analyze and identify the typology of learning mechanisms that characterized each level.

The initial insights provided by these interviews intended to show how Portuguese project managers organize and manage project information, how they share knowledge and if they consider that their tools and techniques are contributing to the organizational learning from the projects they perform. Since the literature regarding the issues this dissertation is dealing with is still quite small (and inexistent in the case of specific Portuguese contexts), we believe that the data collected through these interviews will allow to support or to refute results from the literature. Also, it allowed us to better contextualize and focus the second study.

The questions we wanted to be answered were the following<sup>4</sup>:

1. *How project teams usually collect and share information?*
2. *In your opinion, what are the main problems regarding managing information in projects? Why do you think they happen?*
3. *Would you say that your organization is learning from the projects that are made there? How?*

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<sup>4</sup> Since the project had a very heavy and structured questionnaire to be answered, many times, by answering to such questionnaire, interviewers have provided us the answers we wanted to have, according with the developed questions. When that didn't happen, we asked directly the questions, in order to get the inputs we wanted for the purpose of our dissertation.

## **2.2. Study B**

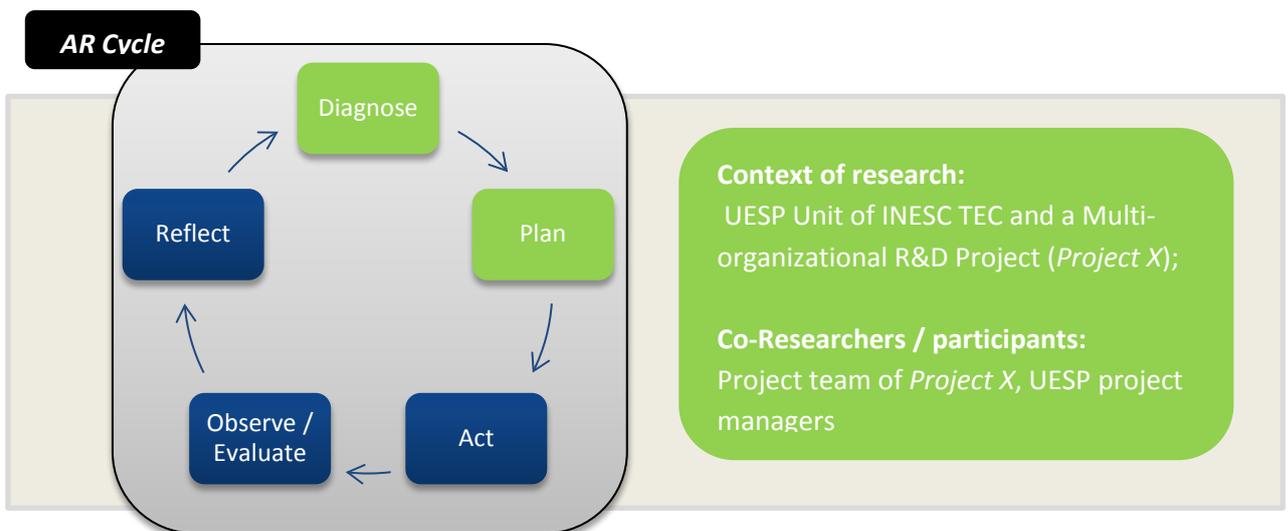
The second study consisted in an in-depth study in INESC TEC that analyzed empirically the main information and knowledge management practices and problems in projects of an organizational unit - UESP. In the scope of Information Management we analyzed, under a specific project, the ICT tools used, the content and document management rules, and the information architecture (i.e., how information was organized and classify). We also examine, outside the project, how the knowledge sharing mechanisms are used to disseminate project knowledge in UESP. We wanted to understand how these strategies could lead to a better learning from projects, since, as the literature and also our practical knowledge about the organizational context already told us, learning in project contexts can be very difficult.

This study applied the principles of Action Research (AR). It consists in a holistic approach to problem-solving, rather than a single and monolithic research method (R. L. Baskerville 1999), where knowledge is acquire by working in a context of action and where people try to work together to address key problems in their organizations. Although action research studies have gained only limited attention in the literature related with our specific dissertation topics, it has increased in importance for information systems toward the end of the 1990s, and since then several case studies have been made based on this research approach (R. Baskerville and Pries-heje 1999). We considered this way of researching very appropriate to our goals, mainly because we have to deal with a real situation with real problems that we intend to analyze and solve in a way that people could rapidly apply and learn with the actions performed. More than just observe and bring recommendations for the problems of Information Management and knowledge sharing in UESP, our main purpose was to make a real contribute based on our acquired knowledge about the subjects. Also, we wanted to have our participants closely involved within this research, as *“people learn best and more willingly apply what they have learned, when they do it themselves”* (O’ Brien 2002).

Within an action research project, communities of inquiry and action *“evolve and address questions and issues that are significant for those who participate as co-researchers. Typically such communities engage in more or less systematic cycles of*

*action and reflection: in action phases co-researchers test practices and gather evidence; in reflection stages they make sense together and plan further actions. And since these cycles of action and reflection integrate knowing and acting, action research does not have to address the “gap” between knowing and doing that befuddles so many change efforts and applied research” (Reason and Bradbury 2008).*

Action research typically follows a cyclical process. According with R. L. Baskerville 1999 and O’ Brien 2002, we performed 1 cycle with 5 steps: diagnose, plan, act, observe and reflect. The cyclical nature of this approach intended to provide fast conclusions and mainly the continuous improvement of Information Management practices and a better sedimentation of knowledge in the organization. Given the limited duration of our study, for the purpose of this dissertation, we only addressed the diagnose and plan phases, as illustrated in *Figure 6*. Detailed information about the Action Research Approach and phases can be accessed in *APPENDIX 1*<sup>5</sup>.



**Figure 6 - Action Research Model in UESP (adapted from R. L. Baskerville 1999)**

<sup>5</sup> As explained in *APPENDIX 1*, since the limited duration of our study, for the purpose of this dissertation, we will only address to the diagnose and plan phases, as illustrated in *Figure 6*. We also describe the joint reflection with our co-researchers, as an ongoing task during the whole process.

The choice of using Action Research is also related with the current author's role in INESC TEC, as her everyday tasks are about taking care of informational and content management issues of some UESP projects (i.e.: maintaining templates for the use of project teams, managing the ICT platforms of different projects, etc.). These tasks were closely related with a recently created Project Management Office (PMOffice), where the author started collaborating when arriving to the institution, 2 years ago<sup>6</sup>. According to this, a double advantage is considered when choosing Action Research. Firstly, it allows the investigator to interact closely with a specific project team (related with the observation of a specific project - *Project X*), by integrating meetings, listening and registering their concerns about the organization of documentation and collaboratively introducing improvements in the ICT tools and techniques used, for a better performance of Information Management and knowledge sharing. For instance, concerning action related with *Project X*, since the author was already collaborating within the project (in the scope of the tasks explained above), her presence was not envisaged as an unnatural one from the other participants, which can happen when we are performing participant observation. Secondly, as some tasks performed by the author could also improve Information Management in many other projects, eventual recommendations and changes proposed within this study will be envisaged as natural contributes resulting from her daily work at UESP; therefore its members will be more willing to accept eventual new contributes. This is a crucial aspect of this study and surely what makes it richer and unique: the ability to analyze the everyday reality of such a complex environment like this one, with real problems that we intended to rapidly solve in a way that people could contribute, with their own insights, and quickly apply and learn with the actions performed, as "*people learn best and more willingly apply what they have learned, when they do it themselves*" (O' Brien 2002).

By applying action research, participants were, then, considered as co-investigators of this study (as showed in *Figure 6*). The principle of collaborative resource in action research presupposes that "*each person's ideas are equally*

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<sup>6</sup> A PMOffice is an "*organizational body or entity assigned various responsibilities related to the centralized and coordinated management of those projects under its domain*" (Aubry, Hobbs, and Thuillier 2007). The primary goal of the PMO was to provide updated documentation guidance, methodologies and standards on the practice of Project Management (including improving projects content management).

*significant as potential resources for creating interpretive categories of analysis, negotiated among the participants. It strives to avoid the skewing of credibility stemming from the prior status of an idea-holder. It especially makes possible the insights gleaned from noting the contradictions both between many viewpoints and within a single viewpoint” (O’ Brien 2002).*

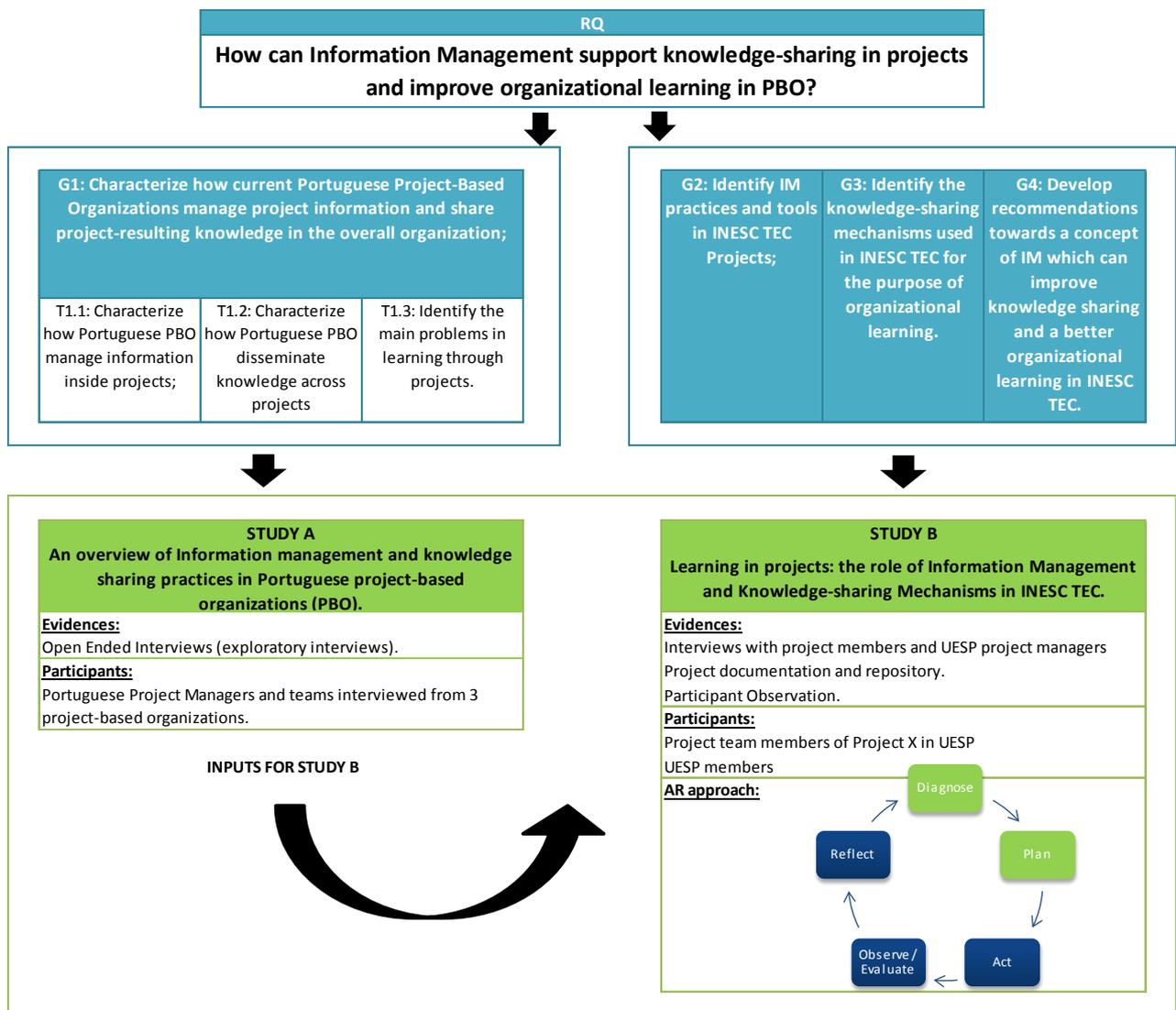
Action research allows for several different research tools to be used as the project is conducted, as it is more a holistic approach rather than a single method to collect data (O’ Brien 2002; R. L. Baskerville 1999). Methods used are generally common to the qualitative research paradigm. Following Yin (2003) recommendations, our evidences relied on three main sources, which were identified with detail in the Action Research Protocol (*APPENDIX 1*). The first was documentation, where we analyzed project-specific documentation (Project application, technical and management reports, and minutes of project meetings) and other means exchanged by the project team (emails and working documents) essentially to corroborate and augment evidence from other sources. We also performed interviews<sup>7</sup> to project team members and INESC TEC project managers, which intended to gather the opinion about the actions undertaken (Documented in *APPENDIX 2*). Finally, and related with the direct and participant observation performed, a research journal was written by the author, in order to help keeping a detailed history of the research process as it unfolds, and register her thoughts and conclusions about some individual conversations with her co-investigators. Evidence for the action research study was collected over a period of 7 months.

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<sup>7</sup> For the interviews data analysis it was used the qualitative analysis software NVivo.

### 3. Empirical studies

This chapter presents and discusses the results of the two independent studies performed. *Figure 7* summarizes the methodology followed and explained in the previous chapter and the relation with the initial research question and generic goals of this dissertation.



**Figure 7- RQ, goals and respective empirical studies performed**

As we previously said, Study A provides an overview of the characteristics of Information Management in Portuguese Project-Based Organizations in order to complement the literature analysis of the related topics, and allowing us to be well prepared for the second study.

Study B is an in-depth study about how project knowledge in INESC TEC is managed and shared, which will provide concrete recommendations about how to improve learning across projects in PBO. *Table 3* summarizes the specific goals and results of the AR cycle performed in Study B.

Action goals and results			Research goals and results	
	GOALS	RESULTS	GOALS	RESULTS
<b>Contexts:</b> <ul style="list-style-type: none"> <li>• <b>Project X (context of a project execution)</b></li> <li>• <b>UESP (context of learning across projects)</b></li> </ul>	<ul style="list-style-type: none"> <li>• To define requirements for the IM improvement during a project execution.</li> <li>• To define requirements for IM and knowledge sharing to improve OL across projects in UESP.</li> </ul>	<ul style="list-style-type: none"> <li>• A better understanding from UESP members about the importance of IM and knowledge sharing across projects</li> <li>• Components of an IM strategy to improve knowledge sharing and OL in UESP: specific tools, strategies and types of classification.</li> </ul>	<ul style="list-style-type: none"> <li>• To characterize the IM and knowledge-sharing issues and practices of a project-based R&amp;D context, during and after a project takes place.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of how multi-organizational R&amp;D projects manage information and share knowledge.</li> <li>• Knowledge of how project teams share knowledge across projects in an R&amp;D organizational context.</li> <li>• Recommendations on how to improve IM and knowledge sharing in PBO.</li> </ul>

**Table 3 - Action and Research goals and results**

### **3.1. STUDY A – An overview of Information Management and knowledge sharing practices in Portuguese project-based organizations (PBO)**

Study A intended to know more about how Portuguese project managers and teams are facing knowledge sharing across projects and how they promote or develop organizational learning based on project-made knowledge. By doing exploratory interviews in 3 Portuguese project-based organizations in different fields, we gathered clear insights about how these organizations are documenting project information, how is it codified, organized and shared to other people in the company's ICT platforms and how new project teams can learn through information of previous projects. The following sections summarize the findings of this first study.

#### **3.1.1. Information Management and knowledge-sharing**

Information Management in project-based organizations was analyzed mostly with the purpose of acknowledging and recognizing how information created during a project execution is organized, stored and shared with others. The main impression within our study is that Information Management practices in PBO are still very dependent on the type of projects the company is developing. Furthermore, it was not recognized, in any of the interviewed companies, a standardized and uniform culture of Information Management in projects within the whole organization (and regardless of its different units or departments). Each project manager seemed to have his own way of managing project documentation and to choose the ICT tools he considered more convenient. Mostly, ICT tools were the ones already used in regular tasks or in previous projects (unless the client imposes the use of some specific tool) and were based in common tools like Dropbox (or other ways of shared folders), Google Docs, email, etc. Creating new project documentation was also made ad-hoc, and only in some cases the reuse of contents or document templates was considered. However, in each one of the PBO's it was obvious and stated clearly (especially during interviews with the Top Management Teams) a concern about walking towards a more uniform and standardized way of managing projects, particularly concerning the management of project-made documentation and information. As some of them have stated, this will

allow to reduce costs of replicating the same project documents or creating information that was already developed in the past.

When it comes to the use of ICT tools, companies C1 and C3 use shared folders for archiving documentation of projects, and each project manager is responsible for the management of the folders structure and content organization. In terms of standardization practices, templates were created for some project managers, but in a global perspective, those standardization attempts are not transferred to the overall organization. Company C2 was the only one using in a regular and standardized basis specific project platforms for Issue & Project Tracking, and project documentation is managed inside this platform, associated to each project. There were also some guidelines of how to write, for instance, an initiation project document or which type of information should rely on a time report document, which allowed an uniformization of language and contents, because everyone was following those guidelines. In this particular company there was a major use of Google Docs and Skype, which, although they are user friendly tools (particularly because many communications with clients were made with them), the information retrieval was quite hard – for instance, if some decision was written only in a Skype conversation, if someone needed to find that precise statement would have troubles to finding it. Nevertheless, tools like Google Docs or Google Calendar were considered useful, in this specific company, mostly because they dealt with many foreign customers with many different ways of working but, since they all knew Google tools, communication was in this way facilitated. Information Management was here supported by the content creation guidelines that supported the writing of project contents, but mostly was characterized by being very flexible. This way, they didn't see any need for using other complex or specific project or document management tools, even though they knew that recovering information was very hard – they were more concerned about the communication requirements and in delivering fast results and so, eventual IM or KS improvements were put in second place. Some of them have even considered a waste of time and resources the idea of register in a more structured way what was being done in every project: *“There is no sense doing that, because projects are not standard, each project is unique and the technical developments that we have in every one of them implies a lot of “mental” work. It's very complex”* (Team member of C2). It was very clear in this company that

they were highly results-oriented “*and that ends up by overlapping the existent procedures*”. (Project Manager of C2)

Generically, we can conclude that Information Management in the 3 Portuguese PBO's was made mostly ad-hoc, according with the project manager: we stated that the organizational culture and experience of who's managing the project clearly impact the way the project documentation is managed. Project managers with stronger principles and competences (certified, for instance) in Project Management tend to better uniformize the ways of creating, communicating and sharing project information. Here we identify somehow a connection between Project Management and Information Management maturities – companies which are more sensitive and aware of Project Management practices and consequent benefits of this management, are more likely to have projects which are more organized and standardized concerning Information Management processes.

We also want to distinguish an interesting attempt of company C3 to create some Information Management principles for project contents, with the specific purpose of. At the time, we had the chance of talking with them, they were in the process of implementing an integrated platform with Project Management, document management and knowledge management features. Although this platform was in a very preliminary phase and only in a small unit of the company, we could state that the platform reflected most of the main concerns related with Project Management (by allowing mechanisms for managing project performance, deadlines, team and time management and reports, etc.), Document Management (through a set of features related with all the informational lifecycle of creating, managing, archiving, publishing and disseminating information) and also Knowledge Management. This last one seemed to us an important input to the overall concerns about this subject we have previously identified – is was a some kind of up-to-date project knowledge base, organized with a hierarchy of themes (business areas, domains of work, type of project, among other tags). Here we identified a mature concern related with the way the information was stored and could be retrieved for the purpose of future projects – using several tags to organize information according with a list of controlled terms, and supported by a searching tool inside those themes or even the ability to navigate through the tags hierarchy. These features reflected a particular sensibility to the more

organizational issues of the information itself, necessary in order to provide a faster and more effective information retrieval, aiming at improving the capacity of reusing past information.

Within the more specific aspects of knowledge sharing and dissemination across projects, and except the particular use of the integrated platform we already talked about (in company C3), knowledge sharing is mostly oral and therefore following a personalization perspective. People talk with each other and share their thoughts or ways or working or of solving some specific problem and by doing so project-based knowledge is transferred. By doing so, project-based knowledge is not conveniently documented or organized in a way that can be easily used by the overall organization: *"If we are talking about Knowledge Management, it doesn't exist. There isn't, for instance, any repository of intellectual capital. If I want to reuse knowledge, I don't know where to look for, I only know WHO to look for!"* (Managing Director of C1). Information and knowledge is, therefore, inside people's minds and is shared by personal contacts. In some cases, when a project finishes, there is a lessons learned document which intends to reflect on the main difficulties and learning occurred during the project execution, in order that other people can be aware of those issues and, for instance, don't make the same mistakes. Nevertheless, it was never a standardized procedure. Therefore, knowledge ends up being much linked to people and to their social connections, and its sedimentation in more traceable and concrete means is not developed.

### **3.1.2. Main Problems in learning through Projects**

Related with the previous aspects identified above, the main and common problems we were able to recognize in the interviewed companies related with the process of learning through projects were:

- Knowledge is still too dependent on people and without a proper codification support. The main disadvantage of this is that when someone leaves the organization, such person takes the knowledge with him, and the organization loses an important informational asset;
- Lack of a period for reflection and collection of some meaningful lessons learned when a project comes to an end;

- Lack of specific and centralized platforms for managing the information created in projects – something like a PMOffice to manage project templates or apply and monitor the way information and project contents is being created, archived and shared, and also to share project knowledge across the organization;
- Lack of an integrated view of projects in the overall organization – people are not aware of which projects are going on and only the top management teams have that perception, but mostly for more management and strategic purposes. If people knew more about current or past projects they might be able to recover or reuse knowledge of those projects, which will contribute for a stronger knowledge sharing and learning;
- Lack of an organizational culture that encourages knowledge sharing – this observation is related with the fact some of team members reveal they were sometimes afraid of sharing this that went less good in a project.

The main significant conclusions related with this exploratory study are probably the differences between companies which, in one hand, reflect the differences among sectors. On the other hand, even inside a company – and this was observed in all the 3 interviewed organizations – differences emerged between projects from different departments or different project managers. Since projects are based in teams from different fields, with different ways of working and different behaviors, these dissimilarities are natural because a project manager, as the one responsible for assuring how the project will be undertaken (including what kind of tools will be used) will always impose his way of working (Fong 2003; Bartsch, Ebers, and Maurer 2012).

Also, we have confirmed that project teams are more concerned about delivering the project results in the planned deadlines and are not so worried with the way they are creating documents. This creates a barrier to a better IM by contributing to an information overload difficult to manage (Holzmann 2012; V. R. Santos, Soares, and Carvalho 2012). So, Information Management strategies for the purpose of the project execution and for knowledge sharing across projects should be able to guarantee that information is coherently created, archived, used and delivered with a minimum effort, and that people understand the benefits of sharing what they have

learnt. Those strategies should, therefore, adapt to the particularities of people, projects and the existing organizational culture, or else they might hamper the project goals.

Generically we can conclude that our exploratory study in the 3 Portuguese PBO interviewed have reflected the main issues and problems we have acknowledged during the literature review, concerning the management of information and sharing of project knowledge. In general, PBOs seemed to be aware of the importance of having coherent strategies for managing information and sharing knowledge across projects. Benefits of Information Management are, however, more visible and obvious in a long term perspective, which is something that PBO and project managers in general are not very concerned about; they are instead more focused on delivering results within the budget and deadlines demanded. The main barrier to the sedimentation of such strategies is, therefore, the nature of projects itself and the unpredictability and fastness that they usually combine. IM seems to have, then, a large path to cross in order to reach a more mature role in Portuguese PBO, to be in the scope of every Project Manager tasks within a project and, in a perspective of global knowledge sharing, within every organizational strategic objectives.

### **3.2. STUDY B – Learning in projects: the role of Information Management and Knowledge-sharing Mechanisms in INESC TEC**

Study B consisted in an action research study in INESC TEC in order to empirically analyze the main Information Management characteristics and knowledge-sharing mechanisms in projects and their contribution to organizational learning. Our main goal was to understand how Information Management strategies and tools can improve the performance of project activities, and also how those strategies should be related with a larger goal of knowledge creation and knowledge sharing, within a perspective of learning across projects.

Results (see *Table 3*) derived from the diagnose and plan phases of our AR cycle. They share the opinions and points of view gathered by direct observation, informal conversations and interviews (and supported by documentation analysis), which

allowed us, together with our co-researchers, to collect significant recommendations to change and improve the processes and tools of Information Management, knowledge sharing and organizational learning in UESP.

The following sections will describe the context of study and the main findings regarding Information Management and Knowledge Sharing in UESP.

### **3.2.1. Introducing the context – INESC TEC, UESP and *Project X***

INESC TEC - Institute for Systems and Computer Engineering of Porto - is a private non-profit association, created to act as an interface between the academic world, the world of industry and services and the public administration in Information Technologies, Telecommunications and Electronics. This study has occurred within one of its organizational units: the Manufacturing Systems Engineering Unit (UESP). Its areas of activity are related to Operations Management and Enterprise Information Systems applied to industrial companies and enterprise collaborative networks. The Unit conducts R&D in the following domains: Manufacturing (operations management, advanced information systems for industrial management, planning and control systems, and others), Logistics (supply-chain management systems, logistic systems, transportation, distribution and warehouse systems) and Operations Research (optimization methods, and Decision Support Systems). Besides the R&D projects, some consultancy projects are also developed with companies in the same identified areas. Today this unit has about 60 people, between researchers, PHD or Masters students, and consultants.

*Project X* – name adopted in order to assure confidentiality issues – is a multi-organizational R&D Project which has been partly funded by the Incentive System for Technology Research and Development in Companies (SI I&DT), under the Portuguese National Strategic Reference Framework, and EU's European Regional Development Fund. It is part of a larger Program<sup>8</sup> with the main goals of<sup>9</sup>:

- Developing a significant set of new equipment, systems and the respective support services that are technologically advanced, innovative and have a

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<sup>8</sup> PMBoK defines Program as a “group of related projects managed in a coordinated way to obtain benefits and control not available from managing them individually.”

<sup>9</sup> From *Project X* Application Document

large potential in several sectors of the industry, in both national and international markets;

- Developing the Portuguese manufacturing technologies sector and create an articulated network capable of gathering the resources and the necessary critical mass for the development and exploration of new systems, equipment and the respective support services, in a collaborative and cooperative way.
- Promote the articulation between this network and the national network of entities within the scientific and technological system, granting access to the sources that produce the science, technology and knowledge necessary to achieve the proposed challenges; and also promote the articulation between this cluster and a selected set of user sectors and companies.

Within this Program course of action, *Project X* had the specific purposes of developing tools to support the rapid development of simulation models for production systems, allowing these tools to be used in most companies, at the various stages of the life cycle of their production systems. In order to do so, the project relied in a large and multidisciplinary team of different entities, namely: R&D institutions, for the development of requirements, software companies for the technical development and a manufacturing company for the implementation of the created tools. *Project X* had the following constitution:

Partners	Type of Participation	Number of people involved in the project team <sup>10</sup>
Partner 1 (INESC TEC)	Project Management and Coordination Project technical team	5
Partner 2 (Manufacturing Company)	Project technical team	1
Partner 3 (R&D Institution)	Project technical team	1
Partner 4 (R&D Institution)	Project technical team	1
Partner 5 (R&D Institution)	Project technical team	2
Partner 6 (Software Company)	Project technical team	2
Partner 7 (Software Company)	Project technical team	1
<b>TOTAL</b>		<b>13</b>

**Table 4 - Project X constitution**

<sup>10</sup> It relates to the people more closely involved within the technical work and the Project Management work, and therefore the users of the ICT tools and actors of the project activities we will address later.

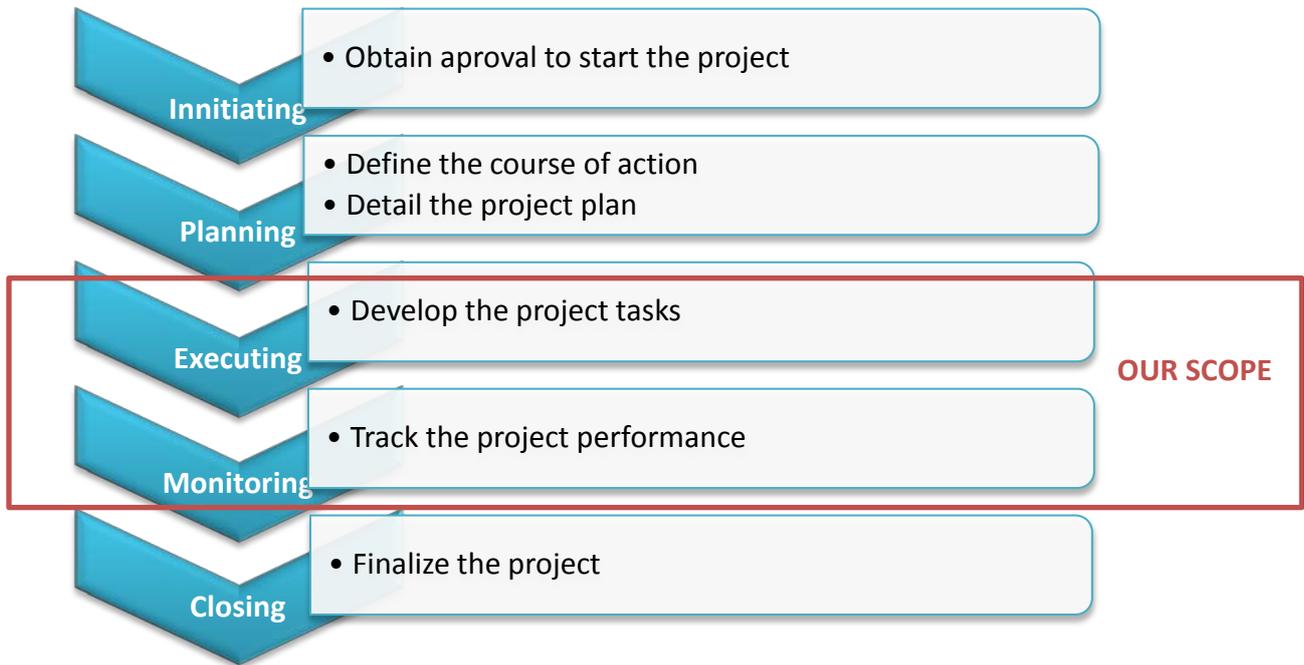
Members, as being from different regions across the country, adopted the use of videoconference meetings every week, and also some occasionally face-to-face meetings (usually every 6 months). *Project X* had the duration of 36 months; our intervention started about 2 months after it began and lasted for a period of 5 months.

### ***Project Management processes and type of contents***

Since the project was included in a larger program, the groups of processes regarding initiating and planning of Project Management were outside the scope of our investigation, mostly because they took place before our period of intervention and also in a higher level of the program. For instance, initiation processes related with obtaining proper authorization to start the project were made before the specific activities of *Project X* take place. (see *APPENDIX 3* for more details about the Project Structure). For the purpose of this study, we will only address the PM processes related with the execution and monitoring phases, since all the contents and information created during our intervention in *Project X* can be classified within this two categories (*Figure 8*). Monitoring includes the processes required to track, review and regulate the progress and performance and, in *Project X*, information about monitoring included, for instance, the project Gantt chart and progress reports. On the other hand, execution comprises all the processes performed in order to complete the work defined in the Project Management plan; contents relates with all the technical work that is made for the execution of the project objectives; where the real innovation takes place.

Following this drive, we considered two types of information, as follows:

- **Technical information:** relates with the execution phase of PM lifecycle, and includes all the information that codifies knowledge created and shared by team members within the project about the R&D developments.
- **Project Management information:** relates with the monitoring phase and comprises the information that codifies the good practices of Project Management and PMBoK about monitoring processes. PM information was created only by the project manager.



***Figure 8 – PM processes of Project X we addressed***

### **3.2.2. Information Management, ICT tools and knowledge organization in *Project X***

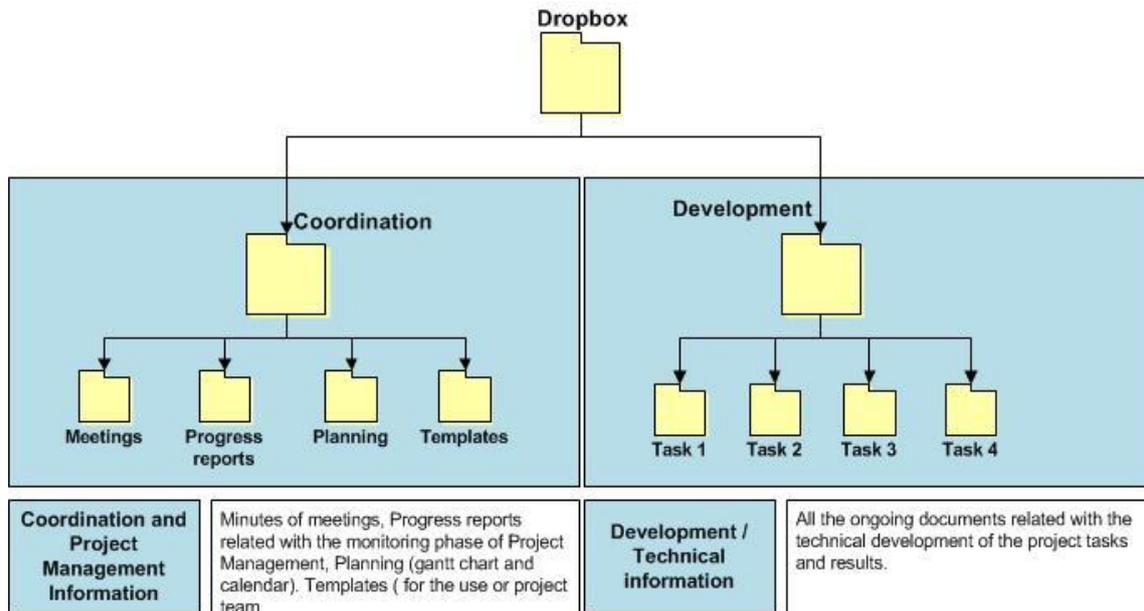
Next, we present the results of the action research study performed, specifically related with the subjects of Information Management and knowledge sharing mechanisms in *Project X*. As we said before, project activities were mainly developed within a strong collaborative environment, by using intensively videoconference tools to have regular meetings with the project team members. Since the project was divided in activities, members attended meetings related with the specific tasks where they were involved. Beside the technical work, the project manager and coordinating team of the project scheduled monthly coordination meetings in order to get the updated information about project performance and guarantee that it was following the initial planning (regarding the typical Project Management constrains of time, scope and quality). All the information created and produce by the tasks performed and all of these meetings was organized and stored in several ICT tools.

The main ICT tools used during the project execution and the IM rules that were developed in order to keep the information organized in *Project X* will be presented. Here, it is important to mention that we will address to Information and Communication Technology (ICT) tools in the context of projects as the “*comprehensive systems that support the entire life-cycle of projects, project programs, and project portfolios*” (Ahlemann 2009), most commonly known as Project Management systems, but also all systems in general that support Information Management, communication and publishing through projects, with the aim of sharing knowledge across the organization. ICT tools of *Project X*, therefore, comprise document management, content management, e-mail management, instant messaging, videoconference tools, Project Management systems and enterprise portals. We also address the document and IM rules and procedures as useful supporting tools which enable and guide the information processes.

### ***Dropbox***

Dropbox is a file hosting service that offers cloud storage, file synchronization and client software, which allows users to share folders on their computers and also access the content through the website or mobile applications. Dropbox was chosen as the main Information Management tool supporting the creation, storage and use of the technical document created within the project. Also Project Management information was stored in Dropbox, although it is important to mention that about 90% of documents in Dropbox were related with the technical work, and only about 10% were Project Management related.

Dropbox informational architecture was the following:



**Figure 9 - Content organization in Dropbox**

Dropbox reflected the 2 types of documents we already mentioned: Technical and Project Management. Coordination folders aggregate all the information regarding the coordination of the project, and produced by the project manager, mainly, Project Management documents (related with the initiating and planning phases of PM), and others), and other documents regarding the performance of the project. These folders were accessible by all project members and were mainly documents in *pdf* format. On the other hand, Development folders were organized by task and aggregate all the documents produced by the project team members during the execution work of the technical tasks. It was where the big volume of information relied.

### **Google Docs**

Google Docs was the platform used for collaborative writing within the project team members. Since every team member had a Google Account, the selection of this platform was very easy and consensual among the team. Team members used Google Docs to discuss, within the technical meeting, documents published online, where every member could immediately comment or edit the document, which has allowed a high level of collaborating in regard of the production of technical documents.

Google Docs was also used for the elaboration of the meeting minutes. Both technical and coordination meetings produced a minute, made online with the

cooperation of all the participants, which allowed the transcription of all the important decisions and conclusions of both technical and coordination scopes. Since we were dealing with a multi-organizational project, writing down all this information was considered crucial in order to compromise partners with the decisions made and also to maintain an accurate historic documentation of the project execution.

### **Google Groups**

Since it was useful to have a place where members could have some discussions on topics related with the project technical developments, it was created a Google Group. Most of the posts were made by the project manager and coordination team, and related to Information Management rules (how to organize documents, collaborating rules for creating documents, etc.) but also were discussed some technical-related topic. Since project meetings were very recurrent, this platform was not used very frequently (discussions occurred mainly during meetings). This justifies the low number of topics created we listed during our analysis.

Table 5 presents the main characteristics of the main ICT tools used during the project.

<b>ICT Tool</b>	<b>Main Features</b>	<b>Organization</b>	<b>Type of contents</b>	<b>Availability</b>	<b>Nr. of documents<sup>11</sup></b>
<b>Dropbox</b>	Repository of documents created within project technical activities; Repository of Project Management documents	Hierarchical folder structure, based on the project activities logic.	<b>Technical Documents</b> produced by team members; <b>Coordination Documents</b> produced by the project manager and coordination team	Project team members	About 500 documents
<b>Google Docs</b>	Collaborative creation of documents	-	Technical documents that were being developed by project team members in a close collaboratively way	Project team members	About 60 documents
<b>Google Groups</b>	Project-related topic discussion	-	Texts / discussions about project-related topics	Project team members	7 topics

**Table 5 - ICT Tools Features**

The first concern reported by project team members about the ICT tools used is that they are many, which makes the Information Management more difficult. In fact,

<sup>11</sup> In March 2013

some team members, when reflecting about it, point out the overload of ICT tools, “*We start having an overload of things [ICT tools] and it gets very difficult to manage all these things. Maybe it would be better to have only one thing*” (E1). Also, in Dropbox, where it was concentrated the most volume of project documentation, as the project evolved the information became overload and it was sometimes difficult to retrieve what the user needed: “*There’s a lot of information and sometimes it is difficult to find it*” (E1).

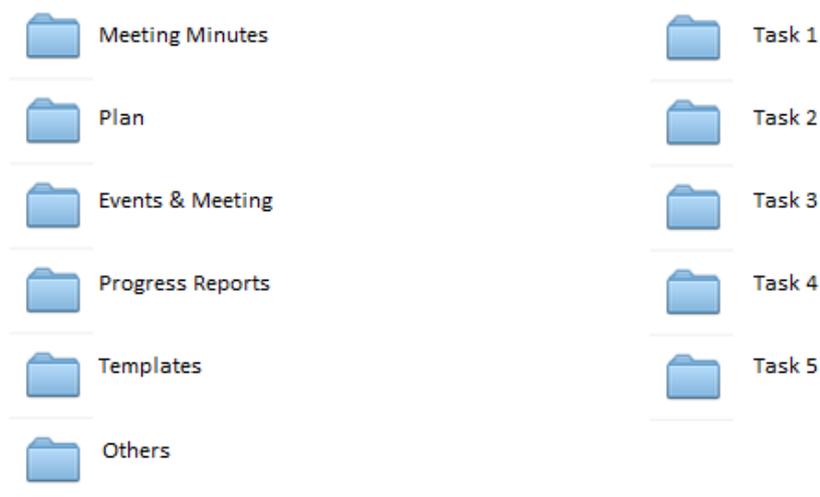
Nevertheless, project team seemed to be satisfied with the ICT tools used: “*we are talking about a large group of people disperse not only in our organization but also in the country, where communication is often difficult, so we should have something that restrict us concerning publishing documents, for instance with versions control and where we can find that version, and I think that is very important.*” (E2).

Dropbox, particularly, was an interesting tool mainly because it was a “familiar” way of managing documents and information; since it is basically a shared folder in everyone’s personal desktop, the learning period about the tool was quite small. Also, the main reason that justified choosing Dropbox was that all team members already were using it in their own organizations or for personal purposes. This is an important issue because, as we have already stated, projects are fast and result oriented; therefore project members don’t want to lose many time in learning how to use an ICT tool. This is increasingly important since project members came from different organizations, with different ways of working, therefore, it would be hard to find a platform that everyone already was using in their own environments. Also, another complex platform to manage information and contents created could create some resistance or opposition.

### ***Knowledge organization and classification***

Classifying the information produced and managed by ICT tools is of utmost importance specially for the purpose of retrieving it. Classification in digital environments is all about finding the right metadata or “label” for our object description; in the best case scenario classification should rely on tools that support browsing, navigation and retrieving and, to a more extend, the presentation of results

(Broughton 2006). Concerning the main project information repository – Dropbox – classification followed a simple hierarchy of folders, related with the project task structure (within the execution phase). Hierarchical classification was mainly based on the task division and document types, because all the participants were familiar with the tasks and work they needed to perform. Contrasting this with the perspectives of knowledge organization that we gathered during the literature review, this type of classification can be considered as “task specific” (instead of only domain-specific) since it reflects a specific project structure of tasks. Hence the “users” of our classification system were from multiple contexts and areas of study, it will be very hard to come up, in a short time, with a standard and a universally accepted classification which would reflect all their different requests of retrieval. The most commonly accepted organization was in fact the project structure itself, i.e. the different tasks, subtasks and related deliveries, and the document type (if it was a technical report, a PM progress report, a meeting minute, etc.). Therefore, the classification developed in Dropbox was based on a set of main “tags” or labels as follows in *Figure 10*. These labels were the first line of the hierarchy tree of folders; produced documents should fit under those folders or inserted inside specific subfolders created by the team members as the project was being developed and according with their specific needs at the moment.



**Figure 10 - Hierarchy folders (first level)**

Besides the classification of content within a task-driven organization of folders (related with the technical contents), other project-management contents were classified by type of document (as also presented in *Figure 10*. Labels (folders names) reflected the type of contents in a way that would be familiar for the users to know what was inside each folder.

Recovering the topics developed during the literature review, our task-specific classification intended to answer to what is called “Medium Knowledge Organization Problems (KOP)”; in fact documentation classification was aimed at being used by *“people with particular, similar interests, beliefs, positions, knowledge, expertise, etc. which can be known, understood, and articulated by those in charge of the collection or service”* (Hjorland 2008). Although it remains a basic knowledge organization method, classifying and organizing documents within this structure was considered useful by its users because all the activities were organized in tasks, and all the participants were aware of the tasks they needed to perform: *“since the project is organized by tasks, and folders also, it isn’t difficult to know the folders”* (E1). *“in the project I am working on a specific task and I know where I can find the documents created or developed under that specific task where I am working on.”* (E2). Also, we confirmed that project members are usually focused on immediate deliverables (Holzmann 2012); they needed to access information related with the tasks related with those results, so classification was faithful to that concern by allowing contents to be organized by task.

On the other hand, when reflecting about evolving for a more complex content management system, the answer was positive by some project members, what can be related with the overload of information and the need of a better retrieving system, for instance with a more powerful search tool (sometimes the task folders have an overload of documents that becomes difficult to find the right one).

### ***Document management***

Since we were dealing with a multiorganizational project, it was very important to develop and implement, since the very beginning, a set of document management rules to be followed by the project participants. Further studies have showed how difficult can be managing a multiorganizational project, due to factors like the different

skills, ways of working and organizational culture of its members. *Project X* can be considered complex because it includes all the factors mentioned: the number of participants, the diversity of skills and the uncertainty involved (V. R. Santos, Soares, and Carvalho 2012), which demand a high degree of collaboration and also the existence of different ICT technologies.

Document management rules intended to specially address the “*unstructured information*” (Detlor 2010), particularly documents created in MS Office utilities (which, in the case, were basically all the created documents). Since any document management system was used, the establishment of document management rules was intended, in the first place, to contribute for a uniform culture of collaborative work, where everybody, despite their individual and organizational backgrounds, could create, store and share information easily and by following common principles.

Document management rules were organized by the project manager and the information manager and shared with the other participants during meetings after what they were consolidated in a document or registered in the meeting minutes or by e-mail. Rules intended to uniformize document and folder designations to assure the versions control, authorship and document classification (which are normally crucial in such contexts – see also Santos et al., 2012). For instance, all documents produced within a specific task should have the task identification in the document designation. This kind of restrictions intended to make easier to find documents in the overload of information produced and to give some classification data about the document without the need of opening it (for instance, information about the document version, creator, related task or date). Also, in the beginning of the project, a set of templates were conceived in order to assure some coherence related with the documents created by the different users.

Document management rules were considered highly important for the project team members. Due to the information overload created within all the project tasks, uniformizing document designations and metadata (for instance, every documents followed versions and authoring control and update information) made the information lifecycle faster and easier – without this type of rules documents could get lost or lead to confusion about latest versions or who was the responsible for a specific version. Also, and contrary to the organizational contexts, implementing a complete document

management system in a project context will be difficult because of its particularities of limited duration, uncertainty of the information to produce and also the decentralization of the project team. So the rules needed to be adapted to the context, i.e., the ICT tools used, but in a way that will be easy for the users to remember them and to respect them. According with some team members, this was the main problem of document management rules: *“I think that [problems] are not particularly about its organization but mostly how people use that organization, because sometimes the rules are not followed. Because I think that the rules are not difficult to learn”* (E2). Communication those rules will then be an important task to the information/project manager, because *“sometimes rules are changed but member are not informed about that”* (E2). Also, not following the rules was mainly related with people’s laziness or lack of perception of the benefits of them, so a clear communication of rules since the very beginning could help the project members to compromise with them.

Since the collaborative nature of multidisciplinary project teams is essential to create new knowledge (and project team members from different knowledge domains are more likely to discuss and share information and knowledge) creating good document management policies helped to support and uniformize the (already dissimilar in nature) creation and share of knowledge. Further details about *Project X* Document Management rules in *APPENDIX 3*.

### **3.2.3. Knowledge-sharing mechanisms and Organizational learning in UESP**

Following we address the results particularly related with learning from projects and knowledge sharing mechanisms used in UESP which contribute to the dissemination of project-based knowledge across the organization. Conclusions relate with the diagnosis period about how knowledge is created and shared inside a project (*Project X*) and across projects and how people learn by sharing project-based knowledge in the project-based context of UESP. Accordingly with our research approach, we gathered some opinions obtained with interviews and individual conversations with *Project X* members and UESP members (both project managers and project team members of various projects).

### ***Knowledge sharing: Codification VS Personalization perspectives***

Literature review have showed us that, in order to enable effective sharing of knowledge across projects, organizations should adopt knowledge-sharing mechanisms, as the means by which individuals access knowledge from other projects. By adopting Boh, (2007) definition of knowledge-sharing mechanisms in PBO, as “*formal and informal mechanisms for sharing, integrating, interpreting and applying know-what, know-how, and know-why embedded in individuals and groups that will aid in the performance of project tasks*”, we will analyze and distinguish them upon a “codification dimension”, which enables the sharing of codified (i. e. explicit) knowledge, *versus* a “personalization dimension” related with tacit knowledge sharing.

Concerning the micro context of *Project X*, we intended to know how knowledge is created and shared through the project team, and by which type of knowledge creation. What the results of our diagnosis period have showed us is that project members usually share project knowledge by following a typical personalization perspective; for instance, when asked about what was the most important source of knowledge creation team members answered “technical meetings” as their first choice. “*Technical meetings are important for me to share and receive knowledge acquired from members from other organizations, which are not in the place that I do, and there we can all share information and knowledge, which I think is important*” (E2). Meetings (by Videoconference) took place very frequently, and a first face-to-face kickoff meeting was held (in order to formalize the project beginning and allow members to personally meet) which have largely contributed for the boundary crossing referred by Fong (2003). Boundaries were related with the existence of team members from different disciplines and hierarchical divisions; crossing those boundaries allowed genuine collaborative work to take place instead of each one focus on their own disciplinary work or personal agenda. Also, and due to this complementarity of skills and areas among the team, interpersonal communication is of utmost importance, and meetings (both face-to-face and by web conference) allowed the knowledge creation and sharing among different disciplines in order to gather significant conclusions for the purpose of completing the project results.

Following the same drive, personal and informal conversations were also considered relevant for the UESP members of this project; being in the same physical

place allowed them to share some thoughts and ideas outside the more formal communication sources of *Project X*. Project members explained that “*since we are in the same building, when I am working in something and I have a doubt I can immediately meet my colleague and asked him, trying, in that moment, directly clarify my doubt*” (E2), which is of utmost importance because it allows to clarify and solve a problem immediately, without the need of sending e-mails or waiting for the next project meeting.

On the other hand, codification perspective of knowledge sharing is also present in *Project X*, but with a more a supportive role. Although it was considered as a benefit to have knowledge documented, members preferred to talk with other people directly instead of reading a document archived in the project repository: “*sometimes is hard to read a document with 40 or 50 pages while in a 15 minutes meeting we can discuss and understand what’s written, because everyone who has contributed for writing the document are sharing the ideas and knowledge in it*” (E2). Documentation was relevant, for instance, when new members arrived to the project, because they could start by reading the technical reports already created in order to become up-to-date concerning the project developments and, on the other hand, without the need of occupying other person. We can refer to a particular member which have entered the project later: “*I lost a month to be aware of the project, but it was only me, just one person, and if that was made by conversations and meetings it will take the time of two or more people (...), so, with information being registered I can read it and, only if necessary, go to meet a colleague in order to clarify something specific*” (E2).

Concerning interviews and conversations we had with UESP members outside *Project X* (and in a more macro perspective of knowledge sharing in UESP), personalization mechanisms were once again in advantage. Most of UESP members more frequently prefer to talk directly with someone they already know will help them, instead of trying to find answers in documentation, which they find boring and heavy to read, and also because most of the times they wouldn’t know where to start looking (due to the overload of ICT tools used in projects). UESP members consider more useful to talk with someone or to have a meeting instead of reading some enormous document – as we are aware, they are also working in projects, with all its shrinking deadlines to answer, so they need to find the right information fast and effectively. An

interesting aspect we have witnessed is that most of the people are not aware of which projects are going on at the moment, or who the experts on a specific area are, and UESP doesn't have any platform where they can search for other project's information. Therefore, they first need to find out if there is (or has been) any project specifically related with what they want to find out, and then they communicate with their team members in order to clarify their doubts: *"there isn't any place where I can easily know which projects are going on right now or that have been, in which areas, etc. If I want to know that I can (...) talk with some experts that are aware of what are the projects related with those topics, and then I need to know who worked or is working on those projects"* (E3). So, when it comes to sharing project knowledge, UESP members first use their personal network of contacts inside the institution, and only after this first contact, they can use some supportive written document: *"I think all starts with a conversation, because when I know that someone inside has some knowledge that I need, she's the one to whom I look up. Also because then that person can show me a specific document that I can read, because the project I want to know more about may have a large number of documents (which is what usually happens)"* (E4).

The main need and purpose for seeking project information is to find out some past experience or problem-solving for a specific problem or area where someone is working on at the moment. Here is important to understand that clearly tacit knowledge (specifically skills, experience and opinions related with projects) is what is more relevant to find out. That's what clearly explains this prevalence and preference for personalization mechanisms, so typical in organizations that are conducting tasks more unique in nature and that do not have clear solutions at the outset (Boh 2007). As someone told us, technical "how to" information is easily found on the web, by "googling it"; on the other hand, the "usability" experience of some technology, point of view or opinion is not always easy to register in documents – tacit knowledge is not always translated into words and texts: *"I see rather difficult people managing at structuring all their experience and knowledge inside some kind of platform – it is very complicated!"* (E3). So, despite the importance of codifying what was learned in past experiences and that is normally transferred orally through personalization, it may not be an easy job to convert tacit into tangible and "written" knowledge.

Following this drive, some initiatives were already being developed with regard to this tacit and unwritten knowledge. A UESP Workshop took place every month where projects were presented in a short period of time (about 20 minutes) and project managers explained its main features, and following a debate period where the audience could pose questions and discuss what was presented. According with all our interviewers, this effort “*was a good improvement in terms of communication inside the unit [UESP].*” (E4), and people were more aware of what was going on in the unit. Nevertheless, it lacked the codification of the information presented in some support: even that in some cases the power point presentation was sent by e-mail, a couple of months later it will be very hard to people to recover that information.

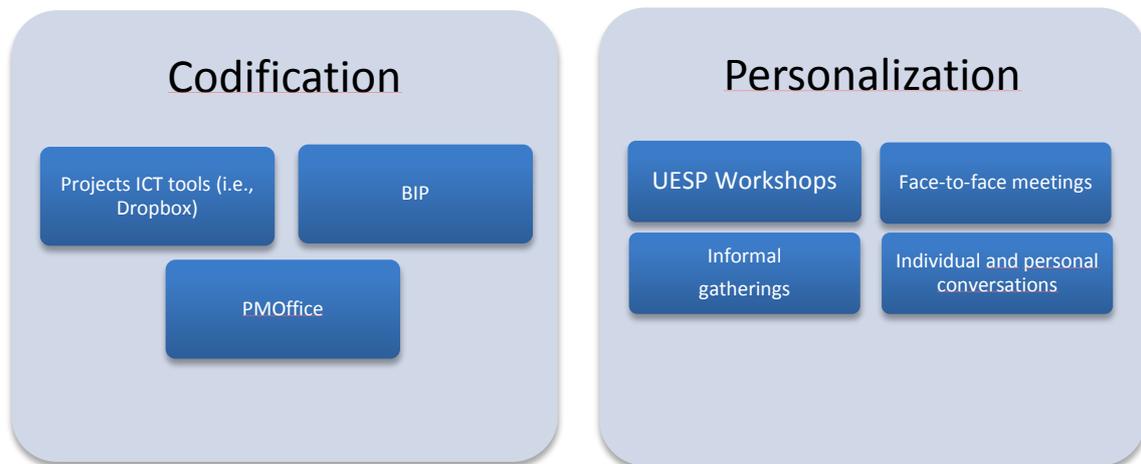
BIP (INESC TEC Bulletin) was another component of the knowledge-sharing mechanisms we detected in INESC TEC. It consists in a monthly institutional journal with INESC TEC news (mostly related with current projects), testimonials of its members and some more informal and “light” sections with funny trivia. BIP was considered an interesting knowledge-sharing mechanism of project knowledge, but since it was published also outside INESC TEC community, information about projects was superficial – nevertheless, it can be consider an important overview of INESC TEC projects and a starting point for other initiatives.

Some efforts of knowledge codification were also being made, particularly addressed to Project Management knowledge. A small UESP group, which develop exclusively consultancy projects, have established a Consultancy PMOffice<sup>12</sup> with the main purpose of developing and centralize template documents and procedures for Project Management. PMOffice included a Project Management Methodology establishing the project lifecycle and related documents (Gantt Chart, Progress reports, communication rules, etc.) and also a standard folder hierarchy to be used for all the incoming projects, which pretty much improved the project documents recovery (since all people of that UESP group were following the same rules). These measures intended to mitigate the lack of a document or content management platform for projects, by creating some standards for managing Project Management information – which end

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<sup>12</sup> A PMO is an “*organizational body or entity assigned various responsibilities related to the centralized and coordinated management of those projects under its domain. The responsibilities of the PMO can range from providing Project Management support functions to actually being responsible for the direct management of a project*” (Aubry, Hobbs, and Thuillier 2007).

up by being significantly useful since “*searching and recovering information is easy, because the [Project] structure is always the same, the document type or formats too, so it ends up being easy to recover information from one project to another*” (E4). During our intervention, PM Office was in a preliminary phase, but, nevertheless, its usefulness and convenience were already recognized by its users, which make us believe that it should be expanded to UESP as a whole and, furthermore, to other INESC TEC units.



**Figure 11 - Codification and Personalization knowledge-sharing mechanisms in UESP**

Figure 11 synthetize the (formal and informal) knowledge sharing mechanisms we identified during interviews, related with the sharing of current or past projects information.

### **3.3. Discussion of results**

This subchapter discusses the results in order to come up with meaningful answers to our initial research question and goals. Given the AR approach, the discussion reflects the AR diagnose phase in UESP, which was based on the data collected by interviews, participant observation and joint reflection with our co-researchers during the whole process. Discussion of results concerns the micro context of *Project X* and in UESP unit as the PBO macro context).

In PBO, knowledge creation occurs within a specific project and, hopefully, should be spread to the whole organization, in order to be crystalized as part of the company's knowledge bases. Information Management should have a set of important characteristics in order to support, in fact, knowledge sharing and, consequently, improve the organizational learning in Project-based Organizations. Here we can distinguish between two different realities with specific informational needs: within the temporary nature of a project execution and in the overall organization where projects occur as smaller organizational forms. Within a project execution, Information Management should assure that project information is easily reachable to its members and, on the other hand, doesn't represent a big effort in managing information (due to project characteristics of temporariness, fastness and uniqueness). Information Management will address codified and explicit knowledge (i.e., information that has a body) with regard to 2 main types: technical knowledge in the first place, but also Project Management knowledge. In the first case, Information Management, by addressing the information lifecycle, should allow an effective knowledge codification (which can, in the end of the project, be recovered and reused for other purposes or projects). In the case of *Project X*, being a multi-organizational project, it was crucial that the ICT tools were easy to use, or else they might delay the project execution (or even compromise deliveries deadlines) and block knowledge transfers among users. In the second case – Project Management knowledge – seems to be easier to manage, in the sense that it is more suitable for standardization in documents and rules, because it encapsulates a set of practices which are always the same in every projects (and by that they are predictable). Here we are aligned with prior research, particularly Boh (2007) who have stated that having a shared interpretive schema will significantly help users to reuse knowledge from a knowledge repository. In his study, to facilitate the sharing of knowledge, Consulting Inc. trained all its consultants in a common methodology for Project Management. We agree that there can be a strong component of standardization in this Project Management knowledge, which definitively Information Management should address, in a way that can automatize in the best possible way the creation, archive, recovery and dissemination of such contents.

### **3.3.1. From IM to Knowledge-sharing: UESP Knowledge-sharing mechanisms**

An Information Management strategy suitable to project contexts needs to be closely aligned with the predominant knowledge-sharing mechanisms of its environment – as we already stated, IM should improve project-specific knowledge creation and sharing and the consequent organizational learning. The major conclusion we gathered here is that oral knowledge sharing is the primary strategy used and the most commonly established within UESP members. This statement relates directly with our assumption that a personalization strategy is more convenient to environments conducting tasks that are more unique in nature (which is the case of PBO) allowing people to engage with each other in discussions to seek a highly customized solution to each unique problem (Hansen, Nohria, and Tierney 1999; Boh 2007). In fact, a personalization strategy seems to be crucial to a more fluid and dynamic knowledge creation and, consequently, a faster development of project tasks and results. On the other hand, codification seems also to have its importance (even that in a more supportive role), especially for 2 specific purposes. The first one is to register knowledge directly related with the results the project intends to achieve and deliver; to codify all the important developments of the project tasks allows to clarify the path performed in order to achieve them, and allows other people to know those developments. Clarifying the way project results were developed (by registering, for instance, in reports or meeting minutes) will make the knowledge creation process more transparent and clear inside a project team, allowing all the members to be aligned with that process. The second purpose is the codification of important decisions (both technical or from Project Management scope) made within the project, in order to establish a compromise and a settlement on the team and avoid future misunderstandings or conflicts for something not being clear to all members. This concern is particularly important in multi-organizational environments like this one, as the literature have showed us, the temporary nature of the project team may decrease the commitment of the organizations involved to collaborate effectively. In a project, each member represents an independent organization with its own goals, they can choose to put their own interests ahead (Leufkens and Noorderhaven 2011); writing down important decisions allows to avoid or mitigate this type of issues.

Concerning inputs from both contexts of isolated projects and PBO, we were able to understand that clearly some codification mechanisms seem to be missing – at least at some levels. Since knowledge is so reliant on people, and on more informal and

verbal contacts between them, it can be easily lost, for instance when people leave their job at UESP they take all their implicit knowledge with them. Also, by relying in personalization mechanisms we became dependent on other people's availability, which is not guaranteed at every moment (because sometimes people working in projects are out of UESP in meetings or other events and, therefore, out of reach). Also, we believe that when the implicit knowledge is codify and integrated in current organization history and knowledge-base, the ease of knowledge transfer increases and costs associated with such transfer will decrease (Boh 2007; Back and Moreau 2001). On the other hand, codified knowledge may instead imply rigidity and, mainly in contexts of change (as project-based organizations are), excess codification can stifle the development of new knowledge and inflict stability and inertia on systems (Prencipe and Tell 2001). It is important to balance these variables in a mix of knowledge-sharing mechanisms, where the codification component should support the management and execution of project tasks and improve the reuse of project information across projects. As we already stated, here it is crucial to have a system which allows effective project information retrieving in order to allow knowledge transfer among UESP members and without a "middle man" in the process.

Therefore, and by connecting IM with the specific UESP behavior concerning knowledge-sharing, once again IM plays a major role in providing to project teams and to the organizational environment the necessary ICT tools and procedures to improve knowledge-sharing. With regard to the two perspectives, IM should focus on improving the codification mechanisms of knowledge-sharing, as the way people "*store large amounts of knowledge, carefully codified and stored in databases and documents, where it can be easily accessed and used*" (Hansen, Nohria, and Tierney 1999).

### **3.3.2. The role of Knowledge Organization**

We also want to establish a link between the more specific aspects of knowledge organization (KO) of project contents and the previously mentioned characteristics of IM and knowledge sharing in UESP – because we consider that the second one has a strong influence into the first one. Modern contexts of information and knowledge creation and sharing are inevitably changed by the Google era and the way people rely on this new way of seeking information may have, in a lot of ways, changed the role of KO nowadays. This perception has been proved by our interviews, where people many

times referred Google as the tool they generally use to find a lot of information. Therefore, more standard KO systems like ontologies and thesaurus compete nowadays with Google and other web based resources. Here, we have to agree with Hjørland (2012): creating a strategy for KO in project contexts, should be based on the premise that users today have access to the internet and all the information they need is one click away. As the same author states, creating complex classification systems for an organization knowledge base may be considered a waste of time and resources.

Following this, KO in project contexts will be embedded in the various ICT tools people use, most of the times created for users themselves and in order to fill specific and temporary needs. In projects, information classification is closely related with the organization of the technical documentation, but also with the Project Management life cycle. Due to the temporary nature of projects, it will be very difficult to create new well-discussed classifications for all new projects. The classification, for the purpose of retrieval, will be closely related with the Project Management life cycle, in a high level approach, and with the specific tasks that are performed during the project execution. It is outside the project and in the overall organization that classification seems to have a more substantial role in supporting knowledge sharing, specifically related with codified knowledge (or, as we have been addressing, simply information). In order to take advantage of the natural knowledge-sharing mechanisms of personalization (that are the most relevant characteristic of UESP culture), we are convinced that we need to envisage KOS as a way that people can find other people. An essential role will be, for instance, to provide a set of tags where people could connect a specific need about a subject or project to the person who have worked on that subject, being able to, consequently, address that person directly. By using this, we will be align with the existent culture and, at the same time, we will improve the information retrieval of codified knowledge. As we have acknowledged, people considered that information retrieval could be, in some ways, improved, mostly because they start being aware of the fact that, if some knowledge is written down, it will be recovered by potentially much more people that the natural social linkages between them allow to. We will be following (Hansen, Nohria, and Tierney 1999): ICT tools are used to help people to communicate their knowledge, and not to store it, and people will scan documents in order to get the crucial information in a particular area and to find out who has done work on a topic, and then approach those people directly. Classifications, therefore, are

envisaged as crucial components of our knowledge-sharing strategies, and not only in the more obvious codification perspective, but also in the personalization perspective.

By recalling the domain-specific perspective of KO that we're following, we also want to point out the importance of KO during a project execution. We have concluded that, in such temporary contexts, where people are more worried about delivering results, a KO structure is helpful in order to arrange contents, but is not a priority to users. Here, we consider that KO should be task-oriented (which we consider it can be a more specific interpretation of the domain-specific perspective), because people in projects have different visions, beliefs and domains of interest; nevertheless their goals are aligned during the project execution, and they follow and commit with the tasks they need to perform in order to deliver the necessary results. KO should address and make more visible those shared goals and domains within the project by providing a familiar and common structure that can facilitate project work.

Following this drive, classifications and categorizations in projects are a way to represent documents and their subject in one of the possible ways they could be organized and represented (Mai 2011). KO in projects and PBO are, therefore, important enablers of a shared meaning about things, which we know is particularly challenging in projects contexts. Following Bresnen et al. (2003) the importance of developing shared meanings highlights the problems of inter-project knowledge diffusion and learning. Also, according with Pereira, Sousa, and Soares (2012), a common conceptualization of the domains involved in a project is the cornerstone for an effective and efficient information retrieving and knowledge sharing. In such dynamic environments, the diffusion of knowledge involves developing some level of shared meaning that allows one group to understand and apply another's insights to their own context. It is our belief that classifications and categorizations, whether in the form of hierarchic sets of folders or in a powerful search tool based on specific tags and keywords, can improve meaning alignment within a project team. In *Project X*, classification was used to organize contents in folders, allowing people to be aligned with the project structure of tasks, better comprehend the project organization itself and even better organize their own internal knowledge structures and mindset about the project – therefore helping people to better find and transfer knowledge in order to accomplish their tasks.

Moving towards the context of learning through projects in the overall organization, KO and classifications are also the enablers of important shared meanings across UESP. According with the people we have interviewed, knowledge classifications here should rely on a set of tags (labels) reflecting a set of knowledge structures that seem to be familiar to many members, and despite whatever projects they might be in. Here, and despite all the intrinsic differences surrounding project contexts (making project significances very dependent on the people's background or on the project scope), it is safe to say that there are some shared understandings across the organization that could be fully understood by everyone and sedimented into KO structures. For instance, everybody seemed to be familiar with the type of industries that exist and that each project could work on - or, at least, everybody is familiar with this categorization, even not knowing in detail the characteristics of each "label" of the classification system. Also, the type of projects in INESC TEC - for instance, simulation, logistics, business process management - may also be a good way of organizing contents within a KO system, because they are connected with the organizational structure itself and its different investigation areas. By gathering a set of categories which clearly reflect INESC TEC environment of action and those users feel it respond to their needs, an important impact can be made to help project knowledge navigate through the organization and also help to create a set of shared categories of knowledge that everyone will be familiar with – improving the recovery of more accurate and meaningful project information.

### **3.3.3. The importance of a learning culture**

Knowledge dissemination through an organization is not just about efficiently transferring knowledge, is also about "*fostering an organizational culture that facilitates and encourages the creation, sharing and utilization of knowledge*" (Ajmal and Koskinen 2008). Organizational learning, in its sociological perspective, suggests that meaning and actions and learning (both individual and organizational) are a result of the conversations and interactions of individuals within their socio-cultural settings (Sense 2011). This means that the interaction among the members of an organization is central to the process of learning. Consequently, and if, in one hand, the organizational culture should foster and encourages knowledge sharing for the purpose of learning, a successful knowledge sharing strategy (whether by using codification or personalization

mechanisms) also needs to have in mind the organizational culture and people's beliefs, because understanding "*how learning happens in the workplace, it may help contrive improved ways of sustaining and fostering learning processes*" (Sense 2011).

UESP has important signs of a learning culture embed in its organizational principles and believes which are shared by its members and need to be taken into account when shaping our strategies for Information Management and knowledge sharing. For instance, we have acknowledged that the preferred way of sharing knowledge is clearly by personal and direct contact, related with the personalization approach of knowledge sharing. Also, more informal gatherings (like team lunches or unit dinners) or more formal ones (like the UESP workshops themselves) seemed to be very important alternative moments of knowledge sharing that people appreciated. Therefore, as we have previously stated, the learning culture we wanted to reinforce should rely on a strategy which supports this way of how people are motivated to share experiences with each other.

On the other hand, and hence that clearly knowledge codification should also be taken into account in UESP (since it would help to recover project information which was at the moment disperse) adopting codification mechanisms for knowledge sharing is crucial. Here comes up an important issue in this learning VS culture relationship: according with the gathered opinions, in order to guarantee that information is created, managed, archived and shared in the appropriate ways, some rules need to flourish into the existing culture. In a preliminary phase, it is important that people follow some mandatory rules (for instance, where to store a project document, which documents should be made available to UESP members in order to share knowledge, etc.) which, after some time, will hopefully be embedded in the organization's procedures and people's ways of working. Nevertheless, and according with the prevalent personalization learning culture, those rules shouldn't be very heavy or they could turn in to barriers to the knowledge sedimentation – rules are necessary to establish some order, but they cannot be conflicting with a predominant way of working that people already developed. We need to have in mind that "*the failure of many knowledge transfer systems is often a result of cultural factors rather than technological oversights*" (Ajmal and Koskinen 2008).

Here we can establish a connection with Giddens's structuration theory (Giddens 1986; Jr 1992). It consists in a social theory of the creation and reproduction of social systems that is based in the analysis of both Agents (i.e., human action) and Structures (as the "rules and resources" embedded in agents' memory traces), without giving primacy to either. In a very basic way, it means that people make society but are, at the same time, constrained by it. Every human action is performed in the context of a pre-existing social structure, which is governed by a set of rules or laws that are distinct from those of other social structures. Therefore, all human action is at least partly predetermined based on the rules of the context in which it occurs. However, the structure and the rules are not permanent, but rather supported and modified by human action.

Such assumptions connect with the need of creating, in PBO, a culture which can support and influence organizational learning, by adopting, for instance, the most appropriate knowledge-sharing mechanisms to leverage such learning. At the same time, the established organizational culture is a result of people's actions and behaviors, from the assimilation and practice of such culture. In other words: it is important to establish a culture of learning that people can follow and integrate on their daily work and practices and behaviors but, also, are those same people which will contribute for the establishment and evolution of such learning culture. Impositions and rules need, therefore, to be carefully developed in order to combine with the prevalent culture and ways of working.

In project contexts, people "*are bombarded by urgent problems and pressing deadlines and do not have the time to commit themselves to an explicit knowledge management undertaking (...). It is thus apparent that project based companies must find ways of preserving and utilizing their knowledge within the established practices of everyday teamwork*" (Ajmal and Koskinen 2008). As a result, an Information Management strategy to improve knowledge sedimentation needs to be embedded within organizational practices and culture.

## 4. Components of an Information Management strategy to improve organizational learning in project-based organizations

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This chapter will present the components of a strategy for Information Management in Project-based Organizations, with the purpose of improving knowledge-sharing and the organizational learning. As we have developed through this dissertation, the specific characteristics of information and knowledge creation and sharing, and the difficulties in disseminating them across the whole PBO, make necessary the establishment of an Information Management strategy appropriate for this type of contexts. The following sections are also the result of the plan phase of our AR approach in UESP, in order to improve knowledge sharing and learning in this specific organization<sup>13</sup>.

### 4.1. Proposal of action for UESP context

As we are aware, project based organizations are now using a large amount of ICT tools to manage the even larger extents of information they possess nowadays. On the other hand, people working in PBO and in projects have distinct cultures and ways of working what makes them to use tools easier and more familiar to them – also because they are too committed in delivering results to be concerned about how is the best way of managing information. Our goal was to understand, with concrete inputs, what are the important components of an Information Management strategy that UESP needs in order to leverage and improve learning from projects. By “component” we mean sets of specific tools which, according with the previous results of this dissertation, we consider highly appropriate to have in this PBO (and potentially in other PBO with similar characteristics) and which we highly recommend specifically in UESP. They are materialized into models and tools for the information organization and classification schemes which will hopefully improve information management,

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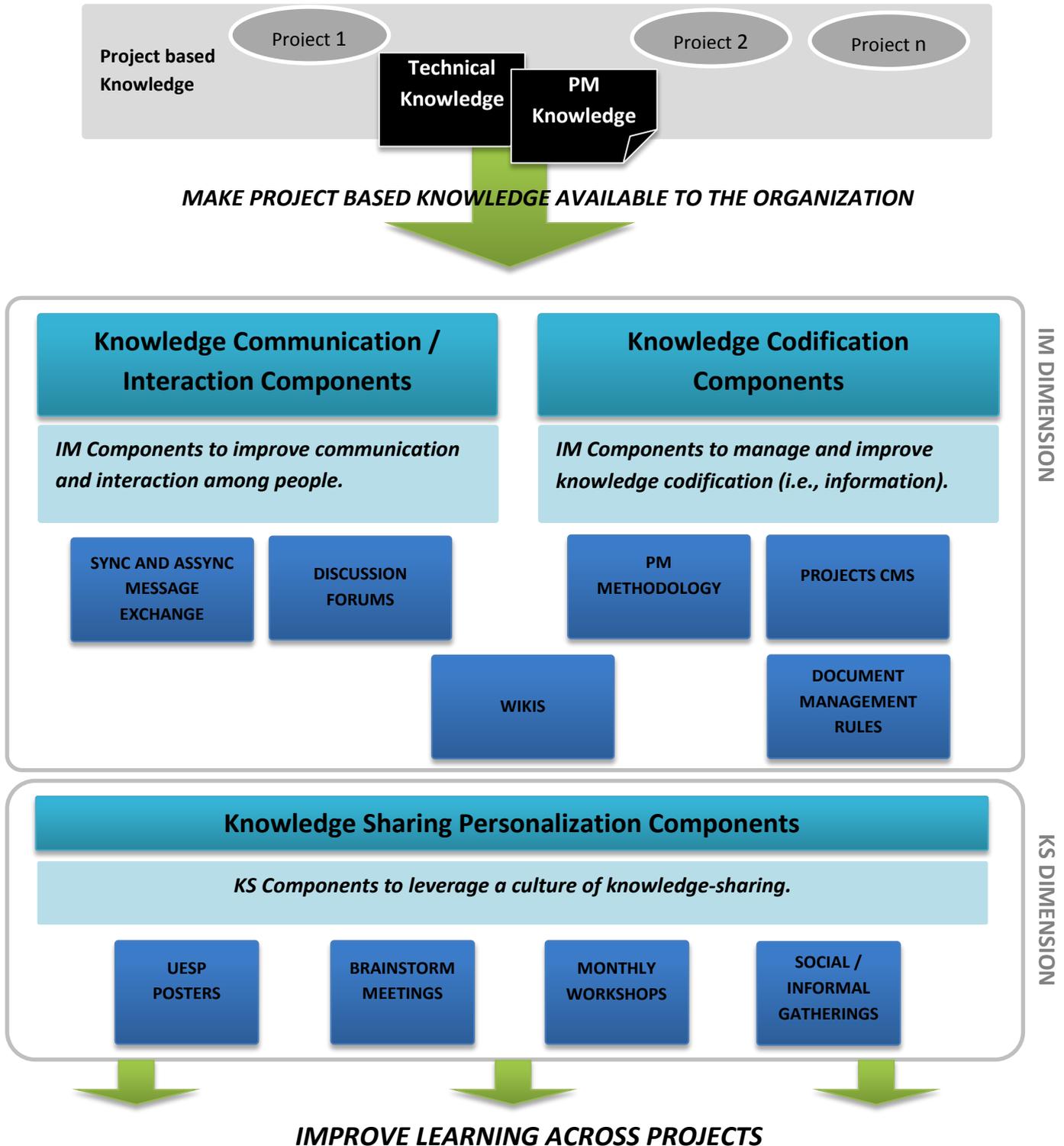
<sup>13</sup> See *APPENDIX 1* for further details about the plan phase.

organization, recovery and reuse and the consequent knowledge sharing and organizational learning. Related with those components, some specific IM recommendations will be also presented.

We also want to explain that, when referring project knowledge we are talking about two different types of it. Technical knowledge “*relates to the techniques, technologies, work processes, costs, etc., that are involved in discipline-specific issues of the project*” (Ajmal and Koskinen 2008) that people need the most in order to find out solutions already developed in the past for their current project based problems. Project Management knowledge, on the other hand, reflects the methods, procedures and good practices required for managing the implementation of projects (which includes the knowledge of the theory and application of Project Management) (Ajmal and Koskinen 2008).

In the next sections we present the components and recommendations for an IM strategy which can improve UESP organizational learning. Our IM strategy aggregates two different dimensions: the IM dimension itself and the knowledge sharing dimension, where we include the appropriate mechanisms for leverage knowledge-sharing. IM dimension is focused on the management of the formal processes, systems and digital platforms that are responsible for the informational lifecycle (i.e., codified knowledge) (Detlor 2010). On the other hand, knowledge-sharing dimension is inherently informal and ad-hoc, embedded in the organizational culture and mostly based on the personalization knowledge-sharing mechanisms, where the knowledge we want to manage and preserve is more intangible. We consider that only a joint strategy like this one, where the more technological and formal aspects of IM are connected with the more social aspects of knowledge sharing, will allow its significant success in leverage organizational learning in these organizations.

## Components of an Information Management strategy to improve organizational learning in Project Based Organizations



**Figure 12 - Components of an Information Management strategy to improve organizational learning in Project Based Organizations**

#### **4.1.1. IM dimension: Knowledge communication components**

IM components for the purpose of communication and interaction are more connected with the personalization strategy of knowledge-sharing and are, therefore, oriented to implicit and non-written knowledge. They should allow people to communicate directly, share ideas, thoughts and doubts related with their experience in projects, and without the need of a personal contact. The main goal of IT here is to facilitate communication and conversations among people and encourage the exchange of experiences. In order to do that, ICT tools should be able to catalyze and preserve those communications. Since, in UESP, people did not seem very interested in reading large amounts of information, we are convinced that this kind of platforms will be very suitable for their needs. This was also corroborated by our interviewers, since they considered that some communication platforms will be useful to help to get in touch with the right people – *“having the e-mail contact of people from that project I could directly ask a question related with that project (sometimes we don't have people's contact or she/he is not available in that moment, so the platform would improve communication” (E2 FJA).*

Concrete communication components for UESP should include digital platforms allowing sync and assync messages exchange (such as instant messaging or e-mail), discussion forums and wikis, because they improve interaction among UESP users in a light and easy way and without direct contact (which can be a plus specially when people we want to communicate are busy or unavailable at the moment). Wikis, particularly, are envisaged as good methods for managing knowledge. They are simple to use asynchronous, web based collaborative hypertext authoring systems (Laughton 2011) very suitable for the continuous communication within a research team and the constant evolution of content (Sauer et al. 2005) and can function as collaborative tools between teams to create and maintain documents that need to be updated frequently. In this sense, Wikis can be also powerful codification components. They can be very useful during a project execution, because they follow the course of the project technical developments, and allow also that everyone contribute actively in the construction of contents.

Discussion forums will also provide an important contribute for the communication purposes. They consist in virtual communication spaces structured by

discussion threads that facilitate virtual interaction. Threads begin with a message containing information, questions, requests or commentary. This message is followed by further messages replying, commenting and inquiring on the topic of the first message (Da Cunha and Orlikowski 2008). We consider that discussion forums are very connected with the personalization perspective of knowledge-sharing, as meaningful modes of cross-project learning which reinforce the importance of the social dimension (Bresnen et al. 2003). Therefore, a discussion forum should be accessible to all UESP members, in order to support both project execution but also a continuous sharing of knowledge across projects. This because a discussion forum enhances the coordination of project tasks, especially across organizational and geographical boundaries, facilitating the distribution and integration of work among members who are not physically together.

In the context of organizational learning across projects, and due to its social dynamism, forums are also the perfect place to build various communities of interest, where groups of individuals share and develop information online about a specific topic (Da Cunha and Orlikowski 2008). This will allow, for instance, that project members get to know other people's problems surrounding projects and how they have managed to solve them. In this sense, a discussion forum addresses particular needs that UESP members have reported us "*maybe it will be easier to have a forum where I can insert my question to a group of people from a specific project that could answer me...*" (E2). The main important aspect is that the discussion forum should be centralized and used by everyone in the organization, allowing that more people can change experiences and establish communities of common interests, where a common language could flourish and knowledge emerge.

While people work they leave marks in the system, and communication components are able to make those marks as visible as possible. This components link contents, and contents with people, therefore they link people. They are meant to be an extent of the more informal and direct ways of people sharing knowledge with each other, by using the technology and the new more social tools to enhance collaboration and sharing.

#### **4.1.2. IM dimension: Knowledge codification components**

Although much of the information and knowledge can be created and shared by communication components, it was recognized the need to access project knowledge in a more structured way, which IM should particularly be concerned about. In fact, all the UESP members which whom we have reflected with agreed that some codification mechanisms will help to sediment project-based knowledge, by mitigating the main problem we have identified: that people do not have any way to recover information about past or even current projects going on, without asking directly to colleagues they know or to more senior investigators. Codification components will then provide direct channels where UESP members can recover, for instance, past knowledge directly, and without a middle man in the process. Codification components address to knowledge that is easily registered and, therefore, highly suitable for reuse.

Current codification tools in UESP include projects content management systems or ICT tools and repositories which are used to manage the information created in each project and that will assure the prosecution of project tasks. Some examples of this components are Dropbox, file servers or other tools used to create, manage, store, share and use project based information. The scope here is the project as a temporary organization and, therefore, the platforms and tools used will also have a temporary lifetime, limited to the project duration. We have here identified 2 important constrains to IM related with a project execution – its temporary nature, which makes people very concerned with immediate delivery deadlines and, also related with this issue, the preference by using tools which project members feel more familiar with or are more used to, in order to get work done faster. For those reasons, we will not point out a standard solution or a specific technology, still, it is possible to describe IM recommendations and requirements to have in mind when choosing an ICT tool to be used during a project execution.

The real challenge in an IM strategy relies, however, in, when a project finishes, to make the project-based knowledge available to the organization. In order to do that, we suggest two changes in this organizational unit, which we found quite important for the improvement of organizational learning. The first one is that the existing PMOffice can be extended to UESP as a whole, and its procedures, methodology and project templates made available to all its members. This will largely improve the existence of a

common PM language that, as we previously stated, benefits the sharing of project knowledge (in this case, Project Management knowledge) by having shared meanings that people are familiar with and can more easily discuss about (Boh 2007).

The second one is that UESP aggregates, in a technological tool or repository, important technical results and other meaningful information of past projects, to be easily available to project teams. Such tool should enable searching and retrieving old information from previous projects, and by doing so, will address the main need for seeking project information of UESP users. INESC TEC already has an internal platform for the management of projects, which was referred from one of our interviewees as not being actually used (*"We already have a projects platform and with some improvements... well, but it is not being used"* (E4)). It is made in Plone – an open source highly customizable content management system – which provides a large number of content management features. Plone also allows the creation of discussion forums or wikis, which consent that the previously mentioned communication components can be also centralized in it. We believe that Plone will be able to materialize many of our IM recommendations, and can be particularly useful as a future and centralized UESP CMS to preserve and disseminate project-made knowledge across the unit.

Finally, procedures and guidelines, like a Project Management methodology (integrated in the PMOffice), are important in order to improve project standardization and PM best practices. Also, the creation of general document management rules to be followed / customized in every project will improve and standardize Information Management in projects. They will provide good principles to organize particularly the unstructured information (i.e. word documents, excel spreadsheets, e-mails, etc.). Here, the good experiences of the past should be catalyzed and reused (see the example of Project X in APPENDIX 3). All this procedures and methodologies could be also centralized in the future UESP CMS.

#### **4.1.3. IM specific recommendations**

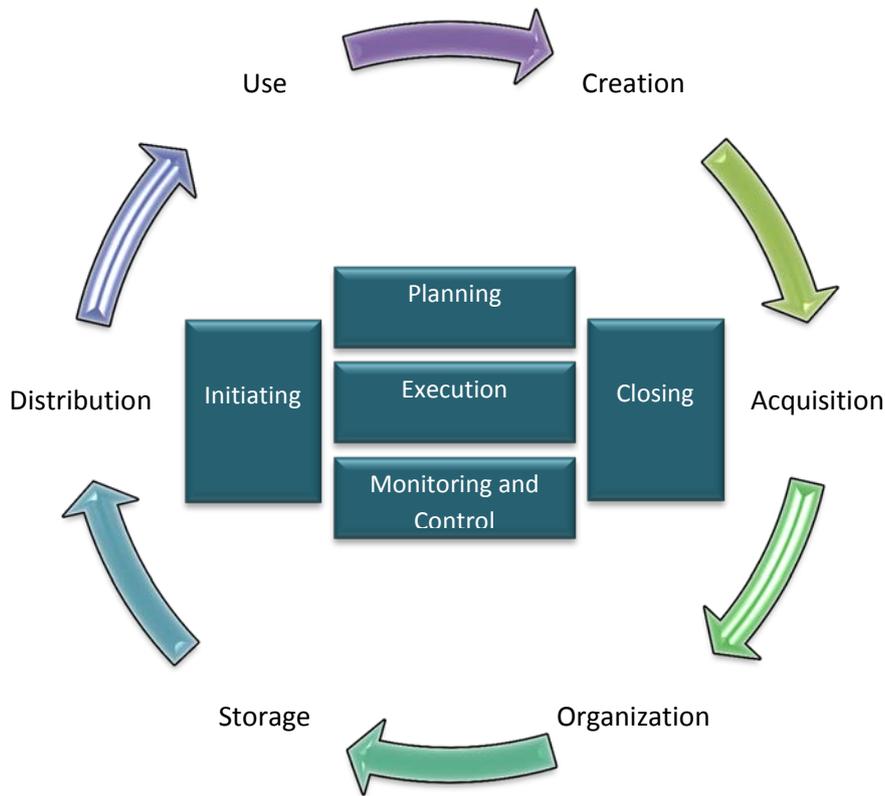
Next we define specific recommendations towards the previously mentioned IM communication and codification components. We will organize those recommendations according with Detlor (2010) processes of the IM lifecycle, in order

to capture every process of the information flows occurring in UESP projects (both during and after a project takes place). We believe to be a good basis for a future IM requirements specification task for projects information digital platforms in UESP.

The **Creation process** is where individuals and organizations generate and produce new information artifacts and items. Creating contents inside project teams need to be made in a very collaborative way, in order to have the team working closely together. In this process, communication components already mentioned (such as wikis, e-mails, skype, etc.) can enhance the dynamism of this process and also contribute to a more uniform language through the project execution, which is so important in such multidisciplinary contexts. Other common and easy to use tools like Google Docs or other collaborative writing tools should also be considered.

On the other hand, creating project information needs to have in mind the long-term recovery of projects information. Therefore, it is important to understand how the information created during a project execution, and within the endemically temporary tools used, will migrate to more long-term storage tools. We suggest that, every time a project is initiated, it would be created the “project file”, with a short description of the project goals and scope, team and important dates. When the project ends, project results (SW requirements, data models, technical documents, etc.) should be preserved in the UESP CMS, associated to the project file. Therefore, it will be important to reflect about the contents that are important to preserve among the overload of information a project produces.

The **Acquisition process** is related with the previous one and consists in the process where information items are obtained from external sources. Digital platforms envisaging both the project execution and the knowledge sharing across projects should enable the acquisition of external contents. For instance, they can provide hiperlinks to other ICT tools in INESC TEC (for instance, for BIP news related with a project or theme) or to other external and useful web pages such as BPM or other domains communities.



**Figure 13 - Relation between IM lifecycle and PM lifecycle, during a project execution**

The **Organization process** is the more important one and addresses the classification schemes and ways of organizing information to support easy retrieval at later points in time, which is clearly the main informational need of UESP members. During a project execution, a scheme based on the project structure will be enough. In this context, all the IM processes, but particularly the classification schemes are very close to the PM lifecycle (*Figure 13*) and their subsequent division of tasks (within the more technical work in the execution phase). In fact, part of the existing information has already some common principles and structures. For instance, in the consultancy area (where PMOffice was being used), all the projects obey to a common folder structure, aligned with the PMBoK Guide, and covering all the PM lifecycle. We have also observed in *Project X* that the project folders covered some of the phases of that PM cycle, with more focus particularly in the execution phase (where all the "real work" happens). In order to obtain a more uniform project organization, we suggest that this structure of contents should be spread to all UESP projects. This will allow an easier navigation and retrieval when someone needs to access to a specific projects documentation (according with the acceptable permissions); also, when new projects

are initiated, the time spent in deciding informational structures or in getting used to them will be lower.

Contrary to this micro context of a project execution, in order to improve knowledge sharing across projects a faceted classification seems more appropriate for the information organization. This is a good way of classifying contents in web based resources and will be, therefore, suitable for a web based CMS like Plone. Users may have a very precise understanding about the domain content even though they are unfamiliar with the website content and a *“faceted classification structure overcomes the limitations of hierarchical classification by classifying digital documents into multiple categories organized from the bottom-up into a multidimensional taxonomy.”* (Uddin and Janecek 2007). Facets, as *“mutually exclusive and jointly exhaustive categories”* (Denton 2003) will help users to search and browse to find what they need.

Facets could reflect many different things, related with different informational needs: the document type, the knowledge type (PM knowledge VS technical knowledge), the project date, project domain (according with the UESP areas of intervention, for instance, simulation, logistics, business process management) or type of industry where the project took place (i.e., shoe industry, SW development company, etc.). According with our interviews, the ability of intersect those categories when searching for information will be a plus. Example: I need to find information about past projects in the simulation area AND in the shoe industry. If contents are organized in such categories, I will find the right information.

Following some of Denton (2003) recommendations, there are two basic ways to make usable faceted classifications for web-based resources. The first one is keyword searching, where the user types in one or more words to see if they match anything. The second one is a facet-based navigation, which can be free (letting the user move from page through a list of hypertextual links) or by selection (the user navigate by choosing options in forms – select menus, radio buttons or checkboxes – and clicking a submit button). Choosing one way or another will depend on the range and size or the classification, but either ways should help the users to find the most relevant results in the shortest time.

Faceted classification can be complemented with folksonomies, which consist in “*unstructured classification schemes that can be described as set of tags*” (Cantador, Konstas, and Jose 2011). A tag is any word that defines a relationship between the online resource and the concept in the user's mind (Guy and Tonkin, 2006, quoted in Kakali and Papatheodorou 2010). Folksonomies represent a more personalized conceptual model of the world, rather than a hierarchical model of knowledge categorization (Kakali and Papatheodorou 2010) and are very suitable for social and collaborative environments, because they emerge from user-generated metadata. Their main advantage is that users are not requested to rely on a priori agreed knowledge structure or shared vocabulary, and thus are not imposed any constraint in the tagging process and information management (Cantador, Konstas, and Jose 2011). Folksonomies can provide different features within the content classification for the purpose of knowledge sharing across projects, by allowing a personal organization of items which can meet more individual user needs (allowing the user to preserve, for instance a “favorites” list of contents according with personal interests and “tags”). However, they should not substitute a faceted classification; due to the multidisciplinary contexts and different professional backgrounds of UESP members, they may cause confusion by expressing personal and subjective opinions.

The **Storage process** of IM lifecycle refers to physically housing items in the digital collection. Our main recommendation here is that the organization provides the appropriate security and backup mechanisms and the necessary hardware.

The **Distribution / dissemination** process is the process of circulating information of interest to end-users. During a project execution, dissemination of information is crucial especially for the accomplishment of delivery deadlines, and the digital tools should provide, for instance, automatic alerts to users according with their particular interests inside the project. This will be useful, for instance, if a technical report from one particular task is ready to be validated by the rest of the team, or if a delivery deadline is approaching. Also for the purpose of knowledge sharing across projects, dissemination features in a CMS tool could deliver newly updated project information according with a member particular areas of interest.

Addressing its role of supporting a personalization knowledge sharing strategy, dissemination processes should also “*help people to find other people*” (Hansen,

Nohria, and Tierney 1999). By presenting contact information of the team members of a specific project, or the people who have worked within a particular area, we will be feeding the personalization strategy of getting people talking with each other. This feature is very important because it directly relates with UESP organizational culture and provides the user the means to directly contact other people and, consequently, spreading the network of contacts which we are aware it is very strong in project contexts.

Finally, the **Use** process concern the way people will use the information provided. Access to any information available in the platform should be enable, according to users' profile and permissions. Permissions in a CMS for the purpose of a project execution can include: public, project team, project coordination. If we are talking about the IM across the organization, permissions can reflect different hierarchical levels or specific roles of UESP members.

#### **4.1.4. KS dimension: Knowledge-sharing personalization components**

Knowledge-sharing components fit under our IM strategy because they generate places where knowledge is shared in a very informal way and where people get to know more about each other and each one's experiences. These mechanisms are important because they feed the learning culture and contribute to get people motivated to communicate and share experiences and knowledge and comprehend the derived benefits of it, contributing, consequently, for a broader use of the more formal IM components.

Here, and reflecting the main suggestions given by UESP members (as co-researchers of our study) we consider appropriate to the UESP culture the following specific knowledge-sharing mechanisms:

- **Brainstorming meetings** in the unit or teams: will help to create brand new knowledge by combining people's experiences and ideas;
- **Monthly workshops** about current or past projects going on in UESP: already a practice implemented in UESP, we consider it provides important points of contacts with what other people is working on and which projects are going on,

helping people to be updated and leverage curiosity for searching more information about it;

- **Social gatherings** between people from different projects or backgrounds: this informal gatherings should be promoted by the organization, because it was proven that people get to know more about other people's work in moments like lunches or coffee breaks. The PBO need to take into account this more sociological aspects and should leverage this culture of learning by creating, for instance, monthly or semester dinners between UESP members where people can get to know each other. Here it will be interesting to gather people from different backgrounds because, as we have confirmed, project team members from different knowledge domains are more likely to discuss and share information and knowledge (Fong 2003);
- **Project Posters:** by having posters with current or past projects information to be spread across the walls of the building, will allow to people know what is going on in UESP and brings more visibility to projects; people, can contact with that information many times in their workday and get curious to know more about it, which motivates contacting the project team or searching for more information in the appropriate platform or repository: *"this will allow (...) that people working here get to know what each one is doing, because you will read someone's name and knew that person who is sitting next to you is working on that subject"* (E4).

It is important to refer that the IM and KS tools and platforms addressed should not be envisaged individually; they have a particular advantage and field of application, but it is the combination of them that allows a greater choice in daily use to bring out full potential. They need to be well conceived in order to be easy to use and, in this way, they need to be well fitted and integrated into the overall systems that the organization uses: business applications, classical communication systems like e-mail or skype, and even the internet applications like Google. Also, people shouldn't be required much training to use those tools, or else they will not use them at all. Once we get more and more people using these components, they will need to follow some rules and procedures – but here, as we have previously stated, rules should be only the strictly necessary. When we have the sources of expertise and knowledge distributed by so many different groups of people (working around projects and constantly changing

their mindset every time a new project arrives), it is very tough to predict what people want and what they know in advance. Tools for creating, sharing and disseminating information and knowledge need to have the necessary features to allow users to navigate in their own pace and requirements – IM and KS components just have to empower people by facilitating and rewarding participation and success.

## 5. Conclusions and future work

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Arriving to the final chapter of this dissertation, we consider that the main goals were achieved. By recalling our initial research question - **RQ: How can Information Management support knowledge sharing in projects and improve organizational learning in PBO?** – studies A and B have demonstrated the issues, difficulties and practices in project contexts concerning Information Management and knowledge sharing. Study A was very important to have a more real overview of Project Management and IM practices in different organizations, which, together with the literature review, have provided strong bases for developing the second study. Study A is particularly relevant to reveal the routines and performance of IM in Portuguese contexts, where Project Management starts very recently imposing itself as a set of important good practices to be followed. We have concluded that, in general, national project managers and project teams are aware that the organizational learning is very dependent on the way project knowledge is preserved and reused; however good practices of IM for that purpose are not yet undertaken because they do not have in fact a clear picture of what Information Management is. In this sense, this dissertation provides a concrete contribution to a better awareness to IM and how to align company's mechanisms of codification and personalization of knowledge sharing (explicit and implicit) for an organizational learning improvement.

Study B, within a context so dynamic in social interactions and in the multidisciplinary range of projects (UESP), have demonstrated that Information Management in PBO can provide important tools and good practices to manage information during and after a project takes place. Both the 2 different realities should be considered when applying a strategy of good practices for IM, since, despite there are convergent, individually they present substantial differences. During a project execution, members are totally focused in delivering project results and they need tools which facilitate that goal in the first place; the best way to help them is to provide, for instance, technologies that they are already used to in their daily routines or embedded in their work practices, with low training required. When it comes to managing information from several projects, in a perspective of global knowledge sharing and

learning across projects, IM plays a major role in providing the necessary mechanisms to codify knowledge in procedures and technological platforms which allow a more effective recovery and reuse of the knowledge produced in an organization's projects.

We are convinced that this dissertation empowers the role of IM in the contexts of projects, by aggregating under its scope the more tacit and informal characteristics of information and knowledge, normally more associated to the field of Knowledge Management. Concerning the definition of IM within the scope of intelligent organizations, and its role of providing relevant information to be used "*strategically in order to generate new knowledge through organizational learning*" (Choo 1996), we conceive that it is necessary to bridge the gap between the more formal aspects of IM and the more fluid characteristics of knowledge-sharing or Knowledge Management in general. In such changeable environments like PBO, knowledge is created in a very dynamic way and it is really everywhere: in people's minds, conversations, behaviors and tasks, spread in different documents and technologies, and it travels around the organization through more formal and informal processes of creation, discovery, archive, retrieval, dissemination and reuse. Only a conceptualization of Information Management within all this idiosyncratic connections and relations – envisaging organizations as "*complex adaptive social systems that collectively learn*" (Firestone and McElroy 2004), and a clear understanding of how the human factor determines the meaning of information itself, will allow that IM provides consistent technologies and tools to take the best profit of the project-made informational flows. IM should make those connections and relations surrounding people, knowledge and technology completely transparent, not by imposing a bunch of sophisticated tools to be used, but the ones which users can feel comfortable and motivated with and which address their work goals and their behavioral and more intrinsic preferences.

It was in fact the clear understanding of this reality which have driven our wider approach to IM in PBO, encapsulated in the set of recommendations of the last chapter. Our framework of IM and KS components provides guidance with a set of concrete tools and principles perfectly suitable for typical PBO with strong personalization mechanisms for KS, by integrating the IM concept on those characteristics, allowing that a learning culture can flourish naturally among people – and it is in fact the only way it can flourish and succeed. Initiatives suggested are, therefore, particularly meant

to facilitate communications and encourage the exchange of experiences, because we know that the interaction among the members of an organization is central to organizational learning (Mishra and Bhaskar 2011). IM should provide them the resources required to the processes of knowledge creation, sedimentation, sharing, reuse and dissemination. There are no standard procedures or solutions, because project contexts do not allow it, there are only choices to provide that project members can combine and use in their own way and according with their best interests.

This study also derives implications for theory under specific KO disciplines, because we have acknowledged that modern KO perspectives are suitable for information recovery in project contexts. Finding the more accurate type of categorization and classification for information recovery is evidently crucial. KO, if used in a wider and transversal way can also improve a sharing of aligned meanings which are so essential and difficult to achieve in PBO, where the knowledge creation have so many different users, domains and places of birth.

We also want to take some moments to reflect about the action research process itself, as a crucial component of our study, which allowed us to develop meaningful results in a collaborative and proactive way. AR was important because, by knowing the organization from inside, we didn't wanted another study that the organization will put on a shelf and not actually use it; to make a difference we knew we will need to significantly include people in our study and analyze data and reflect about it with them, as co-researchers of the study. Although we have only developed the diagnosis and plan phases of an AR cycle (which is understandable hence the limited scope and duration of this dissertation work), the recommendations we have provided are perfectly suitable for a forward action phase (and were, in fact, conceived for that purpose). Our commitment towards the organization will rely in the future development of those initiatives, in a perspective of continuous improvement of IM and KS practices in UESP. We are convinced that the result of our study in UESP is more than this dissertation report – it will act more like a support for an ongoing discussion and learning among UESP members, rather than a final conclusion – as the real aim of Action Research studies is a continuously improving and learning and creating new knowledge and applying it.

There are a lot of possibilities of research for future work here. Since the concepts of Information Management, knowledge sharing and organizational learning are, themselves, intrinsically complex and adhere to several assumptions and perspectives, more studies reflecting their characteristics in project-based companies will help to complement the conceptualization we have address in our study. An obvious path will be to take our framework of IM and KS components and recommendations of the last chapter to the real world, starting by applying it the UESP unit and understanding how people will react and how organizational learning will improve. Not only in INESC TEC, but also in other different project contexts, the framework could be tested in order to perceive its inclusiveness and understand if it can be improved with further requirements or changes. We are also very enthusiastic with the idea of exploring with more detail the role of KO in the creation of shared conceptualizations during a project execution, where we know that is so easy to emerge conceptual misunderstandings and misalignments because of the different member's backgrounds. Also, across projects in a PBO, that role can be further explored.

Projects are without a doubt significant and intense learning episodes and vehicles of information and knowledge which occur very fast and in every directions. Organizations need to learn to think about problems, (rather than grab at proffered solutions) and need to pay attention to the needs, motivations and feelings of its members, in order to get the people working together and towards the same objectives. As Wilson (2002), we are convinced that Information Management is becoming more and more the management of work practices in the organizations. It is the role of the Information professionals here to provide the means by which their members can communicate, collaborate and produce more and better knowledge, at the same time that they adapt those means to the intrinsically social characteristics of their environment.

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# **APPENDIX**



# **APPENDIX 1**

## ***Action Research Protocol***

*This document presents the Action Research Protocol that was followed during our investigation. We explain with details the specific problem of the organization which motivated this research approach, and the main characteristics of the cycle of action.*

*AR protocol was used in order to provide guidance during the investigation, and it was updated accordingly with the actions performed.*

### **1. INTRODUCING THE PROBLEM**

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INESC TEC is an important Portuguese institute of research and development that works with R&D and consultancy projects of many kinds. The author's everyday tasks relate closely with the informational issues concerning project management and project technical work: maintaining templates for project usage, applying information and content management rules (for instance control of versions or the information storage architecture) and managing the ICT platforms of different projects.

Projects are highly dependent on information and communication and the way they are managed, in an informational perspective, can improve their flexibility and definitely contribute for the project success or failure. What can be observed in the INESC projects is that many times a project is finished without the proper assimilation of the knowledge that was acquired (whether is a final meeting with the project team to talk about lessons learned or documentation in some ICT document or tool). Also, when projects are made with several organizations, information management becomes a lot more difficult, because of the lack of common information management practices, as every organization has their own culture and ways of working which sometimes conflicts with the other participants. Because of that, sometimes project teams work with many different ICT tools (for document and content creation and sharing within the project team and other stakeholders) what creates an information overload difficult to manage.

This is an interesting context to explore, in order to comprehend and analyze the main information management problems in projects and how are they hampering the organizational learning (i.e. the information and knowledge transfer from projects – where the knowledge creation takes place - to the organization as a whole and the consequent knowledge sharing between projects).

Specifically in INESC and in *Project X* (which we chose in order to analyze the specific project-based problems), the main known problems related with Information Management and Knowledge Sharing are:

- **Difficulties in managing information:** due to the (digital) information overload created for the developments of project tasks, the amount of different ICT tools used, members being from different organizational contexts and bringing different ways of working, and also the temporary nature of projects. All this characteristics (sometimes at the same time) make more difficult to gather significant content management rules or information organization principles to avoid an informational chaos within projects.
- **Difficulties in sediment knowledge created:** since the project is fast and unpredictable, there is no time or will to sediment and codify the knowledge created, in order to be useful to other future projects.
- **Difficulties in sharing project-based knowledge to the organization as a whole:** as projects documentation is messy, and knowledge is not conveniently codified, sharing knowledge within the organization is mostly oral: by sharing experiences in an informal way or by integrating project meetings. Knowledge-sharing mechanisms for project-based knowledge in UESP are unknown, both from codification perspective as from personalization. Knowledge can easily get lost or get out when someone leaves the organization.

Research Question and Goals that guide this action research intervention are:

**RQ: How can information management support knowledge sharing in projects and improve organizational learning in PBO?**

- **G2: Identify information management processes and tools in INESC Projects;**

- **G3: Identify the knowledge-sharing mechanisms used in INESC for the purpose of organizational learning.**
- **G4: Develop recommendations towards a concept of information management which can improve knowledge sharing and a better organizational learning in INESC.**

## 2. RESEARCH PROTOCOL

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The research protocol will obey to the following structure:



Following R. L. Baskerville 1999 and O' Brien 2002, we performed 1 cycle with 5 steps: diagnose, plan, act, observe and reflect. The cyclical nature of this approach intended to provide fast conclusions and mostly the continuous improvement of information management practices and a better sedimentation of knowledge in the organization. Since the limited duration of our study, for the purpose of this dissertation, we only addressed the **diagnosing** and **plan** phases, as described below.

Phase	Definition <sup>14</sup>	AR Cycle in <i>Project X</i> and UESP
<b>Diagnosing</b>	Identification of the primary problems that are the underlying causes of the organization's desire for change. Diagnosing involves self-interpretation of the complex organizational problem, not through reduction and simplification, but rather in a holistic fashion.	<ul style="list-style-type: none"> <li>• Diagnose the information management characteristics of <i>Project X</i> – gather opinions about its importance, benefits and problems.</li> <li>• Gather evidences about how knowledge is captured within <i>Project X</i> – how the project team creates new knowledge and how it is captured; understand the contribute of information management rules and principles developed in the action phase for the purpose of knowledge creation.</li> <li>• Gather evidences about the knowledge-sharing mechanisms that are used in UESP, know some opinions about problems related with learning from projects.</li> </ul>
<b>Action planning</b>	Researchers and practitioners collaborate in order to specify organizational actions that should relieve or improve these primary problems. The discovery of the planned actions is guided by the theoretical framework, which indicates both some desired future state for the organization, and the changes that would achieve such a state. The plan establishes the target for change and the approach to change.	<ul style="list-style-type: none"> <li>• Analyze data, compare with the literature, and conclude some recommendations and improvement opportunities for information management in projects (within and across projects).</li> <li>• Plan specific organizational actions to improve information management and knowledge sharing in INESC for the purpose of organizational learning.</li> </ul>
<b>Action Taking</b>	Action taking implements the planned action. The researchers and practitioners collaborate in the active intervention into the client organization, causing certain changes to be made.	<ul style="list-style-type: none"> <li>• Apply the Improvement Opportunities</li> </ul>
<b>Observe / Evaluate</b>	After the actions are completed, the collaborative researchers and practitioners evaluate the outcomes. Evaluation includes determining whether the theoretical effects of the action were realized, and whether these effects relieved the problems. Where the change was successful, the evaluation must critically question whether the action undertaken, among the myriad routine and	<ul style="list-style-type: none"> <li>• Evaluate the effects of the implemented initiatives within the organization.</li> </ul>

<sup>14</sup> Based on: Baskerville, Richard, and Jan Pries-heje. 1999. "Grounded Action Research : a Method for Understanding IT in Practice." *Accounting, Management and Information Technologies* 9: 1–23.

	Non-routine organizational actions, was the sole cause of success. Where the change was unsuccessful, some framework for the next iteration of the action research cycle (including adjusting the hypotheses) should be established.	
<b>Reflect</b>	While the activity of specifying learning is formally undertaken last, it is usually an ongoing process.	<ul style="list-style-type: none"> <li>Reflection was actually made through all the process of AR, together with our co-researchers. Main conclusions were register in the Dissertation Report.</li> </ul>

The process is cyclical. After the mentioned cycles are completed, new AR cycles should be developed, in order to continue to maintain the changes implemented or propose new ones. Steps are repeated in sequence as work progresses, creating an upward spiral of improving practice.

### 3. DATA GATHERING

For the **Diagnosis phase**, Data gathering was based on the following categories:

CATEGORIES	EVIDENCES	
	TYPE AND PURPOSE	EXAMPLES
<b>Information Management in <i>Project X</i>:</b> <ul style="list-style-type: none"> <li>Information lifecycle;</li> <li>Information organization</li> <li>Document management</li> </ul>	<ul style="list-style-type: none"> <li><b>Interviews with project team members:</b> in order to gather their opinion about the characteristics of information management.</li> </ul>	<ul style="list-style-type: none"> <li>Interviews with project team members.</li> </ul>
	<ul style="list-style-type: none"> <li><b>Participant observation:</b> find problems and pertinent issues to solve regarding the information management in <i>Project X</i>.</li> </ul>	<ul style="list-style-type: none"> <li>Participation in the Project Coordination Meetings;</li> <li>Participation in some technical meetings.</li> </ul>
	<ul style="list-style-type: none"> <li><b>Project Documentation and ICT tools:</b> in order to confirm how information is organized.</li> </ul>	<ul style="list-style-type: none"> <li>Folders architecture in Dropbox;</li> <li>Project Application document;</li> <li>Meeting minutes;</li> <li>Document templates;</li> <li>Document Procedures;</li> <li>ICT tools used: Skype, Google Docs, Google Groups, Project Wiki.</li> </ul>
<b>Knowledge-sharing and organizational learning in</b>	<ul style="list-style-type: none"> <li><b>Individual conversations and semi-</b></li> </ul>	<ul style="list-style-type: none"> <li>Interviews and individual conversations with project</li> </ul>

<p><b>UESP:</b></p> <ul style="list-style-type: none"> <li>• Knowledge-creation sources in the project;</li> <li>• Knowledge-sharing mechanisms (codification and personalization);</li> <li>• Dissemination of project knowledge within the organization.</li> </ul>	<p><b>structured interviews with project members and project managers in UESP:</b> in order to know more about their opinions and concerns about learning from projects</p> <ul style="list-style-type: none"> <li>• <b>Participant observation:</b> in order to report daily problems and concerns.</li> </ul>	<p>managers from UESP</p> <ul style="list-style-type: none"> <li>• Participant observation</li> </ul>
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## **APPENDIX 2**

### *INESC TEC Interviews (during the performance of the diagnosis phase of AR cycle)*

**E1 – Entrevistado 1**

**Papel: Team Member do Projeto X**

**Data: 01-03-2013**

**Local: INESC Porto**

**Duração: 20 minutos**

**1. No que diz respeito à forma como a documentação do projeto é atualmente gerida e respetivas regras (nomeadamente ao nível do armazenamento de pastas na Dropbox, utilização do Google docs, e-mails, atas de reunião, etc.), quais as principais vantagens e problemas?**

**R:** As principais vantagens são nós termos a informação disponível. Os inconvenientes são poder ser muita informação e nós depois termos dificuldades em encontrá-la. Por exemplo, uma das críticas que fiz foi ao facto de os nomes dos documentos serem muito grandes. É mais difícil encontra-los. Agora, acho que como o projeto foi planeado por tarefas e lá está por tarefas, acho que não é muito difícil pelo menos saber as pastas. Depois dentro das pastas é que é muito complicado, porque tem muitos documentos e os nomes são muito compridos. Isto porque o nosso raciocínio quando é gráfico é rápido. Agora quando tem muito texto é mais lento. É redundante, por ex. se nós já sabemos em que projeto estamos a trabalhar no projeto X porque é que tem de ter essa designação no nome do documento? O mesmo se aplica à designação das tarefas.

Eu percebo que o [Coordenador do projeto] tenha exigido isso porque ele gere mais do que um [projeto]. Porque está a gerir vários projetos. Mas os outros não vêm isso como uma mais-valia. Eu quando estou a trabalhar no projeto já sei que é a tarefa 2.3.x.x, não preciso que mo digam. É redundante.

Quanto aos documentos que são realizados colaborativamente, usamos o Google Docs para as atas, que eu acho realmente útil, foi uma boa aposta, apesar de os parceiros terem muita dificuldade em assimilar aquilo que estão a dizer com aquilo que têm de escrever. No nosso caso é muito útil porque somos vários e conseguimos dividir as tarefas. Mas isso tem a ver como é gerida a própria reunião, podíamos

dedicar 5/10 minutos no final a fazer isso e não o estamos a fazer. Até já o sugeri. Por exemplo, era boa ideia escrever apenas os tópicos, até para não esquecer o tópico, e no final registar o tópico completo. Porque se estás a escrever não estás com muita atenção ao que os outros estão a dizer. Por exemplo, nas reuniões de Coordenação isso acontece, e a ata fica fechada no mesmo dia e depois há apenas um período de validação; no caso das reuniões técnicas isso não acontece, ainda hoje escrevi qualquer coisa lá, outra pessoa também escreveu, e isto de uma reunião que aconteceu na quinta. Mas isso lá está, tem a ver com o que a gente pretende de uma ata, se queremos o texto cuidado e se vale a pena no dia seguinte rever o texto.

Quanto aos documentos técnicos que são criados, usamos a Dropbox para colocar lá as coisas, também usamos o Google Groups, não com a frequência com que devíamos usar, mas de vez em quando colocamos lá tópicos que queremos discutir. E também usamos uma wiki... Lá está, começamos a ter muitas coisas e fica muito difícil de gerir essas várias coisas. Se calhar era preferível termos só uma coisa.

**2. Quais são aqueles que considera serem os principais meios de criação de conhecimento no seio do Projeto? (Ex.: *Reuniões Técnicas, elaboração / leitura de documentos técnicos, atas de reuniões, conversas individuais, encontros informais*).**

**R:** Em primeiro acho que são as reuniões técnicas, que acho que são muito importantes, e depois a redação e leitura dos documentos técnicos. Tudo o resto é importante também, mas acho que estas duas coisas são as mais importantes. Claro que se eu estiver a almoçar e estiver a falar do projeto estou também a aprender qualquer coisa. Todos são importantes.

**3. Considera que uma boa gestão de informação contribui para a sedimentação do conhecimento gerado no projeto e, conseqüentemente, para a passagem de conhecimento do projeto para a organização?**

**R:** Sim. Se conhecerem as regras sim. Se não conhecerem depois não percebem bem onde estão as coisas... Mas se todos aderirem às regras, sim, porque estão formatados para aquilo e já sabem onde procurar.

**4. Quais são as principais formas de partilha desse conhecimento para fora do projeto? (exemplo prático: se um colega seu fora do projeto quisesse saber mais acerca do conhecimento que estão a gerar, por exemplo, no âmbito dos sistemas de simulação, de que forma poderia obter esse conhecimento, - via uma conversa informal, através dos documentos do projeto, etc...)**

**R:** Se eu tiver uma informação bem estruturada ele consegue encontrar rapidamente, eu até posso dizer-lhe em conversa, mas se eu tiver uma boa gestão do projeto eu consigo encontrar as coisas rapidamente.

**5. Como acha que a disseminação de conhecimento produzido em projetos deveria ser feita aqui na UESP? Considera que a existência de um portefólio de projetos ou outras ferramentas de gestão e partilha do conhecimento iriam contribuir para essa disseminação na organização?**

Sim, acho que era benéfico, mas tinha ter os projetos bem organizados, porque se estivesse tudo a monte...

Do [Projeto X] devem resultar dezenas de relatórios, ninguém ia ter tempo para os ler. Mas se tu tivesses um resumo, meia dúzia de linhas de cada uma das coisas e se tivesse isso num determinado local, não que tivesses sempre de andar a ler aquilo mas por exemplo se quisesse consultar ou saber “será que andam a fazer isto neste momento?” e ias ler aquela meia dúzia de linhas, e ver quem eram as pessoas afetas, mesmo que tu não tivesses lá tudo, podias sempre recorrer às pessoas e essa pessoa depois te diria. Por exemplo, nós agora estamos a trabalhar em simulação. Eu não sei se alguém no INESC está a trabalhar em simulação! Estás a ver? Se eu tivesse um local onde, com uma palavra-chave, ex.: simulação, e ele recuperasse logo alguma coisa, eu se calhar quando tenho algumas dúvidas até recorria a essas pessoas, perguntava o que é que ele fez, como é que fez, esse tipo de coisas. Eu penso que mais ninguém está a trabalhar em simulação ou se já trabalhou, mas não tenho a certeza, e aí sim, um portefólio com umas tags ou um sistema de classificação que eu pudesse pesquisar e rapidamente encontrar, isso sim seria interessante. Se não tiver esse tipo de pesquisa, isso torna-se muito complicado, porque há muita coisa feita no INESC todo, muitos documentos, muitos projetos, e muitas vezes os nomes não nos dizem nada (porque são nomes muitos esquisitos), mas se tivesse uma pesquisa, uma classificação e em que nós dominássemos isso e soubéssemos onde é que as coisas estavam, poderia na teoria ajudar-nos muito.

**Nós tivemos aqueles *workshops* da UESP há pouco tempo, foram cerca de 3 ou 4, que no fundo tinham o objetivo de as pessoas ficarem a conhecer os projetos que estavam a decorrer, isso não foi uma iniciativa benéfica na tua opinião?**

Acho que foi interessante sim. Agora ir por ir, se calhar não é muito. Mas se eu estivesse à procura de alguma coisa e soubesse que a médio e a longo prazo ia haver algo sobre isso, eu diria que sim, que era interessante. Estou-me a lembrar de um workshop que assisti, a pessoa também apresentou aquilo a correr, e nem me lembro se enviaram a apresentação por e-mail, e isso era uma das coisas que eu

gostava que enviassem. E até podia ter ficado no tal repositório onde eu pudesse ir pesquisar, e que até podia ter links, do género se quiser saber mais pode consultar na pasta tal, naquele tal repositório que falaste, isso sim era o ideal.

**E2: Entrevistado 2**

**Papel: Team Member do Projeto X**

**Data: 06-03-2013**

**Local: INESC Porto**

**Duração: 20 minutos**

**1. No que diz respeito à forma como a documentação do projeto é atualmente gerida e respetivas regras (nomeadamente ao nível do armazenamento de pastas na Dropbox, utilização do Google docs, e-mails, atas de reunião, etc.), quais as principais vantagens e problemas?**

**R:** Vou começar pelas vantagens. Acho que as vantagens num projeto desta dimensão são muito grandes, porque estamos a falar num grande grupo de pessoas que estão dispersas não só dentro da nossa organização como pelo país, em que a comunicação falada por vezes é difícil, e então teríamos que ter algo (e temos) que nos restringe no que diz respeito à publicação de documentos, por exemplo no controlo de versões e onde é que podemos encontrar essas versões, e acho que isso é bastante importante, porque eu posso dentro deste projeto estar afeto a uma tarefa e sei onde é que posso ir buscar os documentos criados ou que estão a ser desenvolvidos no que diz respeito à tarefa na qual eu estou afeto, e isso é importante quer para mim e para a equipa que está envolvida na minha tarefa como para o gestor de projeto que pode sempre consultar e ver a situação em que se encontra ou o estado em que se encontram essas tarefas. Neste caso, e abrindo um pouco mais o leque e não falando só neste projeto em particular, eu participo em outros projetos e consigo distinguir o que é o projeto X e o que são os projetos [Y] ou [Z], eu consigo, na minha estrutura de pastas, nos ficheiros do meu computador, perceber de que projeto é que estou a falar e organizar-me, mesmo no meu tempo, saber que se estou a trabalhar no projeto X tenho aqueles conteúdos e quando estou a falar de outros projetos são outros. Relativamente aos principais problemas, acho que não se prendem tanto com a organização mas sim com a forma como as pessoas usam essa organização, porque muitas das vezes não são respeitadas as normas. Porque não diria que são difíceis de aprender, mas no meu caso em particular por exemplo, eu entrei a meio do projeto e não tinha conhecimento e se calhar não conseguia apanhar todas as regras e muitas vezes criava aqui entropias porque não guardava o documento com o

nome certo ou não colocava na pasta certa e se calhar criei algumas dificuldades a quem já estava no projeto há mais tempo.

**Mas não achas que essas regras são demasiadas? Que poderiam ser simplificadas? Ou achas que são apropriadas?**

**R:** Eu não acho que sejam exageradas. O que eu acho é que (e isto já aconteceu) às vezes mudam as regras a meio e não avisam toda a gente. E isso acho que é complicado. Por exemplo, no caso das atas das reuniões técnicas, foram alteradas a meio do projeto, não aconteceu comigo mas sei que aconteceu com outras pessoas, o *template* para redação da ata de reunião foi alterado, a pessoa não se apercebeu que a ata tinha sido alterada e depois até foi chamada a atenção [pelo Chefe de Projeto] de que deveria ter utilizado aquele *template*. É mais nesse sentido que eu digo, da comunicação das regras, porque em particular ao exagero das regras, não me parece, porque estamos a falar num projeto grande com pessoas de sítios diferentes e se não houvesse este tipo de regras seria muito complicado gerir a informação. Agora se me perguntas se poderíamos usar outro tipo de plataformas que não a Dropbox, se poderíamos usar um sistema de gestão documental, talvez. Aí não estou certo se isto poderia ser viável ou não mas sim, talvez fosse interessante. Agora relativamente às regras de gestão de informação e da documentação do projeto, acho que estão bem aplicadas.

**2. Quais são aqueles que considera serem os principais meios de criação de conhecimento no seio do Projeto? (Ex.: Reuniões Técnicas, elaboração / leitura de documentos técnicos, atas de reuniões, conversas individuais, encontros informais).**

**R:** No meu caso em particular eu acho que são as reuniões técnicas e as conversas individuais. Isto porque as reuniões técnicas são importantes para eu partilhar e receber conhecimento adquirido de outros parceiros e elementos do projeto que não se encontram no mesmo local que eu, e são nessas alturas que podemos fazer entre nós todos a partilha de conhecimento, o que acho muito importante. Quanto às conversas individuais, são tão ou mais importantes na medida em que nós estamos dentro do mesmo edifício, e quando eu estou aqui a trabalhar e me surge uma dúvida eu posso logo ir ter com o [PSM] ou com outro colega e pergunto-lhe, tento esclarecer a dúvida diretamente, e isso também é muito importante porque conseguimos esclarecer logo aquele assunto na hora e não precisamos de andar com e-mails, de esperar pela hora da reunião para resolver o nosso problema. É mais fácil, se eu tenho um problema levanto-me e vou lá ter com a pessoa e se calhar em 5 minutos resolvemos logo a situação e fica arrumado. Para mim são estes dois os mais importantes. Não estou a dizer com isto que os documentos não são importantes! Mas na minha perspetiva, e enquanto informático às vezes custa-me estar a ler um documento de 40/50 páginas, enquanto numa reunião de 15 minutos conseguimos

perceber e discutir o que está lá escrito porque entre todos os que construíram o documento partilhamos as ideias e o conhecimento lá inserido e as coisas avançam.

**Mas não achas importante que esse conhecimento depois fique registado em algum lugar, fisicamente em documentos?**

Sim, claro, isso também é importante, até porque, como eu disse anteriormente, eu entrei no projeto a meio e eu tive obrigatoriamente que ler esses documentos quando entrei, documentos que já existiam. Recorri muitas vezes às conversas individuais e às reuniões técnicas para esclarecer certos pontos que não percebi nos documentos. Mas – e vamos fazer aqui uma situação hipotética – se calhar eu perdi 1 mês a inteirar-me do que era o projeto e a perceber todas as entranhas, mas fui eu, foi só uma pessoa, e se calhar se isso fosse feito com conversas e reuniões ia ocupar o tempo de duas ou mais pessoas, pois ia ter sempre uma pessoa a explicar-me e a falar comigo. E assim, com a informação toda registada eu peguei no documento, li e em casos pontuais ia esclarecer as dúvidas.

**3. Considera então que uma boa gestão de informação contribui para a sedimentação do conhecimento gerado no projeto e, conseqüentemente, para a passagem de conhecimento do projeto para a organização?**

**R:** No meu caso, como já tive oportunidade de explicar anteriormente, a documentação foi realmente importante e sem dúvida que a gestão da informação e as regras que foram aplicadas foram bastante importantes.

**4. Quais são as principais formas de partilha desse conhecimento para fora do projeto? (exemplo prático: se um colega seu fora do projeto quisesse saber mais acerca do conhecimento que estão a gerar, por exemplo, no âmbito dos sistemas de simulação, de que forma poderia obter esse conhecimento, - via uma conversa informal, através dos documentos do projeto, etc...)**

**R:** Da experiência que eu tenho e que eu acho que é a mais prática, penso que tudo começa com uma conversa, porque quando eu sei que alguém aqui dentro da organização que tem o conhecimento que eu necessito, é a ela que recorro logo de imediato. Até porque ela depois pode dizer-me em específico qual o documento que eu devo ler, porque o projeto pode ter um vasto leque de documentação (que é o que normalmente acontece) na qual eu só necessito da parte de um documento, e eu não vou estar a percorrer os documentos todos e a perder tempo à procura daquela pequena parte da qual eu necessito. Normalmente essas pessoas que estão a trabalhar no projeto já sabem, podem dar-me algumas dicas que me podem ajudar e até solucionar logo o meu problema, mas se for alguma coisa

mais específica direcionam-me ao local ou ao documento e aí sim eu leio e posso até recorrer a eles novamente se necessário.

**5. Considera que a existência de um portefólio de projetos ou outras ferramentas de gestão e partilha do conhecimento iria contribuir para a disseminação do conhecimento dos projetos na organização como um todo?**

**R:** Sim, eu acho que era importante, porque eu acho que é um problema que existe aqui no INESC, o não se saber que projetos estão a decorrer ou já decorreram e em que áreas. Não existe nenhuma plataforma com essa informação e a partilha desse conhecimento é feito entre nós aqui dentro, quase informalmente, do género “ah, aquela pessoa já trabalhou naquilo, vamos lá perguntar...”. Mas... eu acho que era necessário algo mais, para além do portefólio, que é uma boa ideia, poderíamos ter algo, uma plataforma, colaborativa talvez, com um fórum associado a cada projeto possivelmente, onde tivesse tópicos importantes acerca daquele projeto, como os objetivos por exemplo, quais foram os meios que tiveram de utilizar para chegar a um determinado fim, etc., e isto até podia ser algo interno no INESC, já nem digo fora, mas dentro do INESC, onde pudesse haver uma discussão e facilmente falar com as pessoas... isto porque muitas vezes não é possível chegar perto das pessoas, não porque elas não queiram, mas porque muitas vezes estão a trabalhar em projetos europeus e estão em reuniões ali e acolá, e quando não estão em reuniões estão a adiantar serviço para irem apresentar nas reuniões, e se calhar uma plataforma colaborativa que permitisse uma comunicação fácil... porque muitas vezes nem sequer temos o contacto de Skype, e nessa plataforma se calhar facilitaria essa situação, ou até poderia ter o contacto de Skype que eu depois iria usar para abordar então a pessoa, mas por outro lado se calhar até era mais fácil ser um fórum e eu colocar ali logo a minha questão a um grupo de pessoas desse projeto me pudessem responder – e nem precisava de ser só uma em específico, muitas vezes várias pessoas do projeto possuem esse conhecimento, e se eu for por Skype só posso perguntar a uma de cada vez, e se fosse no fórum podiam responder os três, ou um dos três... Acho que algo desse género poderia ser mais importante do que propriamente um portefólio... Porque o portefólio vai obrigar as pessoas a ler, e eu falo por mim, eu não vou ler um documento inteiro de 40 páginas, às vezes nem há tempo para isso sequer, é que não há mesmo tempo...

Até porque esses documentos pesados de que estava a falar já existem em parte, porque normalmente os projetos têm sempre *deliverables* que temos de entregar, e esses *deliverables* têm essa informação acerca do projeto, mas normalmente são sempre coisas muito extensas, que as pessoas não querem ler!...

**E3: Entrevistado 3****Papel: Project Manager na UESP****Data: 19-03-2013****Local: INESC Porto****Duração: 40 minutos****1. Quais os principais problemas em gerir a documentação criada no seio dos teus projetos?**

**R:** Nós não temos no INESC nenhuma plataforma que assegure o armazenamento de toda esta informação. Nos projetos aquilo que fazemos é guardar toda a documentação que é gerada a partir de projetos em documentos, que são depois armazenados em pastas. E não temos depois nenhuma ferramenta que nos permita fazer a recolha de toda esta informação e de todo este conhecimento. Essa é uma das dificuldades em consultar informação ao nível dos projetos. Bem, se calhar voltava um pouco atrás. Tudo começa por perceber os projetos que o INESC tem a decorrer. Não há nenhum sítio onde eu facilmente consiga pesquisar que projetos é que estão no INESC a decorrer, que projetos é que foram feitos, em que áreas, não há. Se tu quiseres pesquisar neste momento isso não existe. Como é que consegues descobrir isso: lendo o BIP, falando com algumas pessoas que percebem aquelas grandes áreas em que o INESC está a trabalhar. A partir daí o que é que fazemos, vamos tentar perceber então que projetos é que são e quais são as pessoas que estão nesses projetos. E aí já consegues ir pesquisar através de uma plataforma do INESC, que é a Intranet. A seguir, depois de se descobrir quem são as pessoas, passa pela tua iniciativa de falar com a equipa que esteve envolvida no projeto e aí tentar perceber melhor o que é que aconteceu no projeto. E depois não chegas normalmente a documento nenhum, a informação registada não é muita; sabes que pessoas estiveram a trabalhar no projeto, vais contactar essas pessoas, trocar algumas questões e vais retirar daí alguma informação. E consequentemente algum conhecimento, alguma indicação de experiência, o que correu bem, o que não correu bem... Mas depois a partir daí é a tua equipa que vai pegar nessa informação e vai resolver o problema. Esse ponto inicial de perceber que equipas é que estiveram a trabalhar poderá depois posteriormente ajudar a resolver questões mais técnicas, em que tens as pessoas em contacto e, dessa forma, consegues esclarecer algumas dúvidas. Não é tanto pela consulta de informação ou de documentos, é mais por experiência pessoal...

Nós próprios temos essa dificuldade nos nossos projetos. Em termos gerais, de “esta tecnologia resultou, não resultou... que problemas tivemos, qual é a nossa experiência...” isso aí fica na equipa, nas pessoas que se mantêm cá. Mas isso também tem a ver com o facto de se aproximar as pessoas nas diversas fases do projeto: existe a fase da conceção, que é se calhar mais técnica, depois há uma fase de

arquitetura, depois há uma fase de implementação, que são normalmente pessoas não tão sêniores a implementar, essas pessoas passam muito de projeto para projeto ou estão pouco tempo aqui no INESC. E aí é que o conhecimento se perde, essa parte mais técnica do que tecnologia é que usou etc., isso perde-se, vai com a pessoa. Mas aquela experiência mais macro, do “é uma boa tecnologia correu bem esta abordagem”, isso acho que se mantém. Mantém-se porque são as pessoas que guardam essa experiência, porque essa experiência e conhecimento não é traduzido para plataforma nenhuma. Portanto, outra pessoa que queira pegar no assunto tem de seguir mais ou menos estes passos que eu estou a dizer: tem de ver o que é que está a acontecer, quem é que esteve envolvido e tem de ir falar com as pessoas. Portanto, eu acho que uma das dificuldades que nós temos é: pelo menos sem grande detalhe técnico, perceber que projetos é que existem no INESC, sobre que assuntos é o projeto, quais os objetivos, que resultados é que conseguiu atingir e que passos é que executou até atingir esses resultados. Se isso existir já nós mais facilmente conseguimos perceber que tecnologias é que devem ser utilizadas, etc. Se tiver isso, a partir daí nós conseguimos se calhar rapidamente chegar às pessoas que estiveram envolvidas no projeto e a partir daí tirar algum partido. Porque eu também noto que é muito mais fácil para a equipa do projeto, tendo alguma dificuldade ou dúvida mais técnica ir à internet e pesquisar esse conhecimento do que estar a procurar internamente, porque a pessoa até nem está disponível, ou nem sabe muito bem quem é, não quer estar a chatear, não quer estar a mandar e-mail, etc., então se nós formos a ver a maneira mais rápida de fazer isso é Google e procurar. Mas no Google nós encontramos questões mais técnicas e até conseguimos resolver o problema, mas não encontramos tão bem experiência de utilização de determinada tecnologia, opinião, e isso é difícil às vezes passar para um documento, por mais que tu leias muitas vezes nós ganhamos confiança pelo número de pessoas que estão a trabalhar com aquilo, pelo número de projetos que foram feitos. E isso é que poderia ajudar. Por exemplo, tu estiveste a trabalhar naquele projeto [XPTO], tu tiveste a trabalhar na ferramenta e tiveste de usar uma metodologia qualquer, tu sabes o que é que se aplica, o que é que não se aplica, tu se calhar até vais à Internet e vês montes de exemplos e como é que se faz, mas tu queres ter a experiência de alguém, que te diga “vai por aqui que tu por aqui se fizeres assim e assim consegues lá chegar e fica tudo documentado e não tens dúvida nenhuma. E isso por vezes é difícil essa partilha de experiências, registar em algum lado. Então se aqui no INESC tivesses uma plataforma que concentrasse os projetos, as descrições, as tecnologias utilizadas, tu depois num segundo projeto facilmente poderias chegar às pessoas.

**E achas que essa partilha nessa plataforma até poderia ser feita através de uma wiki ou um fórum, algo assim direto e menos formal, achas que algo desse género seria benéfico?**

Era. Mas por outro lado, e como estava a dizer há bocado, se tu estiveres a trabalhar com o MS Office e surge-te alguma dúvida, a primeira coisa que tu fazes de certeza é “Googlar”: escreves “Project 2010, problema tal, como resolver” e de certeza que te vai logo aparecer um monte de informação e vais rapidamente procurar a pessoa que tem a solução para aquele problema. Porque é que nós não fazemos exatamente a mesma coisa? Essa experiência que tu estás a obter, essa forma de resolver os problemas, depois pode ser feita de duas formas: ou tu vais à Internet e vais partilhar esse conhecimento com TODA a gente e TODA a gente pode depois consultar isso, ou tu vais, dentro de tua casa, fazer exatamente aquilo que tu fazes na internet, vais ter um fórum, vais registar essas ocorrências, vais dizer como é que resolveste, e isso vai permitir que depois outra pessoa pesquise e consiga facilmente resolver esses problemas. Porque... Eu vejo com alguma dificuldade as pessoas conseguirem estruturar muito bem toda a experiência e conhecimento que obtiveram dentro de uma plataforma. É muito complicado! Não há ninguém que sustente e que esteja a fazer isso. Se tu reparares, aqui no INESC, o facto de estarmos a trabalhar todos juntos faz com que quando tu tens uma dúvida tu levantas-te e vais falar com o fulano de tal, e ela diz-te logo “olha fiz assim e assim”. Mas perdeu-se. Está resolvido, mas perdeu-se. Outra pessoa qualquer vai fazer exatamente a mesma coisa: vai-se levantar, vai falar contigo e tu dizes “vai falar com o fulano de tal” e ele vai falar e está o problema resolvido. É assim que as coisas se passam aqui dentro em muitas situações, e o que acontece é que isso fica destruturado, não fica registado em lugar nenhum. Se tu fores uma pessoa que está isolada num gabinete e só queres ir ao computador procurar “quem é que sabe resolver o assunto x”, tu não encontras isso em lado nenhum. Eu acho que aqui havia duas formas de fazer as coisas. A primeira é fazer com que as pessoas conversem, promover newsletters, promover a partilha de experiências, e aí tu vais começando a perceber a organização onde tu estás inserida, quem é que são as pessoas dessa organização, quem são os especialistas de determinada área, e assim se tiveres algum problema tu sabes logo onde ir. Depois, o facto de as pessoas falarem faz com que nada fique registado. Se tu reparares, na Internet as pessoas não telefonam umas às outras, as pessoas trocam e-mail e usam fóruns. Então, se tu tiveres um problema, tu não vais falar com ninguém, tu vais colocar o teu problema num sítio qualquer e alguém te vai responder. E assim ficam as coisas registadas. Por outro lado, se nós quisermos ter uma plataforma onde concentramos o conhecimento todo, nós conseguimos se proibíssemos toda a gente de falar com toda a gente. E se tu quisesses esclarecer alguma coisa, tu ias a um fórum perguntar, ninguém se ia levantar e ir falar com a outra pessoa. Pronto, é este equilíbrio que nós temos de ter. E muitas vezes aquilo que eu sinto é que eu tenho de conhecer as pessoas, perceber o que é que cada equipa está a fazer para facilitar isto. Uma pessoa nova que entra no INESC, que está ali no openspace e não conhece ninguém, no início vai ter muito mais dificuldade para esclarecer as

questões e problemas que vai tendo. Aí têm de ser as pessoas mais experientes, que estão há mais tempo no INESC, a facilitar isso.

**2. Praticamente já respondeste à questão que te ia colocar a seguir, mas apenas para sintetizar: quais são então aquelas que consideras as principais formas de partilha de conhecimento entre projetos?**

**R:** Sim, sobretudo oral. Nós a esse respeito já fizemos várias tentativas. Uma delas foi: marcar 1 dia por semana, elegia-se o projeto, havia uma pessoa que ia apresentar esse projeto e as outras pessoas ficavam a saber o que é que era. Pronto, isso é feito de vez em quando, o que já permite que as pessoas vão sabendo o que é que está a acontecer. E isso são boas iniciativas. E tu também não entras em detalhes técnicos. Tu estás a dizer que tens experiência nesta área, e as pessoas a partir daí devem usar isso da forma que precisarem. E esses eventos foram interessantes, e acho que o BIP também é interessante. Porque relata o que é que está a acontecer no INESC, que projetos é que existem. Outra iniciativa que se pensou fazer e que nunca foi para a frente, nunca foi muito bem acolhido, foi, à semelhança destes posters que estão aqui no openspace era os projetos que estão a decorrer neste momento ficarem numa espécie de... já nem digo ecrãs... mas em posters por exemplo, com a descrição do projeto, a equipa que está a trabalhar no projeto e os resultados. Uma coisa simples. Isso permitia duas coisas. Uma delas era que as pessoas que andam aqui saberem o que é que cada um está a fazer, porque tu lês o nome das pessoas e já sabes que aquela pessoas que até está sentado ao teu lado está a trabalhar naquilo. Se nós agora olharmos ali para o openspace não temos a mínima ideia do que cada um está a fazer! Eu até sei o que é que o fulano está a fazer, porque por acaso falei com ele, mas já não faço a menor ideia do que é que o tipo ao lado dele está a fazer. E isto aqui era o ponto de partida... Da mesma maneira que nós tínhamos aqui quais era os projetos, a equipa, os objetivos, também poderíamos ter numa plataforma, era igual. Mas o facto de termos aqui fora, era mais visual, e depois também permitia outra coisa: quantas empresas é que não vêm aqui visitar o INESC e até passam no openspace e vê todas aquelas pessoas a trabalhar, mas nem sabem em quê, e assim até podiam ver “ah, estas pessoas estão a trabalhar nisto e naquilo, são estes projetos que estão a decorrer...” E era uma forma de se conseguir partilhar o que está a acontecer. E ainda tinha outra vantagem, que era, se tivesse também a informação das empresas que estão envolvidas, também permitia que se percebesse e se reconhecesse que a empresa XPTO está a trabalhar naquele projeto, e eu até ando à procura de uma empresa em determinada área e vejo que aquela empresa está no projeto coordenado por determinada pessoa e posso logo fazer a ponte. E ninguém neste momento consegue ter essa iniciativa, exceto indo falar com aquelas pessoas mais acima, que estão a par de todos os projetos e estão envolvidas em tudo, mas que por outro lado não estão tão acessíveis ou até nem estão disponíveis naquele momento, etc.

**3. Considera que a existência de um portefólio de projetos ou outras ferramentas de gestão e partilha do conhecimento iriam contribuir para a disseminação do conhecimento dos projetos na organização como um todo? Que tipo de características achas benéficas?**

**R:** Isso era importante. Mas pelo menos por exemplo nesta questão dos posters, para sabermos que projetos é que estão a decorrer, o que acontece é que íamos ficar restringidos ao que se passava aqui na UESP. Daí, podíamos fazer isso por exemplo no bar, ou de outras formas... qualquer coisa que depois uma pessoa diga, fora da unidade, vamos encaminhar para o BIP. O BIP é a plataforma para comunicar este tipo de coisas, O BIP se calhar poderia concentrar esta informação dos projetos, porque isso se calhar não está lá, nós no BIP temos a notícia de determinado projeto, mas depois termos uma lista dos projetos todos não tem... Para nós de uma forma rápida chegarmos à informação que pretendemos. Eu acho que é muito importante. Mas mais uma vez, repara que as preocupações numa equipa e de cada pessoa são diferentes. As pessoas que estão a gerir o projeto são diferentes das que estão na parte do desenvolvimento, mas técnicas. Não sei... Eu concordo em ter uma plataforma que registasse isso tudo. Mas não vejo as pessoas a, por iniciativa própria, sentarem-se ao computador a descarregar informação. Não vejo. Acho que para conseguirmos lá chegar tínhamos mesmo de desligar os telefones e proibir as pessoas de se levantarem...

**Mas isso aplica-se a pessoas que tu já conheces e com quem estás à vontade para te levantares e ires diretamente falar. Não achas que era benéfico se isto fosse aplicável em todo o INESC, abrangendo aquelas pessoas que tu nunca falas normalmente? Ias conseguir no fundo ir para além da tua “rede de contactos”, expandi-la...**

Sim. Depende das coisas. Se calhar vais ter receio ou coragem de “postar” no fórum uma pergunta básica sobre como é que se faz uma fórmula no excel, porque toda a gente deve saber trabalhar no excel, e se calhar preferes ir diretamente ao Google e procurar. Mas, uma plataforma dessas acho que era muito útil se tivesse por exemplo organizada por temas, por exemplo para, se se tratasse de uma dúvida mais técnica, nem toda a gente tem de receber essa dúvida, mas acho que era importante.

**R: Já agora, e relativamente ao conhecimento específico relacionado com a Gestão de Projeto, como é que isso evolui de projeto para projeto, como é que geres esse conhecimento?**

Olha eu não tenho uma metodologia muito bem definida relacionada com a Gestão de Projeto, não tenho isso documentado em lado nenhum. Eu posso definir-te sumariamente como é que funcionam os projetos onde trabalho. Os projetos que fazemos são por norma projetos de I&DT, que têm uma candidatura por trás, onde tu já defines muito bem as atividades, tarefas, equipa, resultados e marcos,

etc. Se o projeto for aprovado é porque à partida ele está bem feito. Depois então arranjas com o projeto. Aí tu vais criar a tua equipa, escolher alguns recursos para trabalhar no projeto. Aí surge logo o primeiro problema aqui no INESC, que é, quando constituímos a equipa fazemo-lo somente dentro da nossa unidade. Neste momento estamos a tentar promover isso, temos dois projetos a decorrer com outros elementos da equipa que pertencem a outra unidade. Estamos nós a tentar fazer isso por nossa iniciativa. E depois crias a equipa, com base no teu orçamento. A partir daí tu sabes que tens aqueles resultados que tens de atingir, e depois vais seguindo as tarefas correspondentes, que já foram definidas e vais fazendo. Pronto, isso eu acho que é simples. Em termos de metodologia num projeto há algumas coisas, e estruturar isto é importante, definir alguns marcos de validação é importantíssimo, temos de ser rigorosos nisso e sobretudo quando trabalhamos com outros parceiros, criar essa disciplina. Mas depois conta muito a maneira como tu consegues motivar a equipa, negociar com os parceiros, gerir conflitos entre os parceiros, etc., pronto isso depois é toda uma habilidade e experiência que se vai adquirindo que não é propriamente registável. Há pessoas que são mais dinâmicas que outras e que conseguem motivar melhor a equipa. E depois gerir um projeto cuja equipa é somente aqui do INESC é uma coisa; agora gerir projetos com por exemplo 10 ou 15 entidades externas é muito mais complexo. E tu, nesses casos, não podes ser tão “cego” no que toca às metodologias que usas. Se tu fores muito rígido e exigires que o parceiro coloque a informação na data tal na ferramenta tal... e nós devemos ser rigorosos e devemos impor alguma disciplina senão também é o descabro. Mas por outro lado tem que se tentar gerir tudo isso sempre focado nos resultados que queremos atingir. Eu por vezes até nem me importo de passar por cima de algumas coisas e “regras” mas ter o resultado como meta, par ao tentar atingir. Não adianta estar a trabalhar meses num projeto e chegar ao fim e não ter cumprido os objetivos. Não adianta. Nós temos de atingir aquele resultado. Depois a forma como nós lá chegamos, isso já tem a ver com a gestão da equipa, a gestão dos recursos... A forma de chegar aos resultados pode ser uma forma mais complicada mais simples... Pronto, e uma boa metodologia, o que nos permite é simplificar o nosso trabalho. Porque eu há ali tarefas rotineiras que só nos dão chatices e que nós temos de tentar agilizar ao máximo. Exemplos: relatórios de progresso que eu tenho de preencher com os contributos dos parceiros, eu tenho de ter um relatório em condições sem ter aquela carga burocrática que só chateia e ninguém gosta, tenho de tentar gerir isso ao máximo. Pronto, e aí é preciso tentar ter alguns templates pré-definidos, com o espaço que eles têm de preencher já assinalado, e etc. simplificar ao máximo. E isto aqui é importante.

Nós deveríamos ter uma infra-estrutura que agilizasse isto ao máximo. É para isso que as plataformas existem; para agilizar isto ao máximo. Nós só nos devemos preocupar em, depois de toda a gente inserir informação na plataforma, olhar e ver se aquilo faz sentido, se não faz, analisar. Acho que ainda perdemos muito tempo com formalismos, que não estão a acrescentar absolutamente nada!

Mas resumindo; não tenho uma metodologia toda escrita, não tenho. Se tivesse de ensinar alguém tinha de me sentar ao lado dessa pessoa e explicar.

O Projeto X era um bom exemplo para nós chegarmos ao fim e sentar-se ao computador e fazer um balanço, e concretizar, dizer assim: chegámos ao fim. Como é que isto devia ter sido? Devíamos ter tido esta ferramenta? Nós no Projeto X devíamos estar a aproveitar para desenvolver as nossas ferramentas de suporte e chegarmos ao fim e tínhamos compilado esse conjunto de ferramentas, para próximos que haja... Porque se estamos à espera do final do projeto esquece... ninguém vai fazer isso.

**Ainda relativamente às ferramentas que se utiliza nos projetos,** A Dropbox é de facto uma ferramenta fantástica porque é muito simples de usar, e é familiar às pessoas. Agora como é que eu tenho de impor regras e tenho de impor uma plataforma e porque tem de ser assim e não se percebe as necessidades das pessoas, passado um tempo ninguém está a usar, e só estamos a perder tempo...

Deves-te focar no resultado, nos objetivos, o que é que se pretende com essas plataformas, como é que vamos partilhar conhecimento, onde é que está o conhecimento, o que é que nós temos de fazer. É por aí que as coisas devem começar. Muitas vezes está-se a arranjar uma ferramenta que depois aquilo não serve para nada. Porque as pessoas só querem partilhar um documento... mas eu tenho montes de problemas e muitas vezes não sou muito produtivo porque por exemplo a utilização do e-mail, há informação que só está no e-mail, e dispersa por vários e-mails. Chega-se a um ponto em que temos de parar e dizer assim: tomámos esta decisão; então vamos registar isso num documento onde vamos resumir o que foi falado de importante via e-mail, e é aquele novo documento que vale, tudo o resto que ficou para trás já não interessa, é aquela informação que é fidedigna. É que depois fulano de tal liga-me a perguntar por uma informação e eu tive de andar à procura em não sei quantos e-mails, e depois é preciso ver a qualidade dessa informação, ou seja eu tinha de encontrar o documento que era válido para aquela informação, e que tinha sido trocado por e-mail.

**E4: Entrevistado 4**

**Papel: Project Manager /team member na UESP**

**DATA: 05-04-2013**

**Local: INESC Porto**

**Duração: 15 minutos**

**1. Quais os principais problemas em gerir a documentação criada no seio dos teus projetos / projetos nos quais participas?**

**R:** Aqui eu acho que tens duas realidades muito diferentes, mas os principais problemas que acabam por acontecer, na minha opinião, devem-se às mesmas razões. Primeiro, a questão do versionamento, é muito complicada. Além disso, a atribuição de nomes aos ficheiros também não é automática; na prática, se nós tivéssemos uma ferramenta de gestão documental que nos agilizasse essas tarefas mais corriqueiras eu acho que a maior parte das pessoas acabava por cumprir mais as regras do que aquilo que cumpre. Depois, falando agora especificamente de cada uma das realidades, uma é a área de Consultoria e a outra é a área de I&D, se quisermos. Na área de consultoria, e fruto da standardização toda que tem vindo a ser feita, é relativamente fácil gerir a informação de um projeto, portanto não há grande espaço para invenções, tudo o que é templates a maioria deles já existe, e depois a pesquisa e recuperação da informação também é fácil, porque a estrutura é sempre a mesma, tipo de documento é sempre o mesmo, o tipo de formato é o mesmo, por isso de um projeto para ao outro acaba por ser fácil de recuperar. Nos projetos de I&D já não é bem assim. Nestes projetos, também por serem projetos muito distintos, com características muito muito diferentes de projeto para projeto, com pessoas também muito diferentes a gerirem, umas com mais preocupação em gerirem a informação do que outras, é muito mais complicado gerir documentação. Porquê – porque não há regras! Portanto, os projetos em si têm características distintas, e não há regras, há um bom senso, que é diferente em cada pessoa. Portanto, e cada pessoa organiza à sua maneira. E depois como pensamos de maneira muito diferente depois acaba por ser muito difícil ou muito mais difícil do que nos projetos de consultoria gerir essa informação. Eu acho que a principal falha que nós temos, coisas que podemos melhorar a esse nível é a standardização, nos projetos de I&D e, em segundo, a aquisição de uma ferramenta que nos ajudasse a automatizar aquilo que é fácil de automatizar, por exemplo, a atribuição de nomes a ficheiros, versionamento, etc, que não temos. Eu acho que era uma mais-valia grande.

**2. Que iniciativas de partilha de conhecimento achas que seriam benéficas aqui na UESP? Em particular, achas que as iniciativas mais informais como almoços de equipa ou os workshops da UESP (estes já não tão informais) são vantajosos?**

**R:** Eu acho que deveria haver um misto dessas duas coisas. Acho que os workshops vieram contribuir para uma melhoria grande do ponto de vista de comunicação em termos de unidade. Ainda estamos no início, ainda não se rodou pelos temas todos, e eu acho que não deveria ser apenas feito o enfoque no I&D, acho que se deveria também organizar workshops dessa natureza para outro tipo de projetos, porque também é conhecimento que se produz cá, por isso também deveria ser feito. Iniciativas mais

informais de partilha eu acho que fazem sentido se calhar com grupos mais pequenos. Porquê, porque se são núcleos muito grandes e que trabalham em projetos muito diferentes, acaba por não se tirar tanto proveito. Por isso eu acho que esses almoços, ou os lanches ou jantares de equipa ajudam não só a essa partilha de conhecimento mas também à construção dessa equipa, ao team building. E aqui, tudo o que é feito é por iniciativa própria, não existem práticas instituídas de. Eu acho que deveria haver. Não falo propriamente dos jantares, mas falo por exemplo em se criarem sessões, iniciativas, jogos, brainstorming, tipo uma vez por semana, onde as pessoas não eram obrigadas a ir, vão se quiserem e participam e acaba por se partilhar. Mas acho que, relativamente aos projetos, poder-se-ia criar momentos formais de partilha. Por exemplo, um projeto tem sempre um Kickoff, esse kickoff envolve o gestor de projeto e a equipa, mas às vezes nem envolve toda a equipa, e aí eu acho que é um ponto muito importante a trabalhar: é que no Kickoff deveria estar toda a equipa no mínimo, sempre. E isso nem sempre acontece. Número dois: depois do Kickoff já se pode dizer que há um projeto que arrancou; essa informação deveria ser partilhada com toda a gente, e não é só: o Projeto com a sigla A iniciou, mas sim: o Projeto com a sigla A, com a empresa B, com os seguintes objetivos, e esta informação deveria ser partilhada. Eventualmente ao nível da Unidade, e porque não pelo INESC todo, mas com grande mais valia ao nível da Unidade. E depois, se calhar um ponto de situação do projeto a meio se calhar é demais, mas pelo menos quando o projeto termina, devia fazer-se uma nova publicação: “o projeto terminou, os resultados foram estes, isto correu bem, isto correu mal” e fazer-se a partilha desta informação também. Eu acho que isso deveria ser formal, ou seja obrigatório para todos os projetos, portanto não é algo que se faz porque se quer, mas sim porque é obrigatório, e eu acho que isso contribuiria e muito para se saber quem é que está a fazer o quê, onde, com quem, e de certa forma também perceber em que áreas é que cada um de nós aqui dentro está a trabalhar, porque isso às vezes é um bocadinho difícil de perceber.

**Mas achas que essa partilha de informação dos projetos deveria ser mais baseada em documentação ou mais “pessoal” ou seja, com menos informação escrita e mais numa perspetiva de estar a dizer quem são as pessoas que trabalharam no projeto para se ir falar diretamente com elas? O que achas?**

Eu acho que as duas coisas. Porque uma coisa é: não precisamos de marcar uma sessão para a apresentação, podemos publicar em algum sítio que o projeto terminou, teve estes resultados, as pessoas envolvidas foram estas e portanto, quase ter-se atualizado como que uma espécie de BI do projeto. Sendo que, dependendo do tipo de projeto (por exemplo, projetos mais pequenos se calhar não justificam), mas projetos grandes se calhar justifica-se marcar uma apresentação no final, por parte de quem o geriu, sobre o que é que aconteceu, e sobre o que é que de facto foi desenvolvido. O registo é tão ou mais importante que esta partilha quando termina, porque ok, terminou, partilhamos, mas

aqueles resultados podem ser re-aproveitados de imediato. E, um ano mais tarde, podemos chegar à conclusão de que temos de visitar aquele projeto. Por isso este registo do fecho do projeto é importante que fique em registo para memória futura.

**3. Considera que a existência de ferramentas de gestão do conhecimento iria contribuir para a disseminação do conhecimento dos projetos na organização? Que tipo de características deveriam incluir?**

**R:** Nós já temos ☺ temos uma plataforma de partilha de conhecimento interno que se chama Intranet. E que, com algumas alterações... temos o Bip também, que é uma newsletter, mensal, que não fala sobre tudo – nem pode falar sobre tudo. Porque esta partilha dos projetos não pode ser pública, não deve passar para fora do INESC, e as notícias do BIP são públicas. Pronto, quando eu falo em partilha não é só dos resultados, bons, mas é também daquilo que correu mal! Porque a seguir vêm outros que podem vir a cometer os mesmos erros. Mas... Sim, era útil que existisse. Ou melhor: se se usassem as ferramentas que já existem para essa partilha. Portanto, a ferramenta, a plataforma já existe; ela não é utilizada. Em termos de conteúdos e organização desses conteúdos na plataforma, a orientação deveria ser a projeto. Os projetos devem ter *keywords*, ou seja, um projeto incide sobre uma área ou mais que uma. Um exemplo, se formos a olhar para o [PROJETO XPTO] tem desde business intelligence, interoperabilidade, e isto do nosso lado [INESC], depois também tem outras coisas que estão a ser desenvolvidas por outros parceiros. Mas é um projeto, que tem um conjunto de resultados. E que incide sobre uma série de áreas de conhecimento diferentes. E que está a contar com elementos de equipa ou da equipa UESP com *backgrounds* diferentes. Agora, a organização, a meu ver, deve ser a mesma que nós adotamos no cyberspace [servidor interno da UESP] ou noutra sítio qualquer: a orientação é a projeto. Agora, depois deve haver forma de conseguirmos recuperar, por exemplo, todos os projetos que já tivemos na área da BI (Business Inteligente), e a partir daí, se vamos fazer um projeto numa área que é a BI, interessa-nos ver todos os projetos na área do BI, mas se formos fazer um projeto na área do BI que é no retalho, se calhar interessa-nos ver os que foram na área do BI no retalho, e este tipo de catalogação tem de ser feita, e as regras têm de existir senão dá asneira ☺

## **APPENDIX 3**

### ***Project X structure and Document Management Rules***

*Project X* is part of a larger Portuguese Program constituted by a wide consortium, set up by 42 entities: 19 companies within the manufacturing technologies sector, 6 companies from the main sectors of the national industry and 17 entities from the national scientific system. This makes it a program with a high level of collaboration, which follows a strategic vision based on the pursuit of innovative activities aimed at developing projects of high technological and strongly oriented for the international market. The program has a duration of 36 months.

To manage a large program like this, it is very important to set up a coherent and strong management structure. In the Program Kick-off meeting, the following structure was presented (*Figure 14- Overall Program structure*). Related with this formal structure, and in order to monitor and evaluate the performance of such a large project, with so many partners and activities, a set of progress reports were defined. The progress reporting will ensure that the technical developments of the different project tasks did not departed from the initial planning and results, and that the global strategic objectives of the project were followed. This is particularly important due to being a funded project, and for that reason if project results were not satisfying and coherent with the initial goals the funding entity could cancel it.

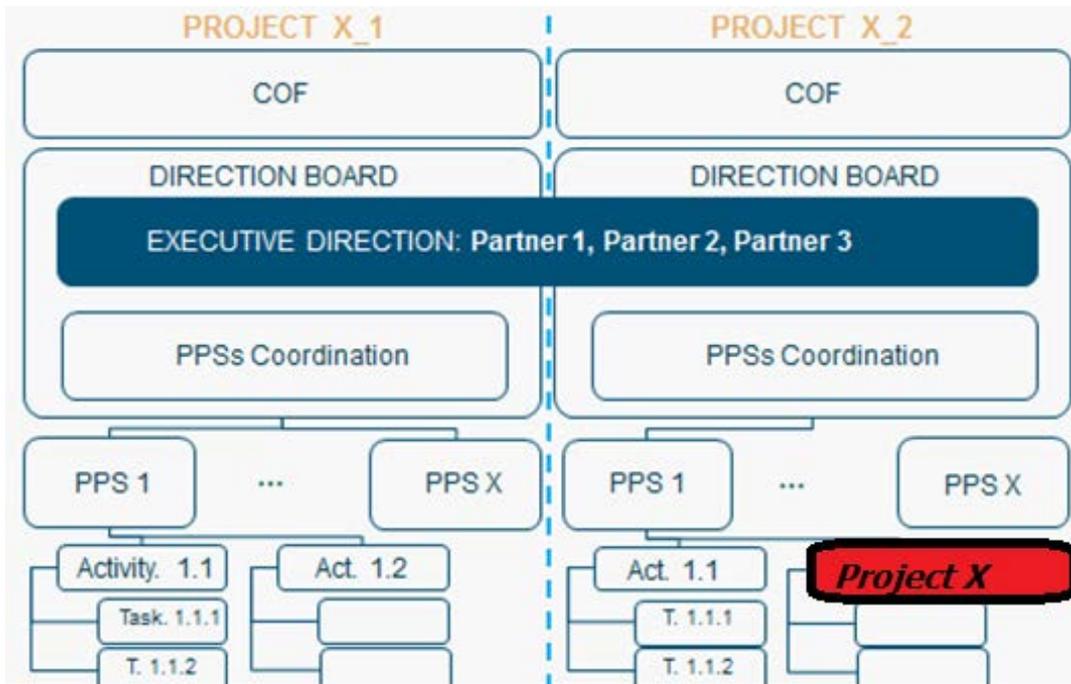


Figure 14- Overall Program structure

Such a controlling reporting structure involves the organization of the necessary documentation, mostly the project Gantt chart and the progress report. Those elements were based on the technical developments, so the activity or PPS leader should be aware both in the technical developments and also in the project management processes. If the PPs/ activity leader considered that the tasks were delayed from the original planning (based on the project Gantt chart) or that the project results were not in the original scope, he should take measures to put the tasks under his control in the right path again.

**Project X Document Management Rules:**

During *Project X* execution, the following document was produced including the main IM and Document Management rules to be followed by the project team. The document aggregates a set of rules that were being defined during meetings and the course of the project tasks. In order to assure confidentiality issues, the project and entities names were omitted.

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## Gestão Documental e Regras de Comunicação

[Project X]

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### A) GESTÃO DE PASTAS DROPBOX

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As pastas Dropbox criadas pela Coordenação da atividade são as seguintes:

- Grupo de Pastas referentes à Coordenação da Atividade (Dropbox\ [Project X].COORD):
  - Contém documentos relacionados com a Gestão da Atividade: Plano do projeto, atas aprovadas das reuniões, relatórios de progresso, *templates*, entre outros;
  - Cada parceiro contém ainda uma pasta privada para o preenchimento dos *reports* de horas trimestrais (para efeitos de preenchimento do relatório de progresso);
  - A responsabilidade de gestão deste grupo de pastas é da Coordenação da Atividade.
  
- Grupo de Pastas referentes ao Desenvolvimento técnico das várias tarefas (Dropbox\ [Project X]DESENV-T2.3.1.EmCurso, (...)):
  - Cada tarefa possui 2 pastas, para documentos Em curso e Finais;
  - Documentos obsoletos ou versões antigas deverão ser arrumados numa única pasta com a designação “\_Obsoletos” ou, caso não sejam de todo necessários, podem ser retirados da Dropbox, para melhor gestão do espaço (que é limitado);
  - Resultados Técnicos em estado final e já validados pelos parceiros deverão constar na pasta Finais de cada tarefa em formato editável e .pdf;
  - Cada pasta de tarefa deverá manter subpastas com a identificação clara das sub-tarefas a que se referem (ex: T2.3.1.1\_Levantamento Ferramentas Modelação Simulação);
  - Documentos em desenvolvimento relacionados com resultados técnicos deverão ser colocados numa pasta com a identificação clara do resultado (Ex.: R.2.3.1.3\_RelatórioXPTO);
  - Deverá evitar-se a manutenção de documentos desorganizados na pasta raiz, procurando organizar-se os documentos em subpastas, de acordo com as regras anteriores;
  - Cabe ao responsável de cada tarefa manter organizadas as pastas e subpastas respetivas:
    - Tarefa 2.3.1 - INESC TEC
    - Tarefa 2.3.2 - [...]
    - Tarefa 2.3.3 - INESC TEC
    - Tarefa 2.3.4 - [...]
    - Tarefa 2.3.5 - [...].

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### B) GESTÃO DE E-MAILS

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- Todos os e-mails relacionados com a Atividade deverão começar o campo Assunto (Subject) com a designação [Project X] (ou, no mínimo, apenas a palavra [...]). Esta regra é essencial dado o número elevado de e-mails diariamente recebidos e garante que os mesmos não são perdidos.
- Deve evitar-se o envio de documentos via e-mail, procurando inseri-los sempre na Dropbox (daí a importância das pastas estarem bem organizadas);

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### C) REUNIÕES DA ATIVIDADE E ELABORAÇÃO DE ATAS

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- Os parceiros da atividade reúnem-se semanalmente, via skype ou presencialmente, no âmbito das tarefas em desenvolvimento. As reuniões técnicas ocorrerão preferencialmente via *Skype* ou *Google Hangout*. Cabe a cada parceiro responsável pela tarefa respetiva convocar/ informar os restantes colegas da realização de reuniões;

- As reuniões de Coordenação ocorrem às 5as feiras, entre as 11h30 e as 13h, via Scopia. O parceiro [X] deverá garantir a disponibilidade da plataforma nestas datas. A Coordenação da Atividade informará (via e-mail) os parceiros sempre que, nessa semana, se realizar reunião de Coordenação;
- Para as reuniões são emitidas convocatórias, utilizando preferencialmente o MS Outlook. Parceiros que não possam estar disponíveis deverão informar atempadamente, recorrendo também ao MS Outlook. Cada reunião deverá ter uma agenda específica, elaborada por quem convoca a reunião;
- Durante as reuniões devem ser produzidas versões online das atas, através do Google Docs, que podem ser acompanhadas e participadas pelos presentes. No final de cada reunião, a ata fica disponível no Google Docs até ao dia seguinte, para leitura e validação por parte dos parceiros. Após esse período, é produzida a versão final, publicada na Dropbox em formato .pdf na pasta Coordenação/Geral/AR. A ata deverá ser aprovada na reunião seguinte.

## D) REGRAS DE DESIGNAÇÃO DE FICHEIROS

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A designação dos documentos e ficheiros eletrónicos deve obedecer ao seguinte protocolo:

[PROJETO].[pps].[ativ.].[tp].[parceiro].[aaaammdd].[dddd].V[D].[d]

Em que:

- [PROJETO]: [Project X]
- PPS: [...]
- Atividade: [...]
- Tp (tipo de documento):
  - CR: convocatória de reunião
  - AR: ata de reunião
  - DG: documento de gestão
  - DT: documento técnico
  - OT: outros documentos
- Parceiro: parceiro responsável pela elaboração do documento (nome é reduzido)
- Aaaammdd: data da elaboração do documento
- ddddd: texto descritivo
- D.d: versão do documento, em que D é um dígito correspondente ao nº major e d ao nº minor da versão.

## E) UTILIZAÇÃO DO GOOGLE GROUPS E WIKI

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Encontram-se também disponíveis as seguintes plataformas para discussão:

Google Groups:

- Contém tópicos para discussão, sendo que cada elemento poderá iniciar um novo tópico, devendo, para isso, solicitá-lo ao Administrador.
- Sempre que for publicado um novo *post*, será automaticamente enviado um e-mail de alerta para os utilizadores.
- Deverá utilizar-se, sempre que possível, o Google Groups para envio de informações ou questões relacionadas com os tópicos de discussão em aberto. Isto permite centralizar a informação trocada entre os parceiros numa única ferramenta e evitar a dispersão da informação em e-mails.
- Link: [...]

Wiki:

- Contém tópicos para discussão e registos de resolução de problemas (por exemplo, no âmbito da utilização do SW Simio). Serve também como glossário de termos chave do projeto. A administração da ferramenta é da responsabilidade do [...].
- Link: [...]

## F) OUTRAS INFORMAÇÕES ÚTEIS

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Na existência de dúvidas ou sugestões relacionadas com as regras aqui presentes deverão ser endereçadas a: [\[...\]](#)

