eXtreme Enterprise Architecture Planning (XEAP)

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Abstract

When developing enterprise architectures, in the same way as software products, companies have to deal with client's demand for fast results, while facing, at the same time, a big uncertainty on the requirements surrounding the project. This thesis investigates the similarities between the difficulties faced in both industries of Enterprise Architecture (EA) and Software Development. That is the starting point, for a proposal of an extension to Enterprise Architecture Planning (EAP) methodology based on the idea that common difficulties can lead to common solutions, to which we will call Extreme Enterprise Architecture Planning (XEAP).

The new approach, that we propose and demonstrate on this document, introduce agile characteristics such as several iterations, sequence deliveries and solution partitioning, into the process of enterprise architectures development. These characteristics are the answer to the need to obtain faster results and grow the response capacity to changing requirements.

As a way to demonstrate and analyze our proposal, we apply it to a real project that has Câmara Municipal de Cascais (Portuguese city council in Lisbon district) as client. Later on, we compare the results obtained by our approach, with the results obtained by GFI Portugal (Consultancy in the area of Strategic Information Systems Planning), on the same project.

Keywords: Enterprise Architecture, Software Development, Enterprise Architecture Planning, Extreme Programming, Spewak, iterations, GFI Portugal, Câmara Municipal de Cascais, Reference Models, agile, methodology, cycles, partitioning, business model, macro-processes, processes, sub-processes. As-Is, To-Be.

Resumo

No desenvolvimento de arquitecturas empresariais, tal como no desenvolvimento de software, as empresas sentem uma exigência cada vez maior por resultados cada vez mais rápidos, ao mesmo tempo que enfrentam uma constante incerteza nos requisitos que rodeiam o projecto. Esta tese propõe investigar as semelhanças entre as dificuldades sentidas por ambas as industrias de desenvolvimento de software e de arquitecturas empresariais. Este será o mote para a apresentação de uma proposta que estende a metodologia Enterprise Architecture Planning (EAP), tendo por base a ideia de que dificuldades similares podem ser tratadas com soluções também similares, e à qual chamaremos Extreme Enterprise Architecture Planning (XEAP).

A nova metodologia que propomos e demonstramos neste documento, introduz características ágeis, tais como, várias iterações, várias entregas e particionamento da solução, no processo de desenvolvimento de arquitecturas empresariais. Estas características são a resposta à necessidade de obter resultados mais rápidos e aumentar a capacidade de resposta à mudança de requisitos.

De forma a demonstrar e analisar os resultados da nossa proposta, aplicamos XEAP a um projecto real que tem como cliente a Câmara Municipal de Cascais. Mais tarde comparamos os resultados da nossa abordagem com os resultados obtidos pela GFI Portugal, usando uma metodologia tradicional, muito semelhante à metodologia EAP.

Palavras-chave: Arquitecture Empresarial, Desenvolvimento de Software, Planeamento de Arquitecturas Empresariais, Extreme Programming, Spewak, Iterações , GFI Portugal, Câmara Municipal de Cascais, Modelos de Referência, ágil, metodologia, ciclos, particionamento, modelos de negócio, macro-processes, processes, sub-processos, As-Is, To-Be.

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List of Acronyms

EA – Enterprise Architecture

EAP – Enterprise Architecture Planning

XEAP – eXtreme Enterprise Architecture Planning

XP – Extreme Programming

CMC – Câmara Municipal de Cascais

DSR – Design Science Research

ADM – Architecture Development Method

PCF – Process Classification Framework

RRM – Retail Reference Model

BRM – Business Reference Model

Chapter 1

Introduction

Businesses in the 21st century and the organizations within those businesses had been changing rapidly (Brooks, JoAnn M & all, 2008). Nowadays all the companies, ones more than others, face big difficulties that came from their surrounding mutable environments. With a relentless competition in almost all sectors, comes the increasing of offers variety, substitute products and a big range of choice possibilities for the costumers (Land & all, 2009).

The software development is one of those industries where there is, in the majority of the projects, a necessity for fast outcomes despite the tight schedules and the requirements uncertainty. With that in mind, we started exploring the parallelism that may exist between the development of enterprise architectures and the development of software, because although being slightly different types of development, these are two areas with common characteristics and problems.

In order to overcome the problems described before, the software development industry introduced the notion of agile approaches and methodologies for the development of the products, as a way to provide faster results while having a bigger capacity to deal with the constant changing of ideas, requests and requirements of the clients. Extreme Programming (XP) is one of the most used and successful agile methodologies and therefore will work as a starting point for our project, through its characteristics that provide the capacity to overcome the market demands in a sustainable way.

On our research for ways to reduce the time of results delivery, we came across several referrals to “reference models”, and how this kind of approaches to the development of business models where becoming more and more used, as an answer to the high number of enterprise architecture projects with tight schedules. Later we decided to explore a little more this topic and from there, we saw a close connection with our overall objectives and what we were trying to achieve. Reference models can be described as models that give us a way of representing organizations businesses, independently from the organization structure. That seemed to fit perfectly our intentions of providing a first high-level view of the client business model while having really limited information, and reducing significantly the time-to-value of the EA development process.

With the objective of introducing some new characteristics into the enterprise architecture, we had to choose an EA methodology with well-defined development process and steps, where we could try to introduce new ideas and changes without having to “reinvent the wheel”. After a careful literature review and analysis of some world-wide used methodologies our choice fell on the Enterprise Architecture Planning (EAP) developed by Steven Spewak. EAP is an overall simple methodology with a clear sequence of well-defined phases, which has since its foundation, a concern in showing results

quickly instead of getting the last detail correct (The MITRE Corporation, 2004). This simple description appears to point EAP as the perfect choice, once it seems to go along with the goals settled for this project.

Later on this document we combine reference models with agile characteristics and try to apply them to the Enterprise Architecture Planning methodology.

We will follow the Design Science Research methodology throughout our work. After clearly defining our problem (chapter 1) and doing a careful literature review (chapter 2), we design, develop and present our solution proposal (chapter 3), followed by its demonstration (chapter 4) and evaluation (chapter 5).

1.1 Research Problem

Today's enterprises face extremely uncertain and mutable environments. This kind of surroundings and their characteristics make the development of any project incredibly difficult to keep on track and therefore, almost impossible to successfully complete without facing enormous unpleasant surprises.

Not rarely, the difficult to deal with the environments leads projects into a two way path, where either the development continues its normal pace, keeps all the original plans and ignores the changing environment and requirements, ending in a completely failed project, either it tries to answer in an appropriate way to the changes and uncertainty of the requirements, and ends up completely failing the predicted and agreed time schedule and/or budget.

The uncertain environments which the enterprises face nowadays, have normally as main reason the constant markets change, with new competitors and substitute products, that lead to the clients own changing requirements and visions of the business. Not surprisingly, maintaining control over the requirements process is nearly impossible as each customer group pushes for its own interests and the changing technologies lure customers into escalating demands (Brooks, J. & all, 2008).

Alongside with this uncertain environment it is the organizations increasing needs and expectations for shorter cycles with production of return, as well as faster results (Spewak, S. & Tiemann M., 2006). The relentless competition that enterprises face today brings them a high necessity for fast results in all the areas evolving the business in order to adapt and create new opportunities (Land & all, 2009).

The problems described above, were especially evident in the industry of software development until some years ago. At that time, it was globally recognized the urgent need for efficient methods and practices capable of facing the fast growing demands. As an attempt to answer this demands, the notion of agile approaches started rising. Instead of developing software as a big complex process which ends with a big delivery, this development started being done in an iterative way with several smaller deliveries. That allowed embracing the possible changes that may happen along the process of development, with the capacity to manage them in a successful way (Sommerville, I., 2010).

Analyzing in a more particular way, the projects of enterprise architecture development are not different from the generality and in this case there are some problems that with the growing of the companies had become more and more difficult to deal, which reclaim for a methodology capable of dealing with those problems in the same way agile approaches did on the software development industry.

There are uncountable examples of enterprise architectures that fail to align the business needs with the right technology solutions, generating astronomic amounts of investments loss. As a result we find ourselves towards organizations that are often paralyzed by the complexity and change nature of the business & technology (Schekkerman, J., 2004).

Those facts let us with two possible conclusions about what is being done wrong in this sector, either the enterprise architecture in general is just something that is not achievable in a sustainable way, and therefore not worth to pursuing, either the methods we are using to achieve those enterprise architectures are, in some way, wrong.

Although the fact that, standard and most used methodologies, are able to generate good descriptive architecture models, they are not capable of dealing with the complex collaborative environments that surround the companies (Schekkerman, J., 2004).

The standard methodologies are considered by some authors as being highly influenced by the world of object-oriented design and analysis. This influence leads to failures when approaching large and complex enterprise architectures, where the reality has changed and the focus must be directed to the interactions between autonomous applications and not so much in the implementation of the applications themselves. This reality change can be justified mainly due to the emergence of the service-oriented architecture (SOA)[1].

Quite often in EA projects, the clients find themselves obliged to choose from the business processes, the ones that must be actually considered in the architecture, due to the limited amount of time allocated for the completion of the project (Townsend, J & all, 2008).

The cases where the clients choose specific business functions or processes to be architected, give us the idea that we can achieve a level of independency between applications supporting those functions. That independence allows us to deliver the expected results for a certain system without compromising the results and having to be dependent on other systems. Furthermore, it can be explored in a way that delivering the results of different systems separately and in several iterations becomes a requirement and success factor instead of an obligation due to the tight schedules or complexity of the project.

As a way to summarize our problem we present the questions that we intend to address with our work:

[1] In http://msdn.microsoft.com

Q1 → Is it possible to successfully develop an EA using agile characteristics as a way to overcome the uncertainty of requirements and the demand for fast results?

Q2 → Is a standard and traditional enterprise architecture methodology capable of "accepting" the introduction of agile characteristics?

Q3 → Are the "intermediate" outcomes that result from each XEAP iteration, valuable to the client?

Q4 → Is it possible to have such independence between processes that an enterprise architecture solution can be delivered in several "pieces"?

After defining our problem is important to establish the goals of our solution and the artifact that will result from our work. That artifact consists of an extension of a well-known enterprise architecture methodology with some new characteristics extrapolated from agile approaches of the software development industry. The main goals of that solution are presented next:

G1 → Reduce time to value of enterprise architecture development process;

G2 → Introduction of iterations on the EA development process with strong feedback and information flow between them;

G3 → Keep the client feedback constant throughout the all EA development process;

G4 → Reduce the response time for changing requirements;

G5 → Eliminate the aversion to changing requirements;

G6 → Introduce incremental delivery of the EA solutions;

G7 → Partition the EA solutions without compromising the quality of the final project;

1.2 Contributions

At the beginning of our work, we knew that would be imprudent and unwise of us to try to reinvent the wheel and come up with an entire new enterprise architecture development methodology. That understanding ended up driving our project into an extension of EAP, which constitutes our solution proposal. For our work and the final solution in particular, we propose some contributions, both from academic and enterprise points of view.

Once this work raises a thesis for a Master degree in Information Systems and Computer Science Engineering, we start by presenting the academic contributions:

C1 → Understand how and which agile software development practices can be extrapolated to enterprise architecture development;

C2 → Understand how Enterprise Architecture Planning methodology can be extended and accept the introduction of "agile" characteristics;

This work will be contextualized in an enterprise environment, by applying our proposal in a real case study provided by GFI Portugal, a multinational company performing consultancy services, outsourcing and systems analysis in the area of information technology. The enterprise contributions that our work intends to achiever are:

C3 → Understand how the introduction of "agile" characteristics in EAP can help with the delivery of faster results and quicker response to environment changes when compared with the standard approaches;

C4 → Understand if process iterations, small releases, continuous client feedback and solution partitioning are "responsible" for achieving faster results and bigger response capacity to changing requirements;

1.3 Research Methodology

In this chapter we describe the research methodology used throughout the development of our thesis and present its main phases and characteristics.

The methodology chosen to guide us through our project and its investigation process is called Design Science Research (DSR). DSR constitutes a continuous evolving research methodology with fifteen years old that is presented by (Hevner, A. R., & all, 2004) as involving a rigorous process to design artifacts, to solve observed problems, to make research contributions, to evaluate the designs, and to communicate the results to appropriate audiences.

In order to carry out a proper research based on DSR principles, a well-defined sequence of six activities must be performed. Next we present those activities that form the process model described in (Peffers, K., & all, 2008), and later, for each one we make the correspondence with our work:

Problem identification and motivation – Define, describe and justify the problem identifying clearly its existence reason and why it should or must be solved. This problem description may or may not provide a direct relation to the objectives of the solution system.

Define the objectives for a solution –Based on the problem identified and its motivation it is necessary to determine the goals that will justify our proposal. The development of a solution must be based not only on the problem itself but also on feasible and achievable objectives capable of guiding the process.

Design and development – Create the solution artifact is the third step of DSR. After defining which problem we want to solve and the specific goals we want to achieve with that, it is time to actually define the solution and produce the artifact, including its architecture and desired functionality that will be demonstrated on the next step. To successfully perform this phase it is required deep theory knowledge achieved by a good literature review.

Demonstration – As forth step it is the demonstration of our solution. After defining the proposal it is necessary to solve one or more instances of the problem using the developed artifact. Demonstration methods include experimentation, simulation, case study, prof, etc.

Evaluation – After demonstrating our solution in action, it is time to evaluate the results of that demonstration. This evaluation can include the comparison between the results of the previous step with the goals defined before for our solution or quantifiable measures of system performance. After this phase, if necessary, the researcher can decide to go back on the phase 3 and redesign the solution.

Communication – As last stage of our research methodology we have to communicate the problem, its motivation, relevance and the resultant solution artifact.

1.4 Document Structure

Next we present the adopted structure for our document, that is, has expected, influenced by the research methodology adopted (DSR):

Chapter 1 →We introduce our work, describe the problem behind it, its contributions and the research methodology used for all the process.

Chapter 2 → We present our literature review, were we cover several different areas, from agile software development to the current state of the enterprise architectures development field.

Chapter 3 → We present our solution proposal through a description of all the steps involved in an extension to EAP methodology (XEAP).

Chapter 4 → We present the case study that demonstrates the use of our proposal, applying XEAP to a real project, provided by GFI Portugal, involving the municipal council of Cascais (Câmara Municipal de Cascais).

Chapter 5 → We analyze and discuss the results obtained on the demonstration process. Our evaluation lays on the comparison of our results with the ones obtained by GFI when developing the same project, using their own approach.

Chapter 6 → On this chapter we describe the conclusions of our work. Here we include a description of the limitations, future work and the communication channel used to present our artifact to the outside world.

Chapter 7 → We present the references that supported our research.

Chapter 2

Related Work

In this chapter we do a description of the reviewed literature during the research process of this thesis.

On our description we start by introducing the main ideas and motivations inherent to the Agile Software Development area and approaches. This will work as a basis to the revision of the particular Extreme Programming and Scrum approaches, which constitute a very important foundation of our work.

Later we do a revision of the general enterprise architecture and its motivation as a way to introduce the description of different EA development methodologies like EAP and Togaf ADM. Furthermore, we do a critical analysis comparing those different methods in order to reach a conclusion about which is the most suitable one, when having into account our problem and what we see as a possible solution.

Finishing this chapter, we analyze several reference models, after describing their purpose and motivation.

2.1 Agile Software Development

Agile Software Development appeared some years ago has an answer to the fast changing, uncertain and unpredictable environments that surround the projects of the software development industry. These environments include client uncertain requirements, new target markets, substitute and competitor products/services and even economic changes (Sommerville, I., 2010).

Although all the difficulties described above, this competitive and restless industry started demanding for methodologies capable of delivering fast results, once this started emerging as the main requirement of the clients, leaving behind important requirements like software quality (Sommerville, I., 2010).

If we think about the traditional plan-driven approaches, we understand that they were design to achieve completely different demands than the ones we described before, once this type of approaches focused on having a complete and final specification of requirements, and then a final specification of the design before the implementation of the product. This kind of method makes the systems very powerless about any change of requirements or any other environmental mutation, which when we are talking about important and numerous changes can compromise the project in an irreversible way, leading to failed projects either in terms of schedule, budget or accomplishment of the desired solution.

Figure 1 outlines the main differences between traditional plan-driven approaches and agile software development approaches, concerning requirements treatment process.

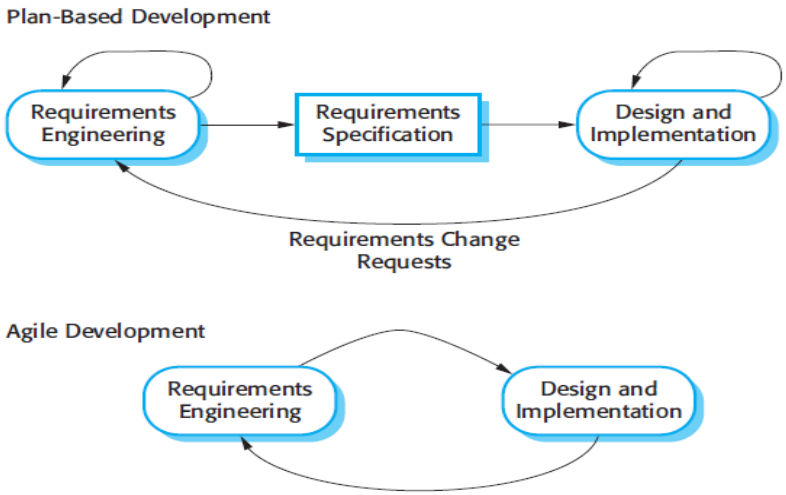


Figure 1- Plan-driven and agile approaches specification from (Sommerville, I., 2010).

The system development process is complicated and complex. Therefore maximum flexibility and appropriate control is required. Evolution favors those that operate with maximum exposure to environmental change and have optimized for flexible adaptation to change (Schwaber, K., 1995). Therefore agile software development and agile methods are made in an incremental way were each increment corresponds to a new release of the system that is made available to the costumer every two or three weeks. The involvement of the client in the process is vital for the method, once allows the development team to get fast feedback about the changing requirements (Sommerville, I., 2010).

Those agile approaches are best suited to projects where the systems requirements change quickly during the development process, once they are made with the intention to rapidly deliver results in the form of working software to the clients so they can give their feedback and change any system requirements if necessary (Sommerville, I., 2010).

2.1.1 Extreme Programming

Extreme programming (XP) is perhaps the best known and most widely used of the agile methods (Sommerville, I., 2010).

The methodology starts by “translating” the client requirements into scenarios that represent the expected final result of the system. Those scenarios are then decomposed in tasks to be implemented by the programmers in series of different releases.

Each iteration, or release, has a normal duration of two to three weeks, producing deliverable software that can be used by the client. This kind of characteristic helps the developing team to receive a quick and solid feedback from the client about the product and gives them the possibility to introduce the

necessary modifications into the next iteration and therefore dealing with the changing requirements in a smooth and efficient way.

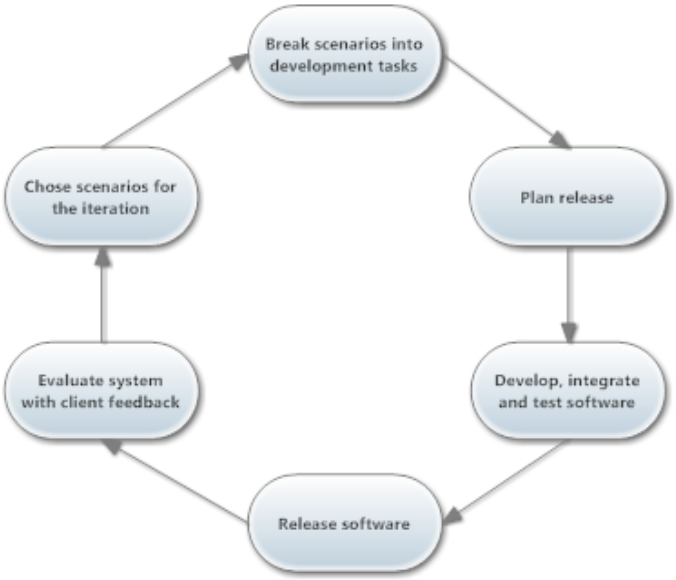


Figure 2- XP iteration cycle, adapted from (Sommerville I., 2010)

Figure 2 shows the steps that are included in a XP iteration cycle. Each iteration produces deliverable software, allowing a supported evaluation. The importance that it is given to the actual client's opinion shows us that this methodology actually embraces the change and the adjustments of requirements that so many times are the biggest threats in other kind of approaches.

In (Beck, K., 1999) are presented the main characteristics of XP approach:

- **Small releases -** The releases should have between two and three weeks;
- **Metaphor –** A simple descriptive story that can guide all the development by telling how the all system works;
- **Simple design –** System must be designed and kept as simple as possible,
- **Continuous testing –** the programmers write unit tests while the costumers write functional tests so their confidence on the project keeps untouched during the process;
- **Refactoring –** On each new feature implementation the programmers always ask if there is a way of changing the existing program to making it simpler;
- **Pair programming –** All producing code is written with two people looking at one machine;
- **Collective ownership –** Anyone at any time is free to add value to any part of the code when that it sees an opportunity;
- **Continuous integration –** Code is integrated and tested few hours after being done;
- **40 hours week work –** Working to many extra hours against XP, in order to keep the programmers fresh and creative. Too many extra hours generally means that there is a problem in the project;

- **On-site customer –** The costumer and future user of the system must sit with the team and be an active voice on the decisions and be constantly available to answer questions;
- **Coding standards –** With continuous changes and a collective ownership is important to have standards that keep the code coherence;

After an analysis of the methodology phases and characteristics it is important to discuss and understand what can be interesting to extrapolate from these software development approach to the enterprise architecture industry and introduced in a specific methodology.

From the characteristics described above and having into account the foundation of the problem described on chapter 2, both the clients demand for faster results and the uncertain requirements that surround the projects, we identify the following ones has being important to consider on our solution:

- **Small releases –** In order to divide a complex project and its resulting solution, it is important to several releases of that solution in small iterative cycles allowing the delivery of presentable results to the client much sooner than in traditional approaches where there is only one big release that deliver the all solution at once. This characteristic allows also to have client feedback in between releases helping to review, correct or rebuild part of the solution when facing changes of requirements;
- **On-site customer –** When facing uncertain environments and requirements it is preponderant to have constant client feedback. Having the client working the closest possible with the project developing team allows to have on-time client opinions and viewpoints, which will certainly help when it is necessary to respond to changing requirements;

Later on chapter 5 we propose a way to introduce those characteristics into an EA methodology in order to produce a solution capable of answering our problem.

2.1.2 Scrum

In this section we present another worldwide known and one of the most used agile development methodologies called Scrum. Scrum tries to answer requirements of maximum flexibility and appropriate control in complex and complicated systems development processes that occur under rapidly changing circumstances.

The encouragement to support flexibility given by Scrum, result in a big tolerance for other variables changes, allowing the methodology to provide more competitive and useful systems despite the increasing chaos where the development team might operate (Schwaber, K., 1995).

We can star by describing the Scrum as a methodology that treats the system development processes as a controlled black box, panning the context and board deliverable in a preliminary stage and then evolving deliverable during the project based on the unpredictable environment. Scrum is based on sprints, i.e. short development cycles.

Figure 3 shows the Scrum, its phases and the constitution of a sprint cycle.

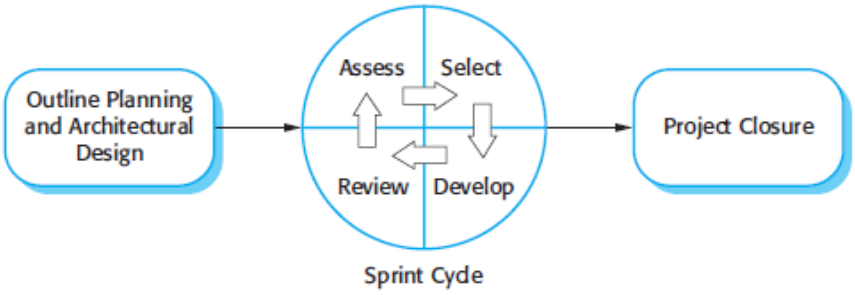


Figure 3 - Scrum process from (Sommerville I., 2010)

The process starts with the Outline Planning and Architectural Design phase which has as main point the definition of the product backlog as a list of the work to be done on the project sprints along with an estimate of its schedule and cost

After the first phase we have the development section of the methodology which is constituted by multiple iterative development sprints, or cycles, that are used to evolve the system. On each iteration several functionalities are selected from the product backlog to be developed during that sprint unit and presented to the client in the end of the cycle.

The last phase, called Closure, is a preparation for the final release, including the final documentation, pre-release staged testing, and actual release.

Next we present the main characteristics of this process, based on what is described in (Schwaber, K., 1995):

- The phases of Planning an Closure are the only ones based on well-defined processes, inputs and outputs with an clear knowledge of out to do and achieve them using a linear flow and iterations;
- The Sprint phase is mainly constituted by unidentified and uncontrolled processes, which are treated as a black box requiring for external controls. Those controls are presented on each iteration, in order to prevent chaos while maximizing flexibility.
- Sprints are flexible where process knowledge is built during the iterations, while open to the environment, and whenever there is no process knowledge available. Sprints are used to evolve the final product.
- The deliverable can be changed at any time during the Planning and Sprint phases of the project. The project remains open to environmental complexity, including competitive, time, quality, and financial pressures, throughout these phases until the Closure phase.
- The deliverable is determined during the project based on the environment.

In the same way we did on the analysis of Extreme Programming, we should now describe which characteristics from Scrum are interesting and capable of being extrapolated to our solution.

- **Iterative sprints** – The presentable results that each sprint produces constitute an interesting way of divide a complex project in several deliverables. At each sprint there is a review step,

allowing the client to give feedback about the work developed on that cycle. This feedback gives us a bigger capacity of response and tolerance to the changing requirements.

Later on chapter 5 we propose a way to introduce this characteristic into an EA methodology in order to produce a solution capable of answering our problem.

2.1.3 Main differences between agile and traditional approaches

As we said before, we are talking about two completely different approaches to the problem of software development, which have, naturally, a big range of differences to be pointed out. With that being said, there is one difference that stands out, once it was the main reason for the appearance of the agile approaches, and that difference is the capability of accepting change. That capacity is what often determines the success or failure of a software project (Williams, L. & Cockburn, A., 2003).

Next, we present a table where we do a comparison between the two different types of approaches, by pointing out the main characteristics of each other:

	Agile	Traditional
Style	Flexible	Rigorous
Cycles	Numerous	Limited
Domain	Unpredictable/Exploratory	Predictable
Time to value	Early in the project	End of the project
Planning	Minimal	Intensive

Table 1 - Main characteristics of Agile and Traditional approaches

As we can observe on table 1, Agile approaches characteristics, seem to adress and fulfill perfectly all the requirements and gaps that we enounced during the description of our research problem on chapter 1, but just in another industry that is not EA development. Table 1 gives us a simple, but very effective answer to the question, “Which characteristis should we extrapolate from agile software development to enterprise architecture development?”

2.2 Enterprise Architecture

Enterprise architecture can be described as a governance and decision making instrument with the capacity to fulfill the gap between enterprise’s vision, strategy, and change projects. EA tries to deal with this gap, by achieving a common, shared and unanimous comprehension about what are the company structure, business model and the necessary systems to support that model (Land & all, 2009).

The traditional organizations were designed with main concerns on the efficiency and effectiveness capabilities rather than the enterprises agility capacity.

The need for competitive advantage has been making the technology a business differentiator. Alongside with that, comes the need for a proper architecture able to follow that technology, which helped the enterprises realizing that this is a field of extreme importance to their business and their development as a company. A coherent description of enterprise architectures provides insight, enables communication among different stakeholders and guides complicated business and IT changing processes (Schekkerman, J., 2011).

In (Land & all, 2009), its described a group of indicators provided by enterprise architecture, that have the capacity to give a clear understanding of the company's current state, the direction they are following, the desired future state and the gaps between the present and the future. Those indicators are:

- Enterprise's current state,
- Enterprise's future state,
- Enterprise's current performance,
- Enterprise's future (expected) performance,
- Direction and progress of its transformation processes,

Enterprise architecture provides a way of centralize and stabilize the information about the environment, making it consistent and normalized throughout the company and among the stakeholders of the business (Schekkerman, J., 2004).

2.2.1 Steven Spewak - Enterprise Architecture Planning

In his book Spewak describes EAP as "A modern approach for planning data quality and achieving the IS mission" (Spewak, S. & Hill, S., 1992)

EAP is a process that take some important steps before going forward with the IS architecture, trying to provide a practical vision for the information-planning professionals and at the same time, understandable for the business people.

We can consider EAP a "business driven" approach to the problem of IS planning, once it has as first main concern a clear and accurate definition of the enterprise knowledge base through the achievement of the vision of where the company is in the present (usually called "AS-IS" vision) concerning the business model and the current systems and technology that are being used (Spewak, S. & Hill, S., 1992).

In EAP, the definition of the business model (Business Model phase) is divided into two different sub-phases, the Preliminary Business Model and Enterprise Survey. Those two sub-phases together with the description of the current systems and technologies that support the business complete the definition of the "AS-IS" state.

After the definition of where we are today, the methodology leads us to the definition of where we plan to go and what we want to achieve based on our reality and in what was defined in the previous

phases (usually called “TO-BE” vision). This part of the methodology includes the data, application and technology architectures that according to the business model produced, will be able to support the business processes of the company.

As last stage and after we define clearly where our company stand in the present and which is the future state to be achieved, the methodology suggests us to define, through one big phase, how we plan to get in that state knowing our present. This corresponds to the phase of implementation/migration plan that will tell how the transition and the actual installation of the projected systems with the chosen technology are supposed to be accomplished (Spewak S. & Hill, S., 1992).

Figure 4 taken from Enterprise Architecture Planning book (Spewak S. & Hill, S., 1992) gives us a clear idea of the structured and well-defined sequence of phases that compose the methodology.

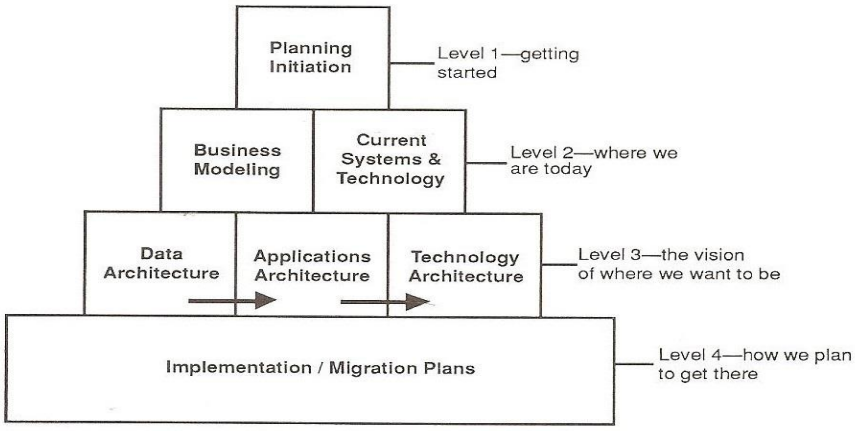


Figure 4 - Enterprise Architecture Planning Model from (Spewak, S. & Hill, S., 1992)

Next we describe the each EAP phases and the steps that compose each one, based on the description made in (Spewak S. & Hill, S., 1992). On the description of each phase we start by doing a small overview and then we present the sequence of steps necessary to perform that phase followed by the main deliverables that result from the process. Notice that, on the presentation of deliverables, we decided to show only the ones that we consider key deliverable documents instead of making an exhaustive list.

Planning Initiation

In this first phase the architects settle realistic objectives and expectations concerning their perception of the project. Here is described the plan that will lead the project into the right direction and end up being completed on time and having qualified team members.

Steps:

- Determine scope and objectives for EAP;
- Create a vision (initial meetings with management);
- Adapt a methodology;

- Arrange for computer resources;
- Assemble the planning team;
- Prepare EAP work-plan;
- Obtain management approval;

Main deliverables:

- Documented enterprise scope and EAP objectives;
- EAP methodology guidebook;
- Documented roles, responsibilities and alignment between available resources and schedule;
- EAP work plan;
- Status report;

Preliminary Business Model

This phase marks the beginning of the definition of the "AS-IS" state with the description of where we are and what we have today. This phase provides a high-level comprehension of the organization structure and a first idea of the actual business.

Steps:

- Document the organization structure;
- Identify and define the business functions;
- Document the preliminary business model and distribute and present it back to the business community for comments;

Main deliverables:

- Organization charts;
- Documented organization structure;
- Documented business functions;
- Documented preliminary business model;

Enterprise Survey

This phase continues the description of the business, going further into the structure of the organization and above all detailing the functions, processes and their architecture based on interviews and analysis performed with the stakeholders.

Steps:

- Schedule the interviews;
- Prepare for the interviews;
- Perform the interviews;
- Enter data into the toolset;
- Distribute the business model;

Main deliverables:

- Schedule of interviews;
- Refined EAP work plan;
- Interviews forms and documented results;
- Verified EAP database;
- Complete set of business model reports;
- Feedback, comments and suggestions on the business model;

Current Systems & Technology

This phase marks the end of the "AS-IS" state definition. Here it is performed an analysis of the applications and technology supporting the actual business and its processes.

Steps:

- Determine the scope, objectives and Information Resource Catalog (IRC) work-plan;
- Prepare for data collection;
- Collect the IRC data;
- Enter the data;
- Validate and review the draft of the IRC;
- Draw schematics;
- Distribute the IRC;
- Administer and maintain the IRC;

Main deliveries:

- Information Resource Catalog (IRC) work plan;
- Completed data collection forms;
- Technology platforms identification;
- Relations between applications and business functions;
- Relations between applications and technology platforms;
- Documented IRC;
- Application schematics;

Data Architecture

This phase marks the beginning of the "TO-BE" state definition. With the description of the needed data entities and their relation with business processes and applications we are able to achieve a data architecture that starts defining what and where we want to be in the future.

Steps:

- List candidate data entities;
- Define the entities, attributes and relationships;
- Relate the entities to the business functions;
- Distribute the data architecture;

Main deliverables:

- List of the candidate data entities and their definition;
- Entity-Relationship diagrams;
- Entity-to-business function lists and matrices;
- Entity-to-current application lists and matrices;
- Data architecture document;

Applications Architecture

This phase will analyze the data entities and the business processes that manipulate them, and from there come up with a suitable applications architecture that describes the systems capable of supporting them.

Steps:

- List candidate applications;
- Define the applications;
- Relate applications to functions;
- Analyze impact to current applications;
- Distribute the applications architecture;

Main deliveries:

- List of possible applications;
- Applications definition;
- Application-to-business function lists and matrices;
- Application-to-organization unit lists and matrices;
- New applications impact analysis;
- Application architecture document;

Technology Architecture

This phase marks the end of the “TO-BE” state definition. After knowing the necessary applications to support our system, is necessary to describe and architecture the technology platforms capable of supporting them.

Steps:

- Identify technology principles and platforms;
- Define the platforms and distribution;
- Relate the technology platforms to applications and business functions;
- Distribute the technology architecture;

Main deliverables:

- List of candidate technology platforms;
- Configuration of technology platforms;

- Technology platform-to-application list and tables;
- Technology platform-to-business function list and tables;
- Technology architecture document;
- Revisions to technology platforms based on users feedback;

Implementation/Migration Plans.

After the definition of all the architectures that meet the enterprise needs it is time to describe how we plan to get there. In this phase is performed a plan capable of clearly give those guidelines and provide the right understanding of what is necessary to achieve the architectures goals.

Steps:

- Sequence the applications;
- Estimate the effort, resources and produce a schedule;
- Estimate the costs and benefits of the plan;
- Determinate the success factors and make recommendations;

Main deliveries:

- Technology implementation sequence;
- Application-to-data entity tables and matrices;
- Application implementation sequence;
- Documented analysis on effort and resources;
- Schedule;
- Plan for converting and/or replacing existing systems;

2.2.2 Updating Enterprise Architecture Planning

Some years after the EAP publication, it started being recognized that the methodology needed some refreshment in order to ensure that EAP remains as a viable approach to EA implementation (Spewak, S. & Tiemann M., 2006).

This refreshment brought some subtle but important changes to EAP although the simplicity of the approach was preserved. Some of the changes are:

- "Planning initiation" pass from a phase of the methodology to a stage of preparation before the beginning of the actual process.
- The first phase of the process is named "Values & Principles".
- The phase of "Business Model" is named has "Business Knowledge".
- There are two new areas that can be considered as being outside the model's components, but that due to their importance in the process are considered key to the implementation of the EA:
    - Project Management
    - Repository Management

This refreshment is presented as a way to strengthen and reconnect EAP to permanent changing reality evolving the EA methodologies in use today, and not as a radical change on the EAP approach, once it is recognized that although being created long years ago, still a very effective way of making enterprise architecture (Spewak, S. & Tiemann M., 2006).

2.2.3 TOGAF ADM

The Open Group Architecture Framework, best known as TOGAF, is owned by the Open Group and describes itself as a framework that has as more important part a descriptive model of how to develop enterprise1 architecture called Architecture Development Method (ADM).

Architecture Development Method (ADM)

Architecture Development Method can be seen as a recipe for creating architecture. This method has well-defined phases and steps in order to achieve architecture through a certain path. From another side ADM is also very flexible mutable on respect to its phases and can adapt to the different needs of the enterprises. In the framework specification (The Open Group, 2009), it is actually said that one of the first thing that should be done is a review of the ADM components and their appliance on the specific enterprise, deciding what is more suitable to each problem.

ADM is divided into nine different phases starting in a preliminary phase of planning previous to the process cycle. In this cycle we follow from phase A (Architecture Vision) until phase H (Architecture Changes Management). In between this two phases are defined the Business, Information Systems and Technology architectures always aligned with the business requirements and goals (The Open Group, 2009).

ADM is a method that started the introduction of iterations in its cycle as a way of having a more sustained process, giving the possibility to access the information of the previous iteration, allowing a constant growth of the business knowledge throughout the all cycle.

Preliminary Phase

On this first phase that is outside the ADM cycle, we must define the scope of our EA and from there understand and plan the processing information that we will be doing during the all process.

Phase A

In this phase, named as Architectural Vision, is intended to define the enterprise mission, goals and strategic drivers for the rest of the process and achieve a consensus vision of the business throughout the company. Still in this phase are refined and documented the scope, principles and mainly the architecture project.

Unlike a good number of other methods, ADM does, in its earliest phase a preliminary and high-level description of “TO-BE” and “AS-IS” states of the enterprise. The detailed descriptions of those states will be built later on the process.

Phase B

In phase B, named as Business Architecture, are defined all the different components that compose that architecture. Those components are: business functions and processes, organizational structure, business goals and objectives and business services. When in the first iteration of this phase, the focus is the definition of the “AS-IS” business architecture and in the later iterations it starts to build the “TO-BE” architecture and that supports the future needs. Later in Phase E, a comparison between those to architectures (“TO-BE” and “AS-IS”) is performed and that will allow to have clearer understanding of where the actual architecture is failing and from there be able to make improvements.

Phase C

In Phase C, named as Information Systems Architecture phase, are defined the steps to describe the data and application architectures and the alignment between them. Those architectures include the relational data models, data security and migration diagrams composing the data architecture, and application portfolio catalog and others application diagrams relating applications with the functions they support, the technologies supporting them, their locations and users.

Phase D

In phase D, named as Technology Architecture phase, there are a group of views that are created in order to define the technology to support the information systems and their structure. In those views are included hardware, communications, processing, cost and standard views.

Phase E

In phase E, named as Opportunities and Solutions, we do the analysis that we talked in Phase A, and search for opportunities of improvement through the comparison of the actual architecture and the needed one. This analysis will allow us to realize our target architecture and identify whether to reuse existing systems make new developments or even make purchases.

Phase F

In phase F, named as Migration Plan, we analyze the existing target architecture transition projects. In this analysis we have into account issues like, organizational behavior, schedules and available time and resources, while performing risk and cost-benefit analysis.

Phase G

In phase G, named as Implementation Governance, we do the actual implementation and governance of the planned and approved projects. This called governance can be seen as a small specific part of the overall change governance that is performed in the next phase.

Phase H

In phase H, named as Architecture Change Management, ADM aims to provide a governance process for on-going business change that the enterprise faces. This governance includes strategies,

suggestions and guidelines that help keeping your EA updated and reflecting the current business, which is essential for the success of the project.

As we said before, ADM started the introduction of iterations on the EA process. Unlike software development agile approaches ADM does not use those iterations to deliver results to the client but it does the business modeling and correspondent architectures in an iterative way, going from the “AS-IS” to the “TO-BE” with the advance of the iterations.

In the end, ADM can seem a very large and quite daunting methodology that provides a step-by-step process to produce enterprise architecture but at the same time has the capacity to be very flexible with a high number of optional steps and actions. Despite giving ADM the capacity to suit to a huge range of different kinds of problems, the flexibility inherent to the process can sometimes bring some difficulties to see how best to select from or adapt the methodology in a way that best serves our project.

2.2.4 Comparison between methodologies/frameworks

On this section we make a comparison between the EA development methodologies reviewed before as a way to justify our choice of methodology to extend and to introduce our proposed changes. We try to do the comparison in a way that makes clear and understandable the advantages of our choice.

In order to do this analysis we choose some different criteria that can be compared between the different methodologies. The chosen points of comparison are the ones we considered more relevant in the point of view of our proposal and that we should have into account in order to introduce the changes we planned.

In our comparisons we number the different methodologies, with number 1 and 2. Number 1 corresponds to the methodology that does better job and the number 2 to the methodology that does the poorest job on each area.

The comparison points analysed for both methodologies are:

- **Process guidance:** Refers to the capability of the methodology on guiding the architects throughout a step-by-step process;
    - EAP: 1 – It can be considered the major focus of the methodology, which was actually its main differentiation from other methodologies at the time when it was published;
    - TOGAF ADM: 2 - It can be considered the one of the major focus of the methodology but can change depending on the enterprise we are facing and therefore adaptable to the problem. It needs some deep analysis before each project in order to clearly define the necessary and needed steps.

- **Completeness:** Refers to how far the processes go with their enterprise architecture.
    - EAP: 2 – Only includes the definition part of the architectures implementation process;

    - TOGAF ADM: 1 – Goes beyond the implementation itself and even have concerns on the enterprise change governance and management;

- **Time to value:** Refers to the existing amount of time between the beginning of the project and the begging of results and value delivery to the client.
    - EAP: 1 – Being EAP only a planning definition process with the implementation and design out of its range allows it to deliver value sooner than other processes;
    - TOGAF ADM: 2 – Is able to provide value in short time, but has a longer cycle of execution than for example EAP, once it includes phases of implementation governance and change managing;

- **Allowance to solution partitioning:** Refers to the capacity of accepting the introduction of partitions into the solution.
    - EAP: 1 – Being EAP only a defining process with the implementation and design out of its range allows it to deliver value sooner than other processes;
    - TOGAF ADM: 2 – Is able to provide value in short time, but has a longer cycle of execution than for example EAP, doe to its completeness;

- **Information Availability:** Refers to the quantity and quality of the available information about each methodology/framework.
    - EAP: 2 – Almost the totality of the quality information is non-free;
    - TOGAF ADM: 1 – Almost all, if not all, the information is free to access provided by The Open Group;

Table 2 resumes the comparison performed on this section.

	EAP	TOGAF ADM
Process guidance	☑	
Completeness		☑
Allowance to solution partitioning	☑	
Time to value	☑	
Information Availability		☑

Table 2 - Methodologies comparison table

Conclusion

When looking at the comparison points and the results we see that although having the lower available non-paying information, Enterprise Architecture Planning may justify being chosen for our proposal. EAP seems to be the most suitable methodology to introduce some of the characteristics that we intend to extrapolate from the agile software development approaches.

The fact that EAP is a methodology that only makes the planning definition of the architectures and their implementation plan without going further into the actual implementation can sometimes be seen as a limitation, but it turns out to be an interesting advantage in our seek for methodology that has a natural appetence for the quick delivery of results and at the same time is able to provide a sufficient independence between architectures and models of the different business functions that can possibly allow the partition of the solution.

2.3 Reference Models

Reference models are prototypes of some domain. Those models intend to reduce significantly the trouble inherent to the creation of domain-specific systems, where we can select the more important parts of the model and adapt them to a specific problem. When applicable, this possibility gives us a huge advantage in terms of both cost and time saving, on the development of the projects (Ramesh, B. and Jarke, M., 1999).

Furthermore, reference models are used as a starting point for the construction of project-specific models. The benefit of the use of reference models is predominantly the reduction of development costs, due to the possible reuse of knowledge. Nevertheless, reference models provide benefits only if the reduced modeling effort resulting through their reuse is not overlapped by the adaptation effort. Adaptations are necessary since the reference model has to comply with the particular application context (Frank, U., 1999).

2.3.1 PCF Reference Model

One of the most used reference models is called Process Classification Framework (PCF). The reason for its popularity lies on the fact that this is a cross-industry model. This means, PCF is a model is flexible and general enough to fit any kind of organization, and this nature, is one of its most valuable features (APQC, 2012).

PCF defines 12 high-level functional categories and contains over 1000 process elements that chosen and suited to represent any kind of business. The 12 functional categories are:

1.0 Develop Vision and Strategy;
2.0 Design and Manage Products and Service;
3.0 Market and Sell Products and Services;
4.0 Deliver Products and Services;
5.0 Manage Customer Service;
6.0 Develop and Manage Human Capital;
7.0 Manage Information Technology;
8.0 Manage Financial Resources;
9.0 Acquire, Construct, and Manage Property;
10.0 Manage Environmental Health and Safety;
11.0 Manage External Relationships;

12.0 Manage Knowledge, Improvement, and Change;

As we can see, the PCF represents a series of interrelated processes that are sociotechnical in nature, are business critical, and represent six major dimensions of the organization: knowledge communities/functions, processes, content, marketplaces, culture, and organizational structure.

When considering the use of PCF we must keep in mind that this framework does not list all processes within a specific organization, and at the same time, not all the processes listed are present in every organization.

2.3.2 Retail Reference Model

Retail Reference Model (RRM) is, as the name suggests, a model that establishes a comprehensive collection of business processes capable of guiding retailers to achieve greater business value. RRM provides a documented set of business processes that can help retailers on several different aspects, such as, educating employees, identifying inefficiencies or communicating changes.

This reference model is a very effective way to reduce speed to value, by reducing implementation time, reducing total cost of ownership through fewer modifications and enabling the retailer to focus on the processes that may give him an advantage, when compared with the competition.

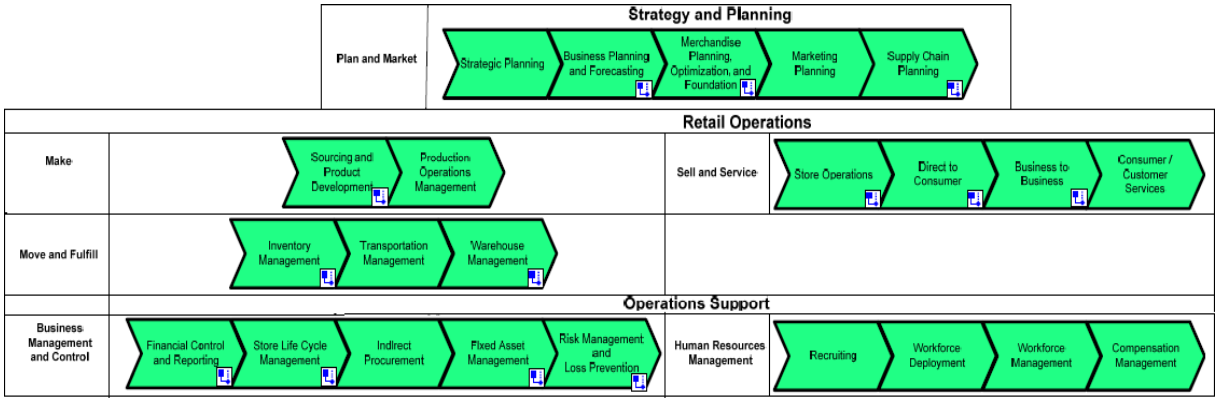


Figure 5 - Retail Reference Model

2.3.3 Business Reference Model

Business Reference Model (BRM) can be considered as a model with an even higher level of specialization, when compared with PCF or even RRM. BRM provides a clear and accurate description for the Federal Government's lines of business, by describing the operations and services that have the citizen as their main target. BRM will give the opportunity to keep the description independent of the Agencies, bureaus and offices that perform them.

The Business Reference Model is commonly used and especially effective on the identification of opportunities to consolidate IT (FEAPMO, 2003).

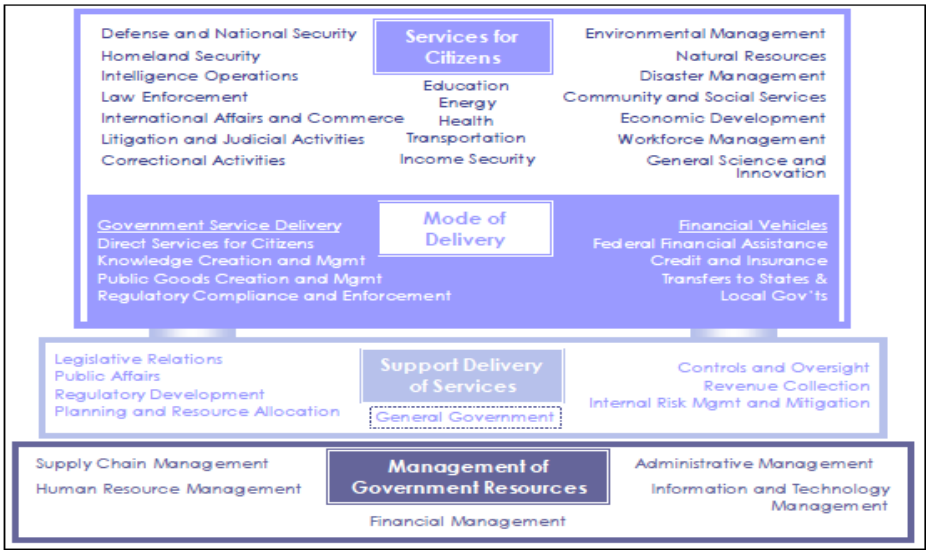


Figure 6 - Business Reference Model (FEAPMO, 2003)

2.3.4 Comparison between reference models

The great majority of reference models are business specific. This means that they give an accurate and very useful representation of the model, but cover only a very specific business area. From the example we presented before, only PCF tries to answer to all the industries needs for a set of business processes and sub-processes that can represent their organization and therefore reduce the effort of producing a specific business model.

The downside of PCF´s wide scope is, obviously, the difficulty that exists for one model alone to represent such huge variety of industries. This led to a reference model that is prepared to be adjusted, once it often needs to be adapted to the specific problem and requirements that we are trying to address.

For the reasons outlined before, PCF seems to be the most suitable choice for any organization that do not have previous work done, concerning the development of a specific reference model for that particular industry.

Chapter 3

Proposal

In this chapter, we present our solution proposal, which results from the research problem identified and the literature review made before. In order to support our proposal, several enterprise architecture development case studies were analyzed giving special attention to the problems identified, as a way to understand the similarities when comparing with the problems found in software development projects that motivated the introduction of agile approaches on that particular field some years ago.

Our proposal is to extrapolate some characteristics of the agile approaches used in software development (Extreme Programming and Scrum approaches), to the domain of the enterprise architectures (Enterprise Architecture Planning methodology). Giving special attention to the inclusion of several iterations in the process, we try to transform a slow, big and complex process into several sequenced simpler iterations. Furthermore, we intent to explore of the possible independence between components of the solution, which in this case are the information systems that support different business functions.

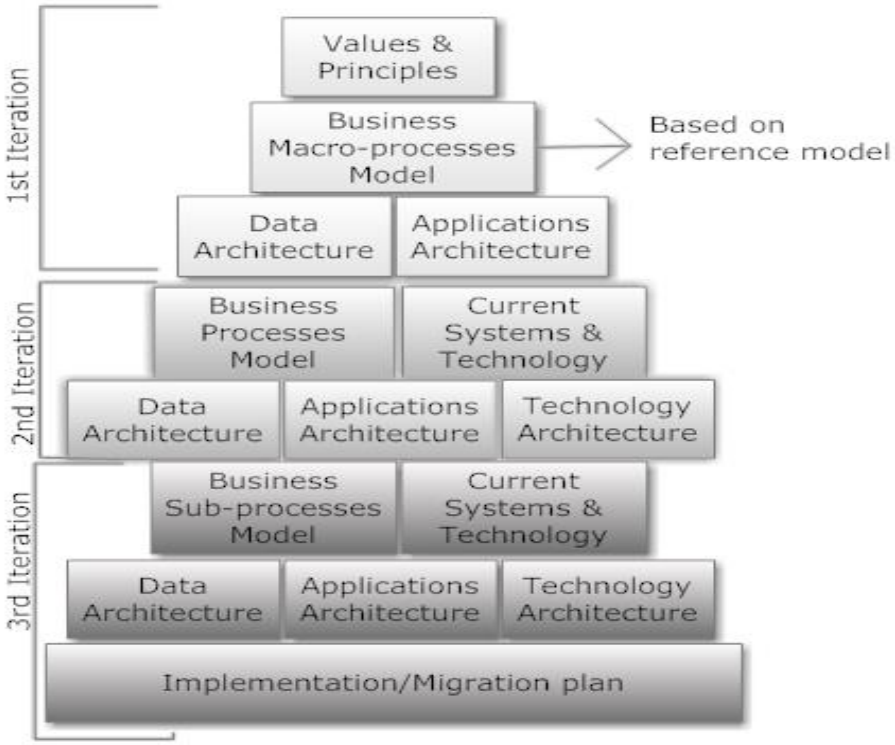


Figure 7 - Phases of Extreme Enterprise Architecture Planning

Alongside with the agile characteristics that we described before, we intend to introduce also, in our methodology, the use of business reference models. Those models have, in general, the clear

objective of reducing the time of the business model definition, and that is obviously aligned with the main goal of our work: fast results.

From now on and as a way to simplify the communication, we will call our proposal of methodology extension, Extreme Enterprise Architecture Planning (XEAP).

Figure 5 shows the model that represents our proposal and its phases, following the same form adopted by the original Enterprise Architecture Planning model.

3.1 Iterations, Phases and Steps

We now present the different phases of the proposed approach. For each phase we make a description, enumerate the steps and deliverables that constitute the phase and make a conclusion in order to contextualize the outcome of the phase with the general approach connecting each phase with the rest.

In Appendix A we present a BPMN diagram representing the process by relating steps, deliverables and actors of each phase.

First Iteration

Has specified before on this chapter, one of our methodology main goals is to reduce, has much as possible, the time that the client has to wait for some valuable results. Therefore, we intend to perform our first iteration even before the meetings with the client have started. This means that we want to provide a view of an idyllic model of the business and use it as a guideline for the client, working as a starting point for the further architectures. Having into account the considerations described before, this first iteration is the only one that will not have the complete set of steps of the EAP methodology, once will not include the ones that need specific detailed information of the client.

Values & Principles

This step defines the basis for the EA and for all its future decisions. This phase is performed only once, since it defines values and principles that must be followed during the rest of the process

Steps:

- Determine scope and objectives for EAP;
- Create a vision (initial meetings with management);
- Adapt a methodology;
- Arrange for computer resources;
- Assemble the planning team;
- Prepare EAP work-plan;
- Obtain management approval;

Main deliverables:

- Documented enterprise scope and EAP objectives;

- EAP methodology guidebook;
- Documented roles, responsibilities and alignment between available resources and schedule;
- EAP work plan;
- Status report;

Conclusion:

After this phase, we are ready to start defining a clear view of where the company stands in today's reality (AS-IS state), with the Business Model phase.

Business Macro-processes Model

Unlike EAP, that does a meticulous analysis and description of the business model, its business functions and information entities in one complex and single iteration, XEAP starts in a simple and high level analysis of a reference model, considered to be accurate enough to represent a good example of what the client business macro-processes structure should look like. We expect this model to serve as a perfect guideline both for us and the client, concerning the future work to be developed.

Steps:

- Chose the most suitable reference model and its macro-processes;
- Prepare the initial interviews;
- Document the reference organization structure;
- Identify and relate business macro-processes and information entities;
- Document the business macro-processes model;

Main deliverables:

- Preliminary interview forms;
- Preliminary organization structure;
- Documented business macro-processes and information entities;
- Complete set of business model reports;
- Feedback, comments and suggestions on the model;

Conclusion:

This phase give us the base, on which we can start working in order to understand the information systems necessary to support a business composed by macro-processes presented on the reference model.

Has a main benefit of this first iteration we have the fact that we manage to start identifying specific business processes and begin to fit them into the reference model in a really early stage, such as the first or second meeting with the client. This will allow us to quickly understand which kind of organization we are dealing with, its main necessities and more important, we have the possibility to compare it with our knowledge database and previous works (also based on reference models), where we can find reusable work or just important information capable of saving us time. Finally, this first step is a major help when framing the client with what we intend to do and what we expect from them.

Having a reference model, representing an ideal situation, is a good starting point to begin the discussion, giving the client a more clear idea of what we need to know about their organization in order to develop the project.

Data Architecture

Now we must structure and relate the information entities identified on the previous step. Having into account that we are dealing with a reference model and information that was gathered without really relevant feedback from the client (once we are in the first iteration), our information entities can also be considered a reference view on the data suitable for the organization that we are dealing with. The relations between entities and their attributes can be represented through several different views, such as an entity-relationship diagram.

Steps:

- List candidate data entities;
- Define the entities, attributes and relationships;
- Relate the entities to the business functions;
- Distribute the data architecture;

Main deliverables:

- List of the candidate data entities and their definition;
- Entity-Relationship diagrams;
- Entity-to-business function lists and matrices;
- Entity-to-current application lists and matrices;
- Data architecture document;

Conclusion:

With the conclusion of this first architecture we have the first documented artifact that will compose this first reference “TO-BE” state.

Applications Architecture

As a final step at this preliminary iteration we have the definition of the applications architecture, which will consist on the definition and description of the applications that are capable of supporting both the macro-processes and information entities structures described on the previous steps. Once again, we call the attention to the fact that this applications should work only as a guideline and as a reference to the work yet to be done, and do not represent the only possible solution for the client.

Steps:

- List candidate applications;
- Define the applications;
- Relate applications to functions;

- Analyse impact to current applications;
- Distribute the application architecture;

Main deliverables:

- List of possible applications;
- Applications definition;
- Application-to-business function lists and matrices;
- Application-to-organization unit lists and matrices;
- New applications impact analysis;
- Application architecture document;

Conclusion:

After this second architecture we are able to provide another palpable result for the client where he can have a first high-level understanding of the needed systems to support the business. We complete the first iteration on this step, once the next steps would depend on technical issues that are only possible to obtain with a more detailed specification off the applications and a deeper knowledge of a particular company. Therefore, only on the next iterations a complete coverage of the EAP methodology is presented, once we are already dealing with specific information provided by the client.

Second Iteration

We now describe the second iteration, its phases and steps. At the beginning of this iteration we must keep in mind that we now have access to a feedback given by the client provided from the results presented after the first iteration. This feedback allied with the architects own experience and know-how gathered throw the previous iteration and on previous projects, brings a big advantage concerning the information available to sustain the following work.

Business Processes Model

In the definition of the business processes model the objective is to take each function architected in the first iteration and decompose them into processes. This decomposition will bring us to the next level of detail and will ask for a more careful and deep investigation concerning the activities and roles performed by the enterprise different stakeholders

Steps:

- Refine the organization structure document and information entities list;
- Refine business functions into business processes;
- Document the business processes model, distribute and present it back to the business community for comments;

Main deliverables:

- Refined organization structure and information entities list;
- Documented business processes;

- Complete set of business model reports;
- Feedback, comments and suggestions on the business model;

Conclusion:

After this phase we have the description of the processes that constitute each function described before. By conducting the necessary interviews throughout the process and using the information, guidelines and feedback from the first iteration we are able to have a good understanding of those processes, the people responsible for them and even more important than that, the information entities they manipulate.

Current Systems & Technology

In this second iteration, as natural, is not necessary to redefine all the current systems and technology already described before. This phase calls for refinement on the IRC made in the previous iteration if necessary or no refinement at all if there is no necessity for that.

Steps:

- Prepare for, and perform IRC data collection:
- Validate and review the draft of IRC;
- Draw schematics;
- Distribute the IRC;
- Administer and maintain the IRC;

Main deliverables:

- New technology platforms identification/refinement;
- Completed data collection forms;
- Relations between applications and business processes;
- Relations between applications and technology platforms;
- Documented refined IRC;
- Refined application schematics;

Conclusion:

The conclusion of this phase marks the end of the “AS-IS” state definition on the second iteration, concerning its business processes and their supporting systems and technologies.

Data Architecture

With this phase we start the definition of the “TO-BE” state of the company concerning the architectures capable of supporting the business processes defined before. Here we describe the data entities and the structure that can correspond to the model.

Steps:

- List candidate data entities;

- Define the entities, attributes and relationships;
- Relate the entities to the business processes;
- Distribute the data architecture;

Main deliverables:

- List of the new candidate data entities and their definition;
- Entity-Relationship diagrams;
- Entity-to-business process lists and matrices;
- Entity-to-current application lists and matrices;
- Data architecture document;

Conclusion:

In a similar way as in the previous iteration, the data architecture phase marks the beginning of "TO-BE" state definition and at the same time, the first presentable result concerning the business process model defined before. It gives the architects the first chance of having some feedback about the desired architecture to support the processes.

Applications Architecture

In this phase we continue the definition of the architecture of support for the business processes, through the description of the applications, their architecture and the impact they may have on the current ones.

Steps:

- List candidate applications;
- Define the applications;
- Relate applications to processes;
- Analyse impact to current applications;
- Distribute the application architecture;

Main deliverables:

- List of new possible applications;
- Applications definition;
- Application-to-business process lists and matrices;
- Application-to-organization unit lists and matrices;
- New applications impact analysis;
- Application architecture document;

Conclusion:

After the definition of the applications architecture we are half-way of the definition of the "TO-BE" definition and able to show the expected necessary systems and their architecture, in order to support the business processes of the enterprise.

Technology Architecture

Reaching the phase of Technology Architecture we are able to finish the definition of the "TO-BE" state of the enterprise and therefore as last phase of that definition, we describe the technologies able to support the business processes modeled.

Steps:

- Identify technology principles and platforms;
- Define the platforms and distribution;
- Relate the technology platforms to applications and business processes;
- Distribute the technology architecture;

Main deliverables:

- List of new/refined candidate technology platforms;
- Configuration of technology platforms;
- Technology platform-to-application list and tables;
- Technology platform-to-business process list and tables;
- Technology architecture document;
- Revisions to technology platforms based on the feedback;

Conclusion:

After this phase we have complete results and outcomes presentable to the client, expecting to receive some important feedback from it that can help us on the third and final iteration of the process. This marks the end of the "TO-BE" state definition of the second iteration.

Third Iteration

On the same way that we called the attention for the influence that the information gathered in the first iteration would bring to the second one, we must now highlight the fact that when we start this iteration, we have at our disposal the knowledge gathered during the two previous iterations and also the feedback of the client on both delivered results, which might be preponderant in order to achieve the final and desired solution architecture.

Business Sub-Processes Model

On the definition of the business sub-processes model, the idea is to, as the same way we decomposed functions into processes, decompose the described processes into smaller and more detailed sub-processes, which are able to give us an clear and bottom-level idea of the business.

Steps:

- Refine the organization structure document;
- Refine business processes into sub-processes;
- Document the business sub-processes model, distribute and present it back to the business community for comments;

Main deliverables:

- Refined organization structure;
- Documented business sub-processes;
- Complete set of business model reports;
- Feedback, comments and suggestions on the business model;

Conclusion:

After this phase we already have the description of the sub-processes that constitute each process described before. By conducting the necessary interviews throughout the process and using the information, guidelines and feedback from the second iteration we are able to have a good understanding of those sub-processes, the people responsible for them and even more important than that, the information entities they manipulate.

Current Systems & Technology

In this third iteration, as natural, is not necessary to redefine all the current systems and technology already described before. This phase calls for refinement on the IRC made in the previous iterations if necessary or no refinement at all if there is no necessity for that.

Steps:

- Prepare for, and perform IRC refinement and data collection;
- Validate and review the draft of IRC;
- Refine schematics;
- Distribute the IRC;
- Administer and maintain the IRC;

Main deliverables:

- New technology platforms identification/refinement;
- Completed data collection forms;
- Relations between applications and business functions;
- Relations between applications and technology platforms;
- Documented refined IRC;
- Refined application schematics;

Conclusion:

The conclusion of this phase marks the end of the “AS-IS” state definition on the third iteration, concerning its business sub-processes and their supporting systems and technologies.

Data Architecture

With this phase we start the definition of the “TO-BE” state of the company concerning the architectures capable of supporting the business sub-processes defined before. Here we describe the data entities and the structure that can correspond to the model.

Steps:

- List candidate data entities;
- Define the entities, attributes and relationships;
- Relate the entities to the business sub-processes;
- Distribute the data architecture;

Main deliverables:

- List of the new candidate data entities and their definition;
- Entity-Relationship diagrams;
- Entity-to-business sub-process lists and matrices;
- Entity-to-current application lists and matrices;
- Data architecture document;

Conclusion:

In a similar way as in the previous iteration, the data architecture phase marks the beginning of "TO-BE" state definition and at the same time, the first presentable result concerning the business sub-processes model defined before. It gives the architects the first chance of having some feedback about the desired architecture to support the sub-processes.

Applications Architecture

In this phase we continue the definition of the architecture of support for the business sub-processes, through the description of the applications, their architecture and the impact they may have on the current ones.

Steps:

- List candidate applications;
- Define the applications;
- Relate applications to sub-processes;
- Analyse impact to current applications;
- Distribute the application architecture;

Main deliverables:

- List of new possible applications;
- Applications definition;
- Application-to-business sub-process lists and matrices;
- Application-to-organization unit lists and matrices;
- New applications impact analysis;
- Application architecture document;

Conclusion:

After the definition of the applications architecture we are half-way of the definition of the “TO-BE” definition and able to show the expected necessary systems and their architecture, in order to support the business sub-processes of the enterprise.

Technology Architecture

Reaching the phase of Technology Architecture we are able to finish the definition of the “TO-BE” state of the enterprise and therefore as last phase of that definition, we describe the technologies able to support the business sub-processes modeled.

Steps:

- Identify technology principles and platforms;
- Define the platforms and distribution;
- Relate the technology platforms to applications and business sub-processes;
- Distribute the technology architecture;

Main deliverables:

- List of new candidate technology platforms;
- Configuration of technology platforms;
- Technology platform-to-application list and tables;
- Technology platform-to-business sub-process list and tables;
- Technology architecture document;
- Revisions to technology platforms based on users feedback;

Conclusion:

After this phase we have complete results and outcomes presentable to the client, expecting to receive some important feedback from it that can help us on the third and final iteration of the process. This marks the end of the “TO-BE” state definition of the third iteration.

Implementation/Migration Plan

After the definition of all the architectures that meet the enterprise needs it is time to describe how we plan achieve them. In this phase is performed the plan capable to guide the process of implementation of the result systems and the technology supporting them.

Steps:

- Sequence the applications;
- Estimate the effort, resources and produce a schedule;
- Estimate the costs and benefits of the plan;
- Determinate the success factors and make recommendations;

Main deliveries:

- Application-to-data entity tables and matrices;
- Application implementation sequence;

- Technology implementation sequence;
- Documented analysis on effort and resources;
- Schedule;
- Plan for converting and/or replacing existing systems;

Conclusion:

With the end of this phase we achieve also the end of the methodology. The enterprise and its stakeholders have now enough information capable of guiding them not only on the decision of which changes must be done in the company but also how to perform those changes.

3.2 Differences and/or new characteristics

As an attempt to extrapolate some of the best practices of agile software development methods like Extreme Programming, we propose the introduction of some changes and/or new characteristics to the world-wide known Enterprise Architecture Planning methodology.

Reference models

Similarly to one of the main goals of our methodology, reference models, appeared with the intention of reducing the time of results delivery. That, combined with the reduced knowledge that we have about the client on the beginning of any enterprise architecture project, drove us into the introduction of reference models to our proposal.

On our work in particular, we use the reference models with the clear objective of presenting results to the client as soon as possible, through the delivery of a first architecture based on one specific model, considered suitable for our project. Reference models are normally used as a starting point to construct project-specific models (Becker, J., and all, 2007).

On the first iteration, the intention is to find an accurate, but high-level view of an ideal scenario for the organization. This, as we said before, is the perfect starting point to frame the client and align him with our future work. Without wanting to be too specific and descriptive, we need a way to present a good overview of the business, while having really limited information about the client structure. Therefore, the introduction of reference models as the basis for our first iteration seems to fit naturally on our methodology beginning process.

One thing that we must keep in mind is our limited experience in enterprise architecture projects. The usage of reference models is something that is supposed to be improved through the growing experience with similar projects. When using reference models in several projects, we are able to start predicting some details and creating specific models for different kinds of businesses, while having access to previous information and documentation concerning the use of each model on each business. That knowledge can be, in some cases, precious and give a big advantage when developing big projects that share a considerable range of characteristics with other projects developed before.

Iterations

Probably the biggest change proposed by this work is the introduction of iterations on the process. EAP makes the definition of the business model and the correspondent architectures in a single iteration with a sequence of steps that does not allow a feedback of the appropriate shareholders. Sometimes, that feedback is essential in the resolution of ambiguities that when not solved on time, can originate bigger problems further on the process.

Unlike EAP, XEAP proposes a definition of the business model and its architectures in an iterative way. XEAP starts on the first iteration, even before all the interviews with the client, where the knowledge about the business is, still, very limited. This iteration starts by using a reference business model has main support for the achievement of the first set of architectures, while having a very limited knowledge about the organization. With the second iteration comes a deeper knowledge about the organization and its reality, which combined with the feedback gathered after the previous delivery, allows us to present an accurate business model and a new set of architectures suitable for the client. On the third and last iteration we have a new EAP cycle, with an increase of detail on the business model and its sub-processes, which will have as result the final set of architectures.

This iterative process brings yet another benefit besides the feedback between iterations, which is the faster delivery of results. Although being results that are not final, the first and second iteration are able to provide accurate results and a clear idea of the work being developed. The client is kept on track of the project and with a good understanding of what is being done and what is coming ahead.

Solution partitioning

XEAP must “looks” at complex enterprise architecture projects as a group of independent systems. This partitioning would allow us to incrementally deliver the solution and therefore reduce the time that clients wait to have final results.

Thought this change we intend to give the possibility to architect each function as a smaller project that can have a different schedule from all the other functions. Primarily we can give the possibility for the client to choose which are the priorities within the project and provide him the expected results quicker than if it would be necessary to wait for all the functions and their architecture results.

From the architects point of view we would give them the possibility of split complex projects into simpler ones giving them an advantage not only considering the provision of faster results, but also the increase of their quality.

Continuous client feedback

Another difference that we considered important to introduce in this new extension is the task of performing interviews to the stakeholders of the business in order to understand the company’s processes. In EAP those interviews have a well-defined position in the methodology being almost exclusively performed during the phase of Business Modeling. Quite often stakeholders have different visions on the business and its processes. Those differences tend to be transported to the

architectures into the form of inconsistences. In a traditional EAP approach, when this inconsistences are detected it is necessary to go back on the methodology, independently of the stage where we were, repeat some of the interviews already done and apply painful changes on the project.

XEAP intends to perform those interviews in parallel with all the other phases of the iteration. This means that just right after the first description of the business functions and the first interviews in order to achieve the first business model we can start performing all the other necessary interviews, preparing and gathering the most consistent and accurate information possible about the next iteration business processes that we intend to model.

The interviews performed allow us to, not only receive new information about the business model but also important feedback on the information already gathered. This feedback would be preponderant to prematurely detect inconsistencies between provided information and enable to resolve it before having negative impact on the project development.

~

Chapter 4

Demonstration

On this chapter we will present our demonstration process, by applying our proposal to a real case study provided by GFI Portugal. GFI gave us the possibility to follow the development process of their project with Câmara Municipal de Cascais. This consists on a plan for the information systems structure of their client based on the business processes and current IT structure supporting their activity. In real time and in parallel, we were able to use our artefact in order to achieve our own enterprise architecture. In the end we could compare and evaluate the outcomes of both and the metrics that we established as a success factor for our work. This evaluation is described on the next chapter.

For our demonstration process, we follow the order of steps presented in the Proposal section, and apply them to the project described. At the same time GFI is developing their work with their own methodology, which we will talk about later on the on the evaluation chapter of the document.

First Iteration:

This first iteration happens when the knowledge about the client and his business is, yet, quite limited, coming mainly from general and public information and from what we manage to gather from the first contacts while the project is only a possibility and a whish of the client, and therefore, even before its real start. Having this in mind, we can say that at this point, our main goal is to give the client a clear understanding of an ideal situation for their business. This will work as a guideline for the future, and hopefully, will start leading the client towards the path that we want to follow while developing this project.

Having into account the reality and environment where Câmara de Cascais (CMC) is inserted, we had to come up with some suitable high-level reference model capable of providing a clear and simple view of what the CMC architecture and macro-processes model should look like, regardless the natural particularities that obviously differ from organization to organization.

The first model will be based on the PCF reference model and will attempt to give the client a first notion of a standard business model that can be considered as an example to follow, allowing the client to be on the possession of valuable results since the very first meeting.

Values & Principles

- Determine scope and objectives for XEAP:

The “E” of XEAP stands for enterprise, so it is important to define what “enterprise” will mean during the development of this project, and for that we have to define the scope having into account the client, his reality and expectations.

This project aims to achieve a complete set of architectures (data, applications and technology) covering the totality of business functions of Câmara Municipal de Cascais. Although the fact that, on a first contact, the client showed a bigger concern on the operational part of the organization, then the management and support part, it is recognized an overall necessity for inclusion in the project, and therefore, the all range of functions will be addressed.

- Create a vision (initial meetings with management):

As we said before, the final result of the project will be the complete set of architectures, covering data, applications and technology. With this we want to achieve and provide a clear understanding of the information entities that are missing or misrepresented and the applications, systems and technologies more suitable to the business and the ones that should be used differently.

- Adapt a methodology:

Our solution will be sectioned in three iterations, with a different architecture, as the outcome of each one of them. Each architecture will be more detailed than the previous one, and therefore will gradually bring more and more value to the client. Our methodology will, for every iteration, start by describing the “AS-IS” state of the organization (with the level of detail allowed by the current knowledge on the client business), followed by the “TO-BE” state, containing data, applications and technology architectures.

- Prepare a XEAP work-plan:

	Task	Assigned To	Start	End	Dur	%
	XEAP		16/9/13	13/12/13	65	
1	First Iteration		16/9/13	20/9/13	5	
1.1	Values & Principles		16/9/13	16/9/13	1	
1.2	Business Macro-processes Model		17/9/13	17/9/13	1	
1.3	Data Architecture		18/9/13	18/9/13	1	
1.4	Applications Architecture		19/9/13	20/9/13	2	
2	Second Iteration		23/9/13	18/10/13	20	
2.1	Business Processes Model		23/9/13	4/10/13	10	
2.2	Current Systems & Technology		7/10/13	8/10/13	2	
2.3	Data Architecture		9/10/13	11/10/13	3	
2.4	Applications Architecture		14/10/13	16/10/13	3	
2.5	Technology Architecture		17/10/13	18/10/13	2	
3	Third Iteration		21/10/13	13/12/13	40	
3.1	Business Sub-processes Model		21/10/13	15/11/13	20	
3.2	Current Systems & Technology		18/11/13	20/11/13	3	
3.3	Data Architecture		21/11/13	22/11/13	2	
3.4	Applications Architecture		25/11/13	27/11/13	3	
3.5	Technology Architecture		28/11/13	29/11/13	2	
3.6	Implementation/Migration Plan		2/12/13	13/12/13	10	

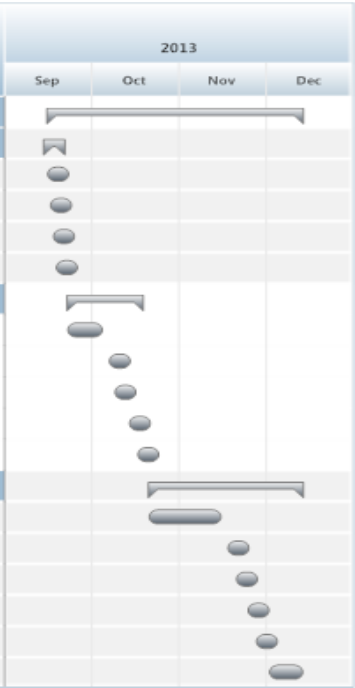


Figure 8 - XEAP Work-plan

Next we present the schedule and plan for all the steps that compose our methodology. This work-plan tries to provide an accurate guideline for the future work to be developed and above all, tries to guarantee that the project is completed on time without any adverse effects on some of the deliverables caused by typical delays that happen in projects missing a detailed work-plan.

Business macro-processes model

- Document an reference organization structure:

Before we start describing our reference business model, we present a reference organization structure that will certainly help on the understanding of the reference macro-processes that we will be showing later on this iteration. Our reference organization structure is based on Customer Model – People, Departments, Work (Microsoft Dynamics, 2007).

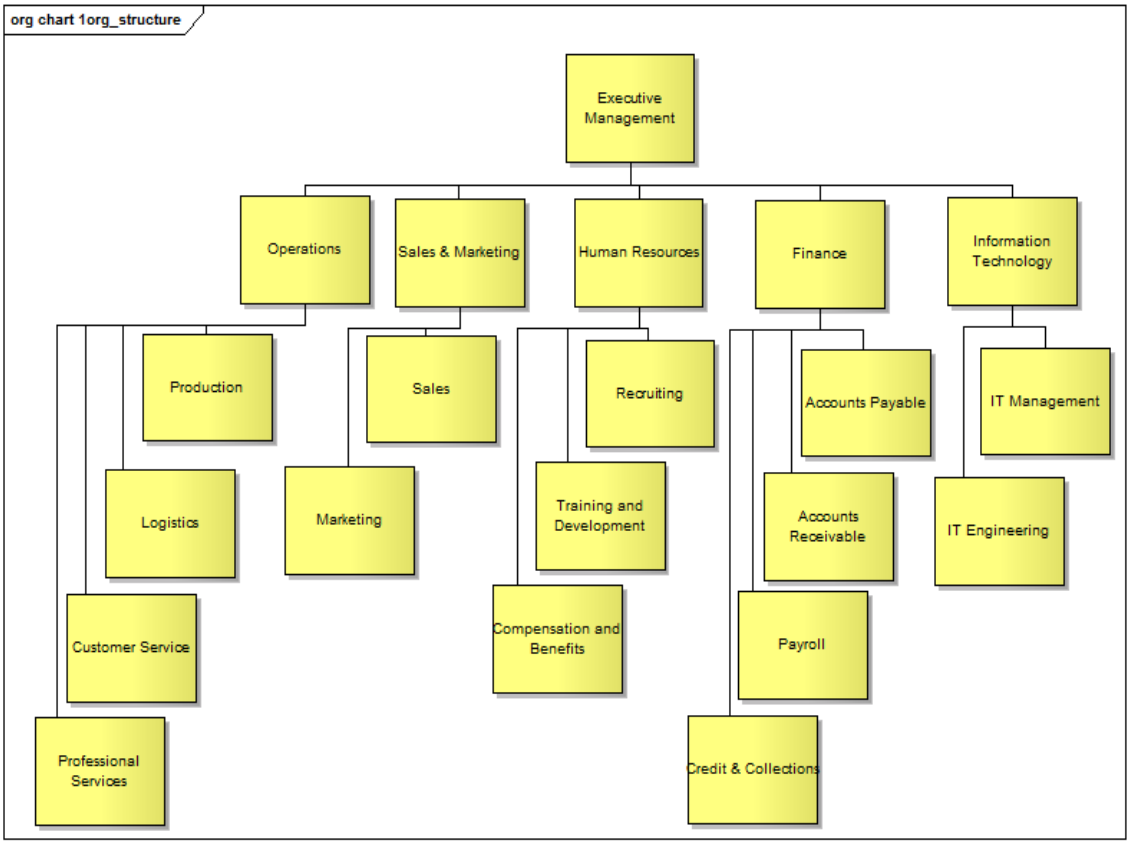


Figure 9 - Reference organization structure.

- Schedule and perform the necessary initial interviews;

On this step we will provide the summary of our first reunion with the client, where we proposed what we intended to do for this project, and listen to the client's expectations. From this preliminary meeting with the management we were able to take some important high-level information about the organization and its business. Although being quite limited information, it gives us a good guideline for our first objective, which is to find a suitable reference model that fits in our client expectations and reality, so it can give a good starting point for our alignment with Câmara Municipal de Cascais.

Meeting 04/09/2013 – Summary:

- Project duration: 3 moths
- Following documents:
  - From GFI Portugal to CMC → Proposal presentation(18/09/2013);
  - From CMC to GFI Portugal → Description of the main applications that support the business and the technology behind those applications;
- Main operational functions:
  - Customer/citizen services → here we can highlight activities like property licensing and management of economic activities;
  - Spatial organization → including activities such as territorial planning and urbanism;
  - Intervention in the community → we can consider activities concerning sport, culture, education, environment and social interventions;
- Main systems:
  - ERP (AIRC 2000) → System is making the complete treatment of information throughout the organization. It is divided in several modules for all the different areas where it is being used;
  - CRM (Microsoft CRM Dynamics)→ System is making the management of the contact with the clients, maintaining track of the relation with them, since the very beginning until it finishes processing the requests;
  - SIGWeb and Incidents Management System→ Responsible for all the management of georeferences and the information associated to each one of them;
  - Electronic mail (Microsoft Exchange) → Used as a tool for documental storage and communication both internal and external;
  - Institutional website → Used to share all the public information with the citizens. Information related with the services and products provided and all the areas of activity. It works as one of the main communication channels with the clients.
- Important notes:
  - Operational area is the one needing more attention, concerning the information systems, how they are being used and their interaction with the users;
  - The excessive overlap of roles is considered to be a problem that needs to be addressed;

Next, we present the list of scheduled interviews, from which we will extract all the necessary information to build our second iteration "AS-IS" state:

- Domingos Antunes → Executive Management;
- Pedro Estácio Marques → Department of Municipal Works;
- Simão Vieira → Department of Information Technology;

<u>Identify and define business macro-processes and information entities:</u>

Having into account that we are in a really early stage of the process, we present to the client a list of reference business functions and information entities based on a general knowledge and preliminary

research about the organization. From this knowledge and research, combined with the analysis of the existing reference models, we decided that PCF would be the most suitable one in order to work as a helpful starting point, from where we can start building the following iterations.

Business macro-processes	Details
Operation processes	
1.0. Develop vision and strategy	Define and develop the business concept and long-term vision.
	Evaluate and study the most suitable strategic options and the overall mission.
	Manage, develop and execute strategic initiatives capable of bringing value to the business.
2.0. Develop and manage products and services	Evaluate and study the performance of existing products and services having into account market opportunities.
	Search for new products and services and study the possibility of introducing them into the business.
	Perform all the necessary activities capable of preparing the organization for the production of new products and/or services.
3.0. Market and sell products and services	Study and construct a clear understanding of markets, costumers and capabilities while developing and evaluating selling and marketing strategies.
	Develop and manage sales plans, including sales, orders, partners and alliances.
4.0. Deliver products and services	Plan and acquire for necessary resources and materials.
	Develop and manage contacts and contracts with suppliers and partners.
	Manage the services delivery processes to the customers and ensure the resources requirements inherent.
	Manage the warehousing and logistics related to the services delivery.
5.0. Manage customer service	Develop a suitable and accurate customer service strategy.
	Plan, manage, perform and evaluate the operations involved on the customer service processes.
Management and support processes	
6.0. Develop and manage human capital	Define plans, strategies and policies for the available human resources.
	Execute recruitment activities. Source and select employees.
	Develop employees by providing appropriate training and managing their relations.
7.0. Manage information technology	Develop and manage the IT strategy and resources according to the customer services and relationships.
	Manage, maintain and support the information used by the IT resources.
	Develop new IT solutions and services capable of bringing considerable value to the business. Maintain and improve the IT services and solutions already in use.
8.0. Manage financial resources	Perform accounting planning/budgeting/forecasting, cost control and evaluate financial performance.
	Manage general and fixed-asset projects accounting.
	Manage treasury operations, internal controls, taxes and funds.
9.0. Acquire, construct and manage property	Design, construct and maintain nonproductive assets, including people, workspaces, materials and tools.

		Obtain, install and plan maintenance of productive assets.
	10.0. Manage environmental health and safety	Define the environmental health and safety strategy. Develop and manage the program and train employees and stakeholders.
		Ensure the alignment of the program execution with the regulations. Ralize compliance audit for that purpose.
	11.0. Manage external relationships	Manage and build healthy and strategic relations with investors, government and industry (competitors, partners and clients).
		Build a clear, easy and accurate communication with the board of directors.
		Manage legal and ethical issues.
		Manage public relations. Plan, develop and execute projects to improve those relations.
	12.0. Manage knowledge improvement and change	Create and manage a strategy and benchmark the organization performance.
		Create and develop an efficient knowledge and change management capability.

Table 3 – First iteration business macro-processes description

Next we present several information entities that we consider to be a reference set of data objects, having into account the type of business that we are dealing with, and at the same time the reference business macro-processes that we presented before. This combination is essential to help the client achieving a clearer and accurate understanding of the connection between the reference model that we are presenting and the actual model its own business.

Information Entities	Description
Client	Represents the final addressee of our products/services. We can have information such as **id, name, contacts, products/services used, reclaims made**, etc.
Request	Represents the orders made by one client, concerning a product/service. It's expected to contain information such as **open date, author, closure date, state**, etc.
Productive Project	Represents the projects related with the business. Those projects can be related with the development of new services/projects or with the execution of the existing services/products. Can have information such as **id, name, responsible, partners, description, local, initial date, closure date, service/product related**, etc.
Non-productive Project	Represents the projects not directly related with the business. Those projects can be charity, social intervention, strategic cooperation, relationship development, etc. Can have information such as **id, name, partners, description, cooperator, initial date, closure date**, etc.
Partner	Represents organizations (public or private), or even individuals, who collaborate with our client in the investigation, elaboration, production or delivery of the services/products. It also represents others involved on a common project with any kind of mutual beneficial interaction. It may have information such as, **id, name, description, projects, responsible**, etc.
Sell	Represents each and every transaction, where money is received in change for a service/product of the client organization. Can contain information such as **id, date, type, buyer, description, value**, etc.
Purchase	Represents each and every transaction, where a service/product is received

	in change for money from the client organization. Can contain information such as **id, date, type, seller, description, value**, etc.
Financial Report	Represents the reports that the department, responsible for the financial and patrimonial management, has to produce on a regular basis, with a defined limited period of time between one report and the next. Typical information contained by this entity can be **id, date, author, body**, etc.
Supplier	Represents organizations that sell important resources for the normal functioning of the clients business. Can contain information such as **id, name, contact, description**, etc.
Asset	Represents all the productive assets that the client possesses. Can normally have information such as **id, location, responsible, description, value, purchase date**, etc.
Resouce	Represents all the non-productive assets that the client possess (excluding IT resources and employees), such as raw-material, machinery, etc. Can normally contain information such as **id, location, quantity, responsible, purchase date, origin, description**, etc.
IT Resource	Represents all the non-productive assets related with IT. Contains information such as **id, name, description, fabricant, contract type, purchase date**, etc.
Employee	Represents all the workers that are being paid for their work on the client organization. Can contain information such as **id, name, age, salary, role, work description,**

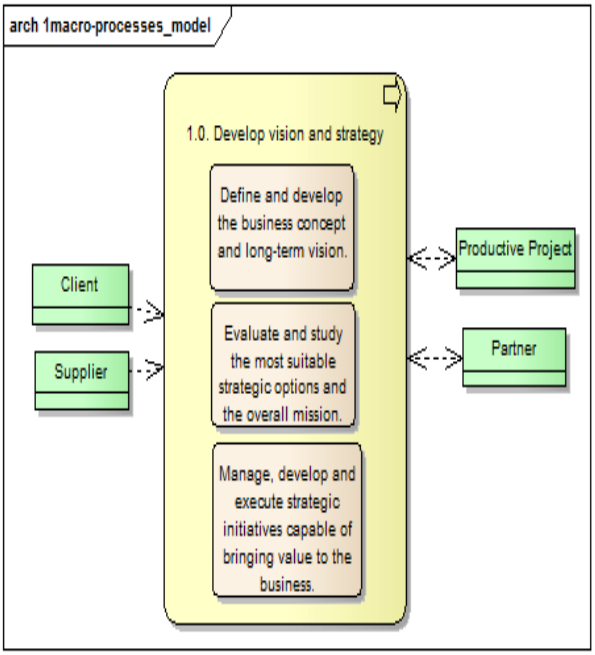
Table 4 – First iteration information entities definition

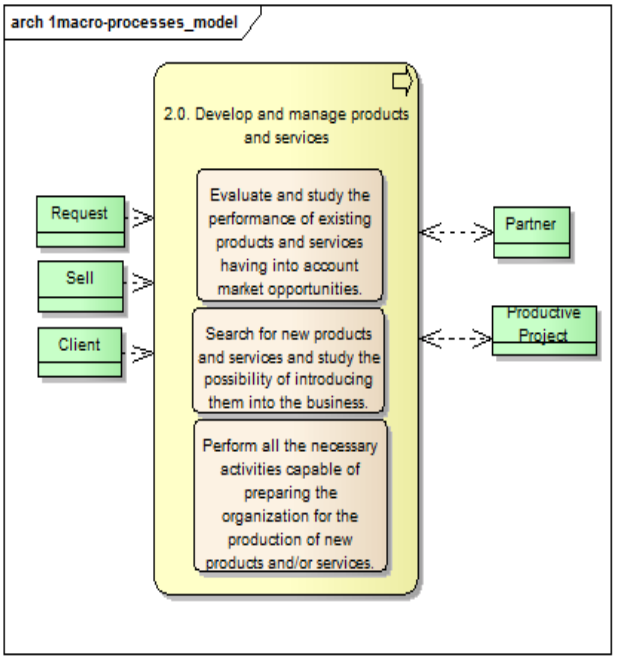
- Document the business macro-processes model, distribute and present it back to the business community for comments:

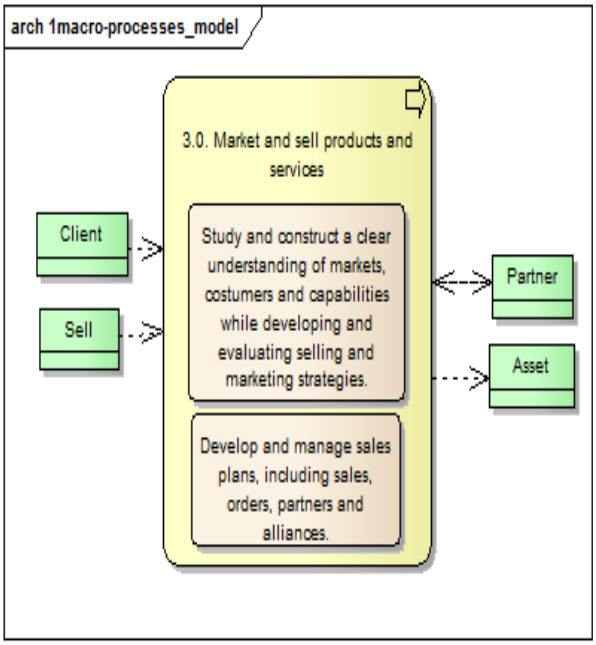
After defining our reference macro-processes and the information entities that are (normally) common to organizations such as our client, we can now present our macro-processes model that relates those two elements. Since the macro-processes are quite high-level, we decided to include some more detailed information inside each one of them.

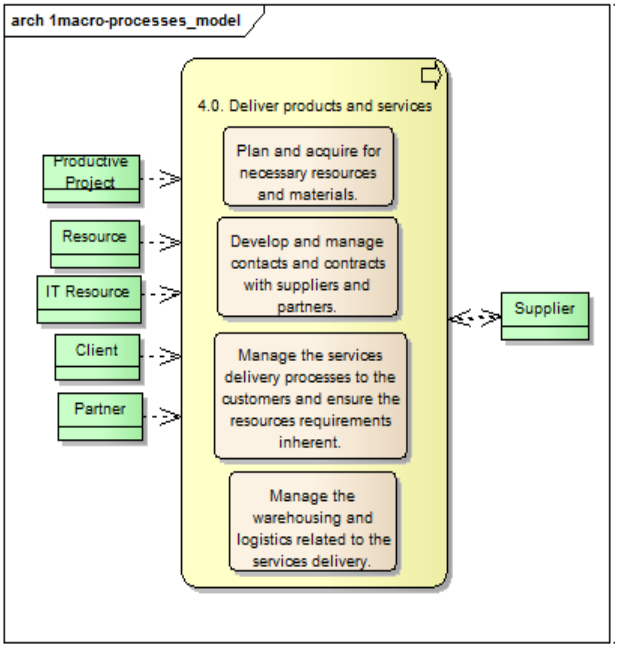
On the following diagrams we represent the macro-processes with the central rectangle. Inside each macro-process we have some more detailed reference processes that intend to help the client when making the bridge between this reference model and their own reality.

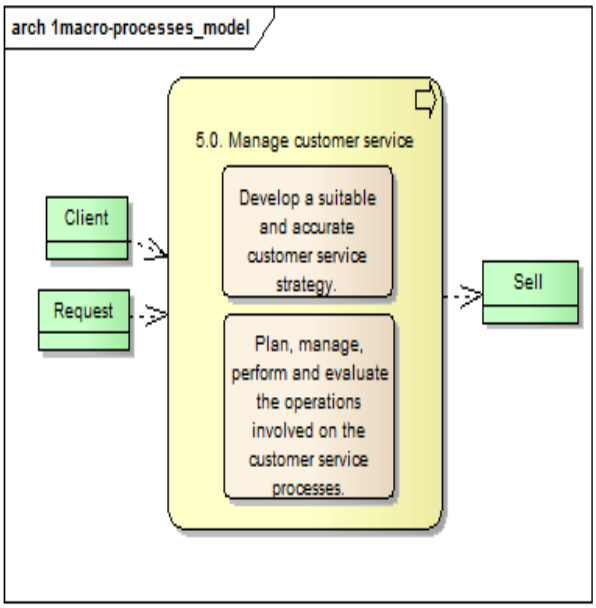
The green rectangles with an arrow pointing to the macro-process are the ones being accessed (read or update) by that process and the ones with an arrow coming on their direction, are the entities being created by the process. From here we can easily understand that the bidirectional arrows represent an entity being created and accessed (after creation) by the same process.

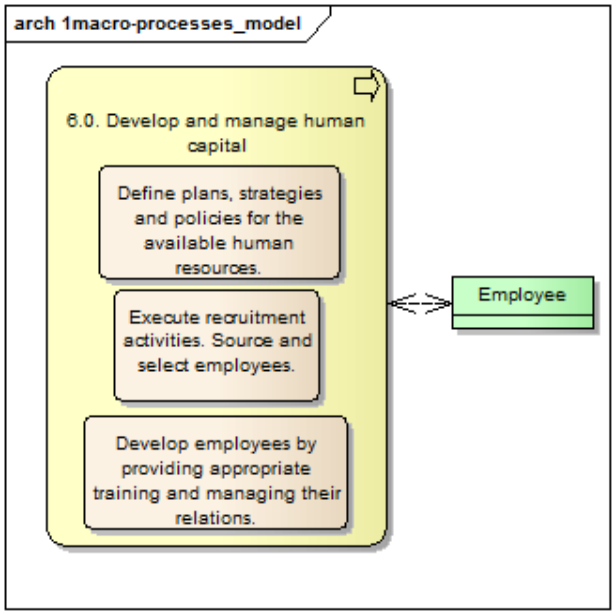

arch 1macro-processes_model
1.0. Develop vision and strategy
Define and develop the business concept and long-term vision.
Evaluate and study the most suitable strategic options and the overall mission.
Manage, develop and execute strategic initiatives capable of bringing value to the business.
Client
Supplier
Productive Project
Partner

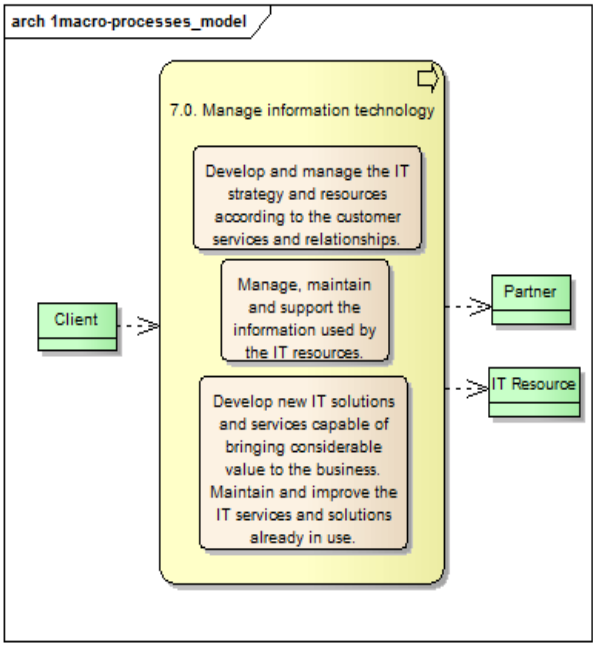

arch 1macro-processes_model
2.0. Develop and manage products and services
Evaluate and study the performance of existing products and services having into account market opportunities.
Search for new products and services and study the possibility of introducing them into the business.
Perform all the necessary activities capable of preparing the organization for the production of new products and/or services.
Request
Sell
Client
Partner
Productive Project

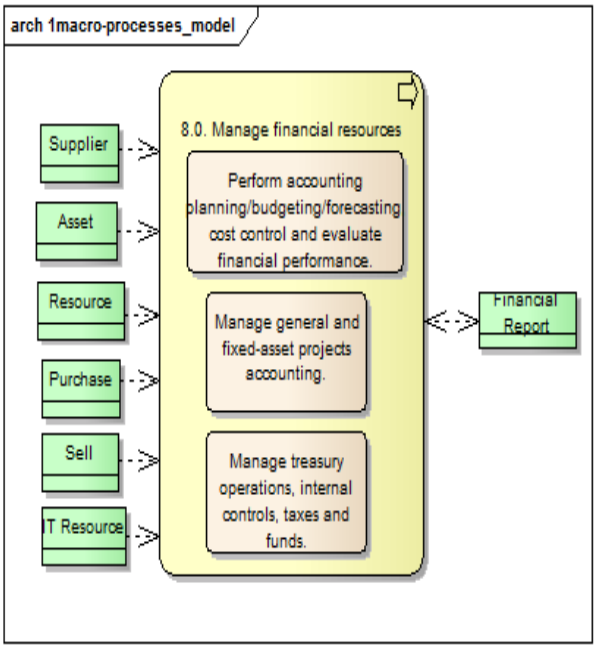

arch 1macro-processes_model
3.0. Market and sell products and services
Study and construct a clear understanding of markets, costumers and capabilities while developing and evaluating selling and marketing strategies.
Develop and manage sales plans, including sales, orders, partners and alliances.
Client
Sell
Partner
Asset


arch 1macro-processes_model
4.0. Deliver products and services
Plan and acquire for necessary resources and materials.
Develop and manage contacts and contracts with suppliers and partners.
Manage the services delivery processes to the customers and ensure the resources requirements inherent.
Manage the warehousing and logistics related to the services delivery.
Productive Project
Resource
IT Resource
Client
Partner
Supplier


arch 1macro-processes_model
5.0. Manage customer service
Develop a suitable and accurate customer service strategy.
Plan, manage, perform and evaluate the operations involved on the customer service processes.
Client
Request
Sell


arch 1macro-processes_model
6.0. Develop and manage human capital
Define plans, strategies and policies for the available human resources.
Execute recruitment activities. Source and select employees.
Develop employees by providing appropriate training and managing their relations.
Employee


arch 1macro-processes_model
7.0. Manage information technology
Develop and manage the IT strategy and resources according to the customer services and relationships.
Manage, maintain and support the information used by the IT resources.
Develop new IT solutions and services capable of bringing considerable value to the business. Maintain and improve the IT services and solutions already in use.
Client
Partner
IT Resource


arch 1macro-processes_model
8.0. Manage financial resources
Perform accounting planning/budgeting/forecasting cost control and evaluate financial performance.
Manage general and fixed-asset projects accounting.
Manage treasury operations, internal controls, taxes and funds.
Supplier
Asset
Resource
Purchase
Sell
IT Resource
Financial Report

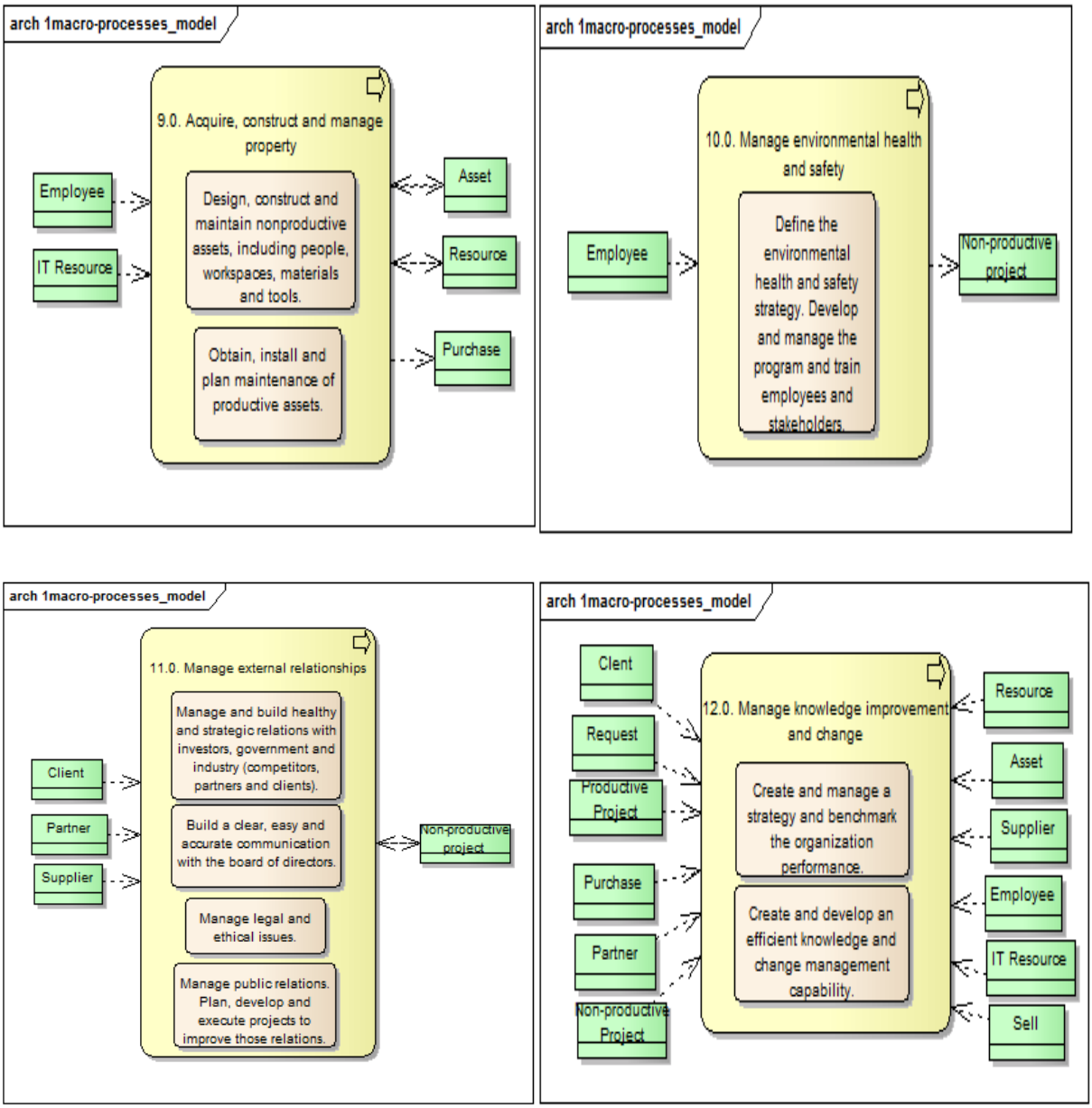


Table 5 - Business macro-processes model.

<u>Data architecture</u>

- <u>Entity-relationship diagram:</u>

On this step and trough figure 8 we relate all the data entities identified before. Through this relation we are able to provide a general view of the most suitable data structure for the organization with a business model such as the one presented before. Here we give special attention to the information that is shared by more than one entity.

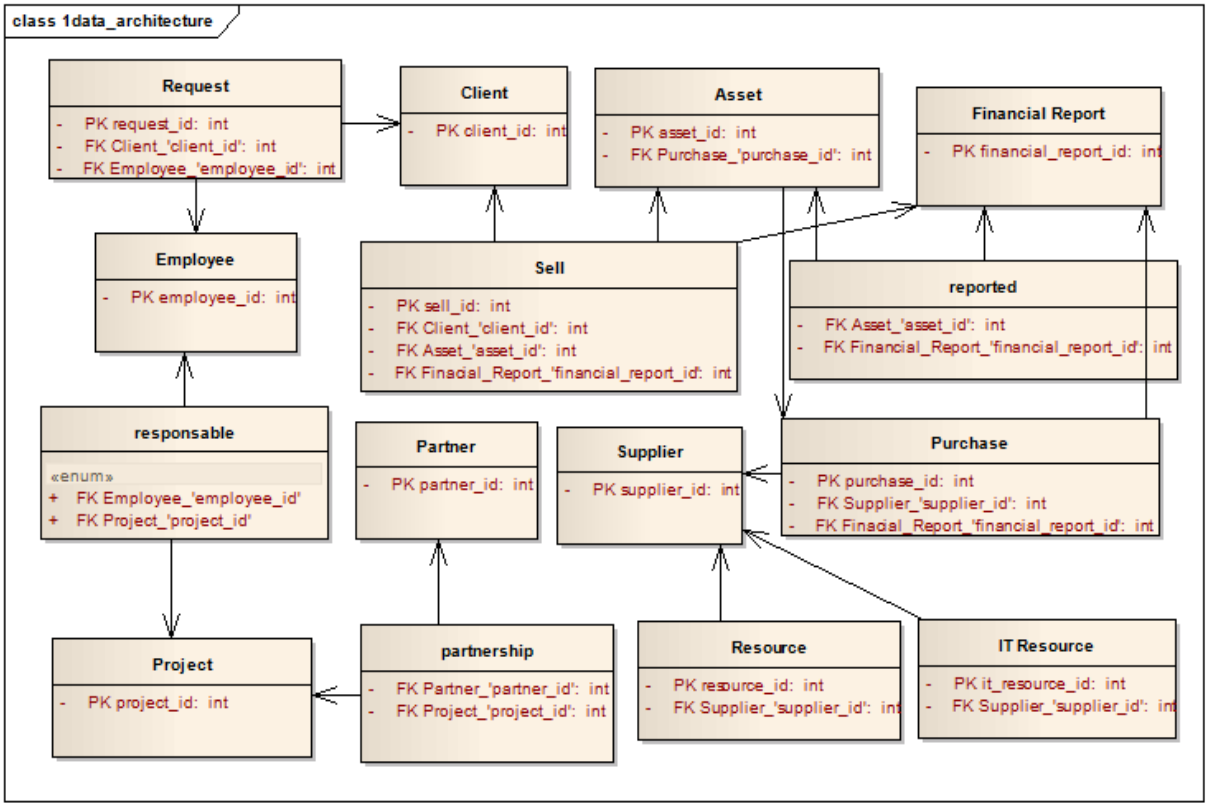


Figure 10 – First iteration entity-relationship diagram

- <u>Entity to macro-processes:</u>

	Request	Client	Employee	Supplier	Partner	Sell	Purchase	Asset	Financial report	Project	Resource	IT Resource
Operation processes												
1.0. Develop vision and strategy		x								x		
2.0. Develop and manage products and services	x	x			x	x				x		
3.0. Market and sell products and services		x			x	x		x			x	
4.0. Deliver products and services		x		x	x					x	x	
5.0. Manage customer service	x	x				x						
Management and support processes												
6.0. Develop and manage human capital			x		x							
7.0. Manage information technology					x							x
8.0. Manage financial resources				x		x	x	x	x		x	x
9.0. Acquire, construct and manage property			x					x	x		x	
10.0. Manage environmental health and safety			x							x		
11.0. Manage external relationships		x			x				x	x		

12.0. Manage knowledge improvement and change	x	x	x	x	x	x	x	x	x	x	x	x

Table 6 – First iteration relations between macro-processes and information entities

- Entity to applications:

	GDCC	CRM	Incidents Management System	Institutional Website	Electronic Mail	ERP
Employee	x			x	x	x
Client	x	x	x	x	x	x
Asset	x					x
Supplier	x				x	x
Request	x	x	x	x		
Financial Report	x					x
Purchase	x	x				x
Sell	x	x				x
Resource	x					x
IT Resource	x					x
Project	x	x	x	x		
Partner	x				x	

Table 7 – First iteration relations between information entities and applications

Application architecture

- Candidate applications:

CRUD matrix	Request	Client	Sell	Partner	Productive Project	Supplier	Employee	IT Resource	Asset	Financial Report	Purchase	Resource	Non-productive Project
Operation processes													
5.0. Manage customer service	CRU	CRU	C	App 1		App 2							
1.0. Develop vision and strategy		R		CR	CR	R							
2.0. Develop and manage products and services	R	R	R	CRU	CRU								
3.0. Market and sell products and services		R	R	CR	CR								
4.0. Deliver products and services		R		RU	R	CRU		R				R	

Management and support processes													
6.0. Develop and manage human capital							CR UD	App 3					
7.0. Manage information technology		R		R				CR UD	App 4				
8.0. Manage financial resources			R			R		R	R U	C U	RU	R	App 5
9.0. Acquire, construct and manage property									C R U		C	C R U	
10.0. Manage environmental health and safety													CR U
11.0. Manage external relationships		R		R		R					App 6		CR U
12.0. Manage knowledge improvement and change	R	R	R	R	R	R	R	R	R		R	R	

Table 8 - First iteration candidate applications (CRUD matrix)

App 1 → Application capable of managing all the interaction with the client. The systems used for this purpose are normally classified as CRM systems and the great advantage of adopting a specific system for this macro-process is centralization of all the functionalities and necessities in one common place. This application must be able to receive, treat and answer to client requests and later preform the transactions inherent to the sale of the company's products.

Organization units: Customer Service.

App 2 → Application capable of aggregating all the necessities inherent to the development and improvement of the business, its processes and products. Once it aims to support several important macro-processes, this can be composed by separate modules that can work independently, but with the capability of sharing information between them.

Organization units: Professional Services, Production Department, Logistics and Marketing

App 3 → Application responsible for the employees monitoring, development and engagement. This is, normally, a very independent application that has few interactions with other systems.

Organization units: Recruitment, Training and Development and Compensations and Benefits.

App 4 → Application responsible for the monitoring, development and management of all the information technology and the systems used inside the organization. In the same way as

App 3, this can be an independent application, once it as minimum interaction with other systems, and therefore there is no need to share big quantities of information.

Organization units: IT Management and IT Engineering.

App 5 → Application responsible for all the financial management of the organization. Here we can include the monitoring of all the transactions with clients and suppliers, all the accounting process and obligations with partners. This can, normally, be divided by different modules that can work independently, but have a common storage place and communication language.

Organization units: Accounts Payable, Accounts Receivable, Payroll Department and Credit & Collection.

App 6 → This must be an application capable of supporting a considerable diversity of processes. Here we should be able to control all the organization environmental and health concerns, including new partnerships, non-productive events with the community and all the legal aspects inherent to the obligations of any organization.

Organization units: Marketing and Logistics.

After defining the candidate applications to support our business macro-processes, we can see that it is possible to maintain an independency between the systems used on the operational and management/support areas. This independency allows us to take advantage of a characteristic that we intend to introduce on XEAP, such as the solution partitioning. If it is our intention to divide the solution in several smaller parts, giving priorities to different areas of the business, it is important to maintain this separation.

After presenting a reference model to the client, where we included not only the reference business macro-processes, but also two reference architectures (data and applications architectures), we are able to give a superficial view of the work to be done and what to expect from the project. From this first iteration we can highlight the data and applications architectures that can provide the client with a first idea of the information entities structure, which applications use each entity, and finally how the applications can be distributed across the organization macro-units.

Second Iteration:

In a first contact with the client and in an embryonic stage of the project, we managed to start a clear and focuses discussion about the organization reality, overcoming almost instantly the gap that traditionally exists between our and the client's perception of the work in progress and what are its main goals.

After performing the interviews scheduled on the first iteration we were able to achieve a good and clear understanding of the business, its processes, objects and stakeholders in general. On this

iteration we ‘present a complete set of architectures capable of supporting the Câmara Municipal de Cascais business. Although our knowledge about the client reality is already quite clear and accurate, we must keep in mind that we didn’t dig as deep as possible into the business processes details. For this reason this is “just” an intermediary iteration, capable of giving considerable important value, but not the final expected results.

Business processes model

- Schedule and perform the necessary interviews:

Next, we present the list of scheduled interviews, from which we expect to be able to extract all the necessary information to build our third iteration “AS-IS” state:

- Paula Tavares → Department of Territorial Management;
- Pedro Estácio Marques → Department of Municipal Works;
- Nuno Lopes and Filipe Nasciemnto → Department of Financial and Patrimony Management;
- Luis Campos Guerra → Department of Urban Management;
- Clara Doroana Baião → Department of Administrative Urban Management;
- Carlos Moreira → Department of Spacial Planning and Ordering;
- Matilde Cardoso → Department of Communication Management;
- António Mota → Department of Human Resources and Legal Affairs Management;
- Eugénio Rosa and João Montes Palma → Department of Territorial Intervention;
- Conceição Cordeiro, Rogério Peixoto and Luís Costa → Department of Human Resources and Legal Affairs Management;
- Lurdes Bettencourt → Department of Territorial Intervention;
- Marina Gil and Manuela Correia → Department of Leisure and Cultural Promotion;
- João Montes Palma → Department of Social Development;

- Document the organization structure

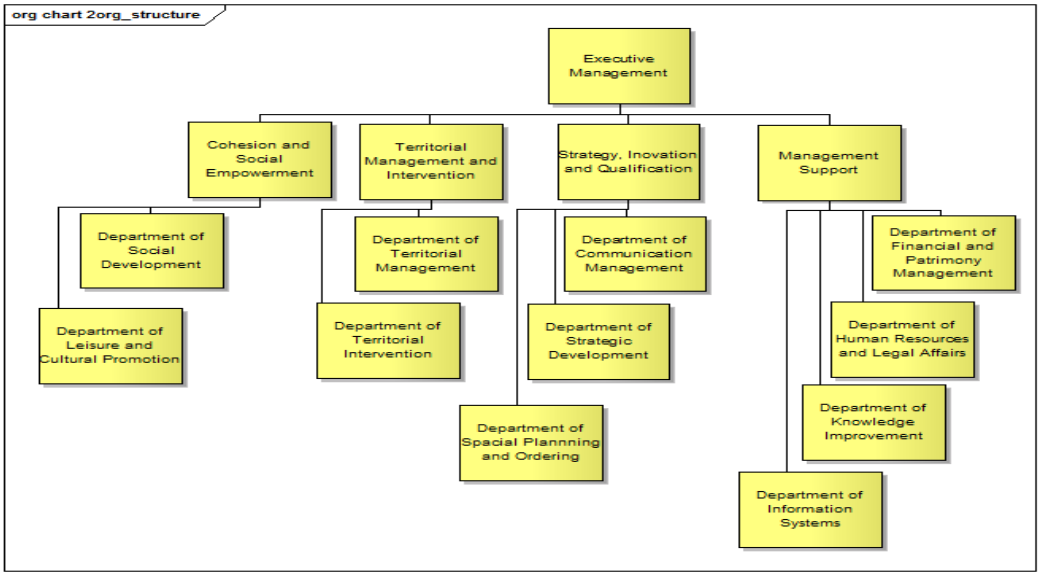


Figure 11 - Second iteration CMC organization structure.

- Identify and define business processes and information entities:

On this step we will describe the several business processes identified as a result of the interviews performed until that moment, and which we already talked about before on this phase.

In order to describe the business processes, we will for each one of them, write a set of objectives, to provide a deeper understanding of it, which may later provide an important source in order to decompose those business processes into sub-processes. Additionally, we present the information entities involved on the process and organization unit responsible for performing it (if applicable).

Business processes	Details
Operation processes	
Economic activities	Process responsible for the licensing and control of the economic activities present in the domain area of Câmara Municipal de Cascais.
Customer service and communication	Process responsible for the interaction and communication with the clients. This includes answering the clients in person requests, performing all the activities related with the request treatment and monitoring the service provided.
Municipal works	This process represents the Board motorization of the works being developed throughout the organization.
Urbanism and urban rehabilitation	Execution and control of all the urban projects proposed by the citizens or organizations. Includes requests for projects such as private or public intervention, allotment, building construction, changes on existing buildings, demolition, certificates, etc.
Territorial planning	This process is responsible for all the planning of the territory. This includes not only the management of the land use but also the infrastructures involved.
Police & Civil Protection	Process responsible for all the interaction with the police and civil protection through the communication of occurrences.
Sport, environment, culture and education	This process includes the intervention of CMC in the schools, the management of the education and all the cultural, sport and environment events that happen throughout the CMC territory.
Habilitation and social inequity	Process that includes the execution and management of intervention projects with the objective of decreasing the social inequity. This can go from projects of construction to funds or food raise.
Management/support processes	
Financial and patrimony	Process responsible for all the management of the financial issues where we include all the transactions made across the organization, including sells, purchases, loans, projects funding, etc. This process includes also the patrimony management.
Information systems	Process responsible for all the support and management of the information systems supporting the business.
Human resources	Process that includes all the management of human resources, where we can highlight the recruitment of new employees and the control and development of the existing ones.
Legal affairs	Treatment and management of all the issues that are related

		with the law. Here we can include legal documents, processes, certificates, etc.
	Statistics	Process where all the organization performance is analyzed through the existing reports and other available information, in order to build an accurate understanding of what is being well done, and what needs to be changed or replaced.

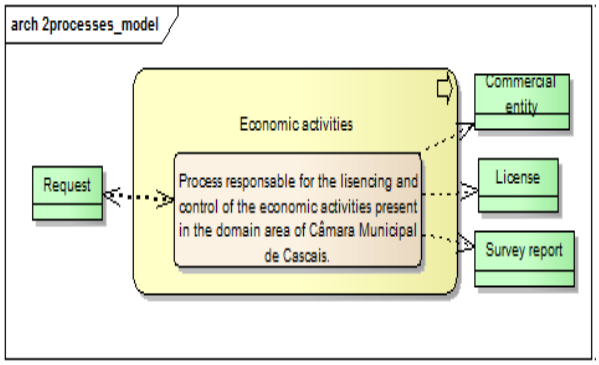
Table 9 – Second iteration business processes definition

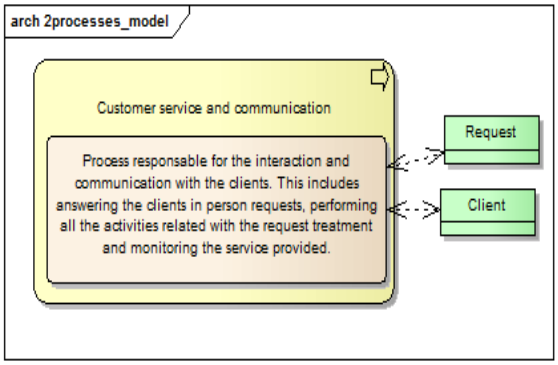
Information Entities	Description
Client	Represents the citizens or enterprises that exist within CMC. Those are who makes the requests that CMC must respond to. Clients or enterprises outside CMC are also considered clients, as long as they have any kind of request that needs to be addressed by CMC.
Request	Represents the requests made by the clients (citizens or enterprises). Those requests can be made in-person or online.
Project	Represents the projects in which the company is involved. Those can be intervention or a urban project.
Partner	Represents organizations (public or private), or even individuals, who collaborate with CMC in the investigation, elaboration or development of any of the existing projects.
Sell	Represents each and every transaction, where money is received in change for any service/product of CMC.
Purchase	Represents each and every transaction, where a service/product is received in change for money from CMC.
Supplier	Represents organizations that sell important resources for the normal functioning of the CMC business.
Asset	Represents all the productive assets that the client possesses. These can be for example machinery or buildings.
Resouce	Represents all the non-productive assets that the client possess (excluding IT resources and employees), such as raw-material, machinery, etc.
IT Resource	Represents all the non-productive assets related with IT.
Employee	Represents all the workers and collaborators working all across the organization, and which are paid directly by CMC.
Activity report	Report that results from the board monitoring of the municipal works being developed throughout the organization.
Comercial entity	Represents all the commercial entities that have a running business within the territory of Câmara Municipal de Cascais.
External entity	Represents the target entities of the organization intervention projects. This can be a charity institution, a school, a library, etc.
Financial report	Monthly report that results from the financial processing made by Financial and Patrimony Management department
Georeference	Represents the georeferences corresponding to any interest spot on Câmara Municipal de Cascais territory. This can point to some particular lot, commercial or external entity, partner, natural park, school, etc.
IT Supplier	Represents the suppliers of the IT platforms used around the organization, and with which Câmara Municipal de Cascais has any kind of contract.
Intervention project	Projects that aim to intervene on the local population and territory as a way to make it evolve. This can be for example monument rebuilding, natural park cleaning, refitting public institutions, etc.
License	Represents the essential documents that each and any commercial entity

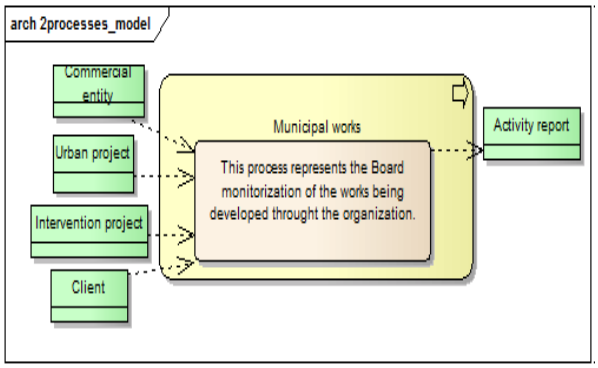
	needs to possess in order to be able to have their business running.
Lot	Represents all the pieces of land that make part of the territory and can belong to a particular citizen, an enterprise or to Câmara Municipal de Cascais itself.
Municpal document	Represents all the documents legally that any client needs to have concerning some specific requests and municipal works where they are involved. Those can be legal documets, processes, certificates, etc.
Police/civil protection report	Report that results from the police or civil protection activity and intervention in any specific case. This can be generated after a specific incident, or just on a monthly basis.
Statistic report	Report that results from the observation of all the ongoing and completed processes on the organization and that aims to develop the knowledge of Câmara Municipal de Cascais about the business.
Survey report	Report that results from the surveys performed at each commercial entity as a way to ensure that everything is being done accordingly to the law and there are no irregularities.
Urban project	Represents the projects that result from specific client's requests to a specific lot or set of lots. This can be for example, a particular house construction a lot purchase or even a building construction for further apartments sell and/or leasing.

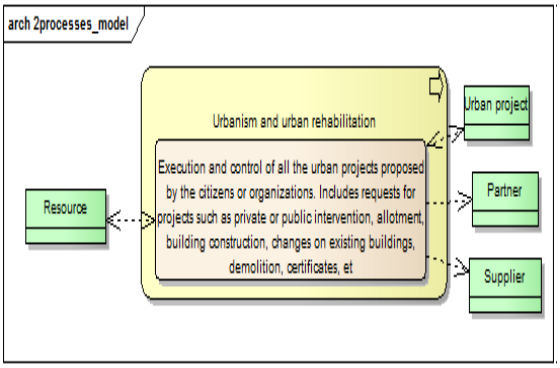
Table 10 - Second iteration information entities definition

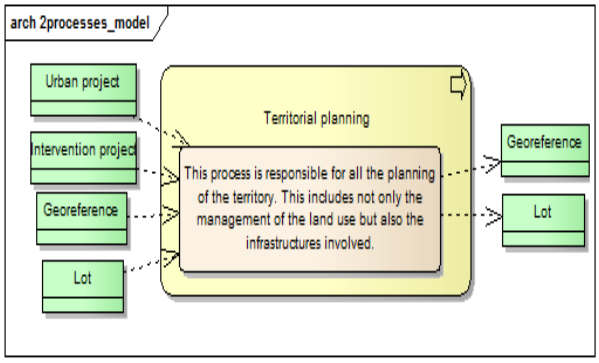
- Document the business processes model, distribute and present it back to the business community for comments:

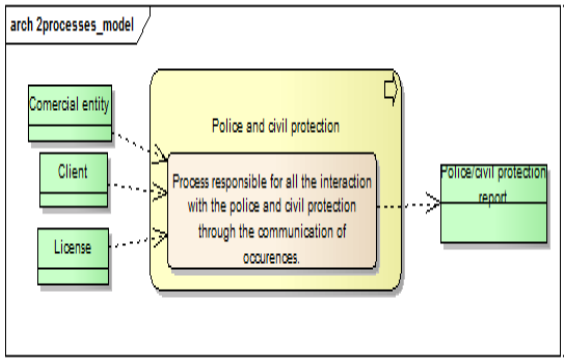


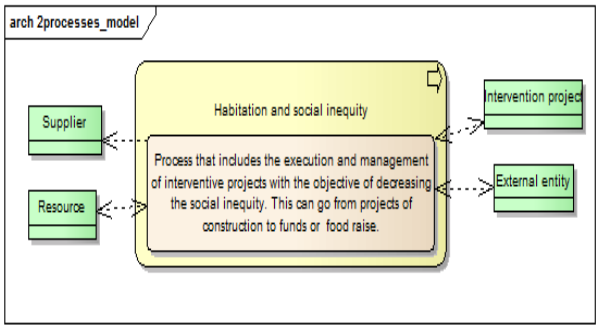


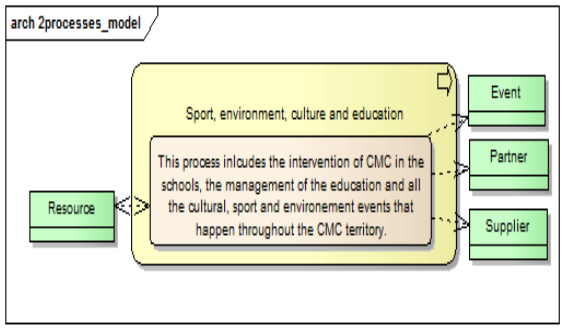


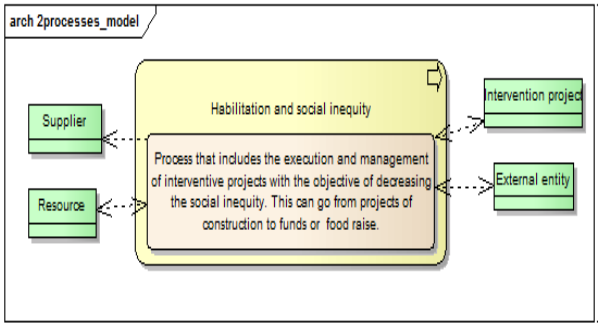


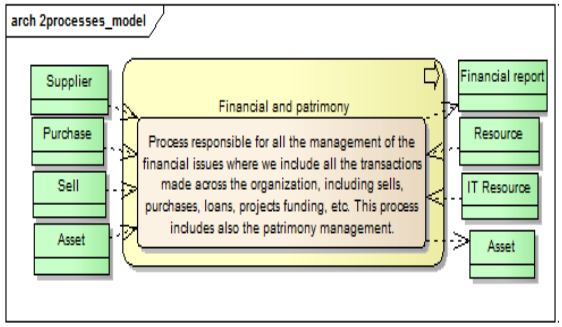


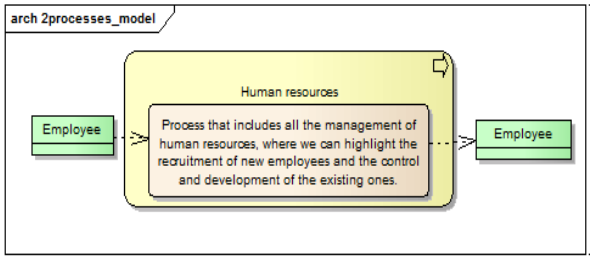


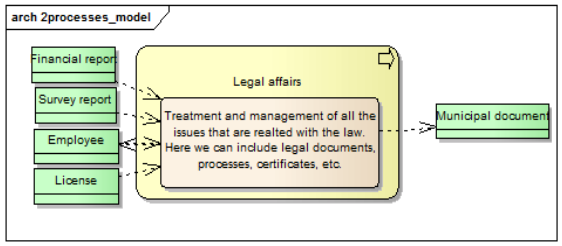












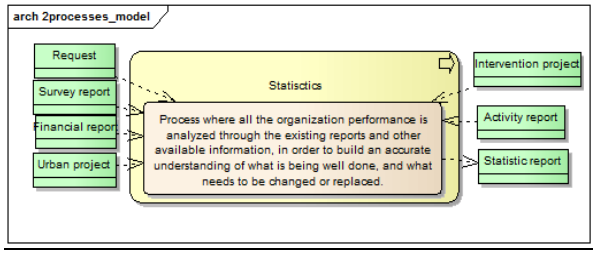


Table 11 - Business processes model.

Current Systems and Technology

On this phase, we present the systems that are currently support Câmara Municipal de Cascais business processes. On the interviews performed, we asked about the systems that were being used to perform the activities composing each process described on the previous step.

- Prepare for, and perform IRC data collection:

System name	Description
GDCC	Document management solution. Supports the dematerialization of decision and administrative processes. Currently implemented on Web environment, allows real-time access to all the information stored. All the income correspondence of CMC is registered here in GDCC.
AIRC 2000	This is the ERP solution of CMC, divided by several modules and information management systems. The independence that exist between the several modules and systems, allows the global treatment of information, according to the specific needs of the users. AIRC performs the complete information treatment throughout the organization. It is divided in several modules for all the different areas where it is being used;
CRM	This is the system to manage the relation with the citizens. Easiness on the creation and maintenance of a clear vision of the clients, from the very first contact, till the end of any request treatment process.
Legacy SQL/Visual Basic	Application developed internally, based on SQL and Visual Basic. It is responsible for the management of economic activities licensing process. Allows the management, renewal and printing of licenses.
SIGWeb	Web version of the geographic information system. Provides all the geographic information to the users, both within CMC and external ones. Developed and customized accordingly to CMC needs.
AutoCAD	Solution for the areas of projects development, allowing doing it in an aggregated way.
GEDOM	Customized platform based on Microsoft Project Enterprise Server system. This allows the users to manage all the projects of each department.
Occurrences Manager	Solution connected to SIG. Allows georeferencing places where the employees of CMC have to go, as a response to some occurrence.
MAPInfo	With this tool it is possible to do data mapping, based on geographic analysis. It has been designed to visually obtain the relations between data, georeferences and other geographic information.
Legix	Solution available through web. Allows searching the legislation and provides all the published legislative acts.
BizTalk	Business Intelligence solution. Incorporates several business applications: EDI, Business Activity Monitoring (BAM) and RFID resources.
Project Server	Used for the planning of construction projects. Provides advanced tools for small teams or individuals, assigned to manage projects. Provides tools for the management of

	work, time, resources and budget.
Adobe Creative Suite	Set of tools for designers with the need to express ideas in a precise and fluid way. Provides the possibility to create images and attractive graphics.
Queues Manager	Allows the control of requests waiting queues. Provides an easy way to produce statistic information concerning the requests answering process.
Inpatrimonium	Allows the global management of CMC cultural patrimony.
DataEase	It is used to register purchasing procedures, placing minutes and manage warehouse.
XTraN	Application managing all the resources operating outside on the field. Provides real-time information about workers and machines, helping the managers to make better decisions based in reliable data.

Table 12 – Identification of current systems.

Data Architecture

- Entity-relationship diagram:

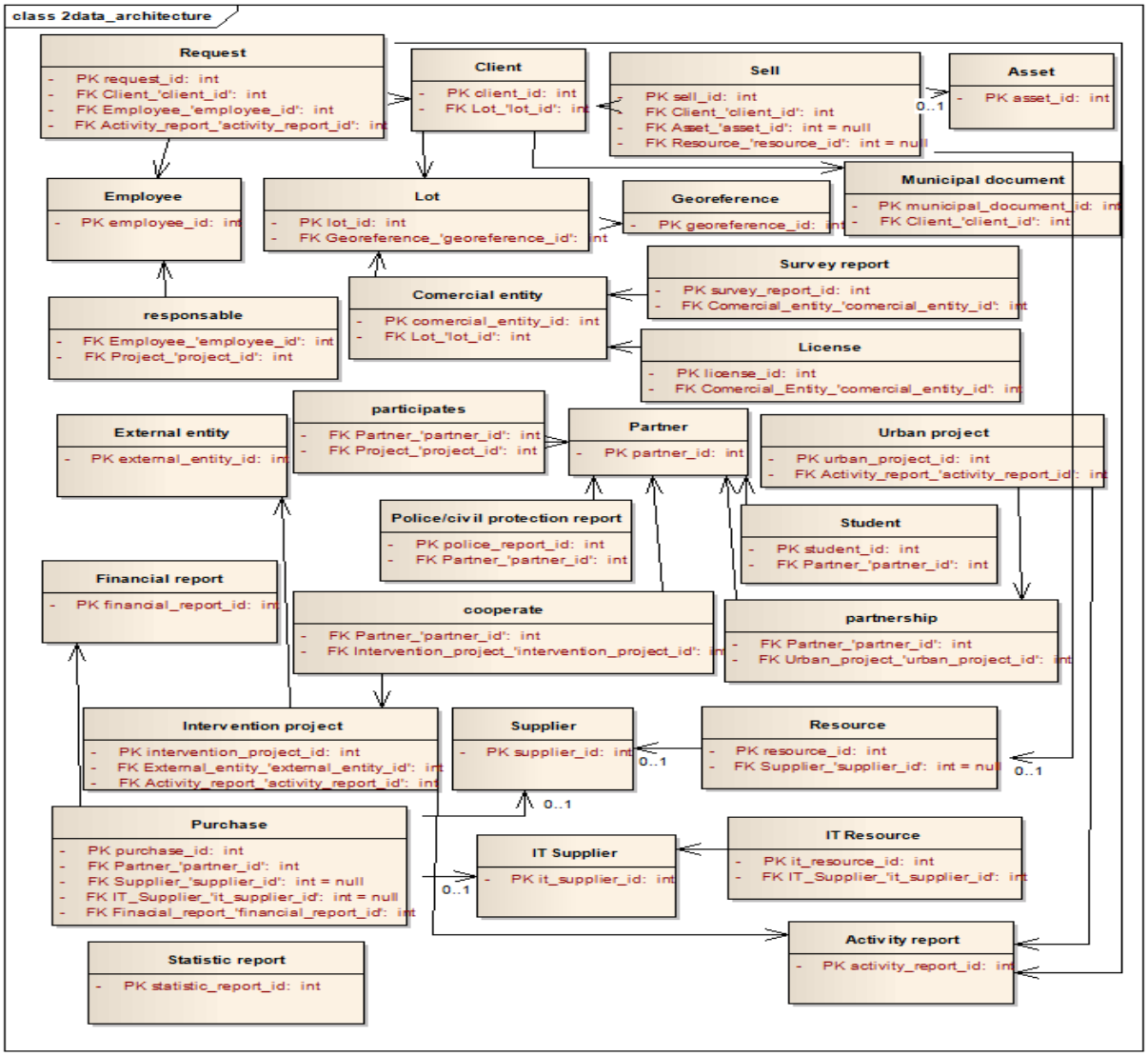


Figure 12 - Second iteration entity-relationship diagram.

- Entity to macro-processes:

	Commercial entity	License	Survey report	Client	Request	Resource	Partner	Supplier	Event	External entity	Intervention project	Urban project	Georeference	Lot	Police/civil protection report	Activity report	Asset	Financial report	Purchase	Sell	IT Resource	IT Supplier	Employee	Municipal document
Operational processes																								
Economic activities	x	x	x		x																			
Municipal works	x			x							x	x				x								
Urbanism and urban rehabilitation				x	x	x	x	x				x												
Territorial planning											x	x	x	x										
Police and civil protection	x	x		x											x									
Sport, environment, culture and education						x	x	x	x															
Habitation and social inequity						x		x		x	x													
Support processes																								
Financial and patrimony						x		x									x	x	x	x	x			
Information Systems																					x	x		
Human resources																							x	
Legal affairs		x	x												x			x					x	x
Statistics			x		x						x	x				x		x						

Table 13 - Relations between information entities and business processes.

- Entity to current systems:

	GDCC	AIRC	CRM	Excel	Access	Word	Legacy SQL/Visual Basic	SIGWeb	BizGov	AutoCAD	MS Project Enterprise Server	GEDOM	Gestor de Ocorrencias	X-Arq	MAPinfo	Legix	CMC Website

Client			x					x								x	x
Request	x		x	x	x								x	x			x
Partner									x			x					
Sell		x	x	x													
Purchase		x	x	x					x								
Supplier		x		x												x	
Asset		x		x		x											
Resource		x				x					x						
IT Resource		x				x					x						
Employee	x			x							x		x				x
Activity report				x		x			x			x		x			
Comercial entity		x		x	x		x									x	
External entity									x								
Financial report		x		x	x	x											
Georeference								x					x	x	x		
IT Supplier		x		x												x	
Intervention project										x	x	x			x		
License				x			x										
Lot													x		x		
Municipal document			x			x								x		x	
Police/civil protection report						x								x			
Statistic report						x								x			x
Survey report						x								x		x	
Urban project			x		x				x	x	x	x			x		

Table 14 - Relations between information entities and current systems.

Applications Architecture

- Candidate applications:

CRUD Matrix	Comercial entity	License	Survey report	Client	Request	Resource	Partner	Supplier	Event	External entity	Intervention project	Urban project	Georeference	Lot	Police/civil protection report	Activity report	Asset	Financial report	Purchase	Sell	IT Resource	IT Suplier	Employee	Municipal document
Operational processes				App 1																				
Economic activities	CRU	C	C		R																			
Costumer service and communication				CRU	CRU	App 2																		
Sport, environment, culture and education						CRD	C	C	CRU				App 3											
Habitation and social inequity						CRD		C		CRU	CRU													

Urbanism and urban rehabilitation				R	R	CRD	C	C				CRU			App 4									
Territorial planning											R	R	CRUD	CRU										
Police and civil protection	R	R		R												C	App 5							
Municipal works	R			R							R	R					C	App 6						
Support processes																								
Financial and patrimony						R		R										CRUD	C	CRU	CRU	R	App 7	
Information Systems																			App 8			CRUD	CRUD	
Human resources																					App 9			CRUD
Legal and municipal affairs		R	R													R			R			App 10		CRU
Statistics			R		R						R	R					R		R					

Table 15 - Second iteration CRUD matrix.

App 1 → Application focused on creation of new economic activities and control of the existing ones. This includes the attribution of licenses and the execution of surveys, in order to keep track of the activities actions.

Organization units: Department of Economic Licensing.

App 2 → Application responsible for the management of the interaction with the customers. Here we include the reception and treatment of requests, both in person or online, and the answering to all the doubts of the clients.

Organization units: Department of Communication Management.

App 3 → Application responsible for the creation and management of all the projects inside CMC. Here we include urban projects, intervention projects and public events. On this application should be possible, not only to create and manage the project itself, but also things such as the resources being used and the partners involved.

Organization units: Department of Leisure and Cultural Promotion, Department of Social Intervention, Department of Urban Management and Department of Administrative Urban Management.

App 4 → Application responsible for the management and planning of CMC land and special ordering. This is expected to be used mainly by architects and engineers, and therefore should be a quite technical tool.

Organization units: Department of Territorial Planning.

App 5 → Application with the capacity to receive real-time complaints and occurrences, with the possibility of immediate answer or routing to the police and/or civil protection. It must be possible to generate a report of individual or groups of occurrences, as an official document that will be available for the police and/or civil protection use.

Organization units: Department of Cooperation.

App 6 → Application capable of monitoring all the projects and events happening within CMC. This is for board use only, and must keep track of the most important metrics of each project at any given time.

Organization units: Department of Municipal Works.

App 7 → Application for the management of all the financial issues of the organization, including CMC property, their assets, resources, transactions, receivables and payables. From the feedback obtained before, it was perceptible that the current system being used is performing well, and therefore, there will be no necessity to change it.

Organization units: Department of Financial and Patrimony Management.

App 8 → Application responsible for the control of all the information systems operating inside CMC. Here we consider information about the systems performance, but also about suppliers and the contracts signed. This will be used exclusively by the IT department, including the support team.

Organization Units: Department of Information Systems.

App 9 →Application responsible for the management of employees and all the bureaucracies and legal affairs related to them. This application must be capable of dealing with other legal affairs that don't involve employees (at least directly), and more related to the projects and activities happening on CMC.

Organization units: Department of Human Resources Management and Department of Legal Affairs.

Technology Architecture

First of all we should say that our analysis of the technology was not as deep as for data and applications. The main reason for that was the lack of information available and above all, the fact that this was not the main concern and focus of the original project, being developed by GFI.

- Identify technology principles and platforms:

Principle 1 → Systems must be as autonomous as possible. This means that a failure in one system should not directly affect other systems, as a way to maintain the service quality and minimize the consequences of a possible disaster.

Principle 2 → In cases of systems replacement, the new systems will provide at least the same service level as the systems being replaced.

Principle 3 → **T**echnology will be scalable and flexible. It must have the capacity to adapt and meet any change in the CMC business requirements. This will help minimizing the impact of change.

Principle 4 → There is only one system making the contact point with the client, avoiding the existence of any doubts on the clients mind when trying to approach CMC services. This means that both the in-person and online requests must be placed on the same system.

Principe 5 → Proven solutions are preferable. If there is a proven solution on the structure of CMC, there is no need to replace it. This minimizes operational risks normally related with the testing of new solutions.

Principle 6 → IT systems are changed as a response to business needs, and never the contrary. This aims to reduce the possibility of having unexpected effects on the business due to unexpected changes on the IT.

Principle 7 → Systems reuse is preferable to buy, which is preferable to build. When suitable, the reuse of a system is the best choice. As long has the current system is able to address the required needs, there is no reason to buy a new one.

Principle 8 → Management of IT systems is automated as much as possible. This reduces the costs of intervention by reducing the need for manual intervention and reduces at the same time the risk for human errors, inherent those interventions.

Principle 9 → Access to IT systems is authenticated and authorized. This ensures that people do not have access to data and resources that they are not supposed to. Notice that this should require measures in all the systems across the organization.

- Define the platforms and distribution;

Having the list of current systems, we will now identify the needs of CMC technology structure, considering the applications identified on the applications architecture phase. Here we will make some recommendations on which systems should be replaced, removed, upgraded, kept or added to the CMC structure

.

System name	Recommendation
GDCC	The document management system should be kept. There is a necessity centralize documentation, once there are Word and Excel documents stored locally, that need to be included on GDCC solution.
AIRC 2000	AIRC system should be kept, but needs to be integrated with other systems. Internal information management is being efficiently done, but the collaboration with other systems requires human intervention. The analysis of AIRC modules will be done on the next iteration, where will have a more detailed knowledge about CMC business.
Microsoft CRM Dynamics 4.0	The current CRM should be upgraded. The current system does not allow an integrated management of entities and contacts. A new CRM system should be correctly integrated with GDCC.
Legacy SQL/Visual Basic	Should be kept, but needs to allow the creation and management of survey reports for each economic activity. Needs also a better integration with the AIRC system.
SIGWeb	SIGWeb system must be upgraded or if that's not possible, replaced. This system aggregates all the georeferenced information, being critical to CMC business. However, this system does not allow the analysis of scenarios with several variables, necessary to the territorial planning process.
AutoCAD	Should be kept. It is a technical tool used in specific projects.
GEDOM and EPM	Should be removed / replaced. The management of projects must be centralized in one single system.
Occurrences Manager	Needs to be urgently replaced. This is a pilot version of the system and has already exceeded the number of registered occurrences supported without repeating identifiers.
MAPInfo	Should be kept as it is.
Legix	Should be kept but should be integrated with the system that manages all the employees' information.
BizTalk	Should be kept as it is. It is serving its purpose for board activities monitoring.
Project Server	Should be removed / replaced. The management of projects must be centralized in one single system.
Adobe Creative Suite	Should be kept. It is a technical tool used in specific projects.
Queues Manager	Should be kept.
InPatrimonium	Should be kept.
DataEase	This system should be removed. All its functionalities are also supported by the AIRC system, and therefore, the right choice should be to manage all the information inside the same platform.
XTraN	The tasks being performed by this system should be included in a centralized project management system. If that is not a possibility, then XTraN needs, at least, to be integrated with the system that is responsible for the projects management.
Projects Management System	Should be added to CMC technology structure, replacing existing systems. System that allows a centralized management of all projects. There are projects being

	management in Project Server, GEDOM/EPM, Access and even Excel. This decentralization makes the control and monitoring of activities a very hard process. A centralized solution allows not only the exchange of information about shared resources but also a way to get essential statistic information for the board control process.
Occurrences Management System (replacing the current one)	Should be added to CMC technology structure, replacing the current Occurrences Manager. Should be taken into attention that this needs to be a system with large capacity, once some occurrences can have a big urgency and not answering them can represent a big risk for the population.

Table 16 - Second iteration platforms identification.

- Relate the technology platforms to applications and business processes;

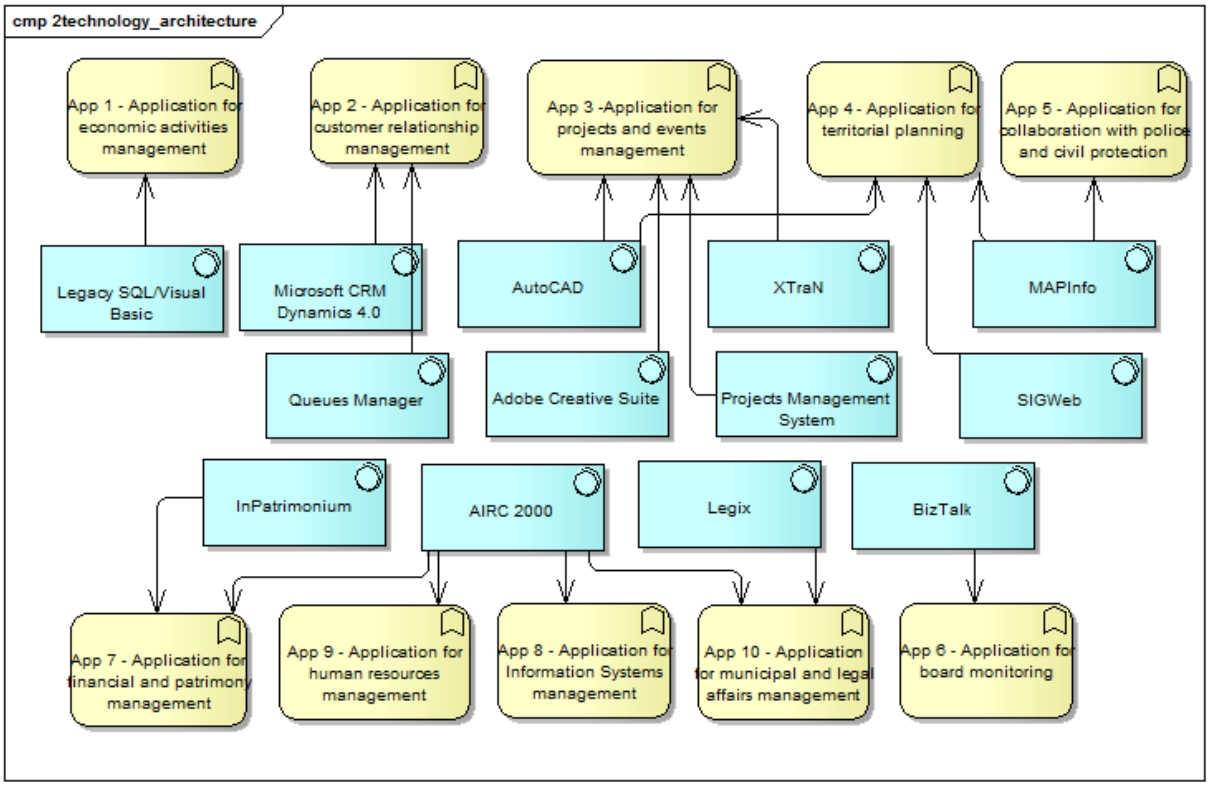


Figure 13 - Second iteration relation between systems and applications.

Third Iteration:

Business sub-processes model

- Document the organization structure:

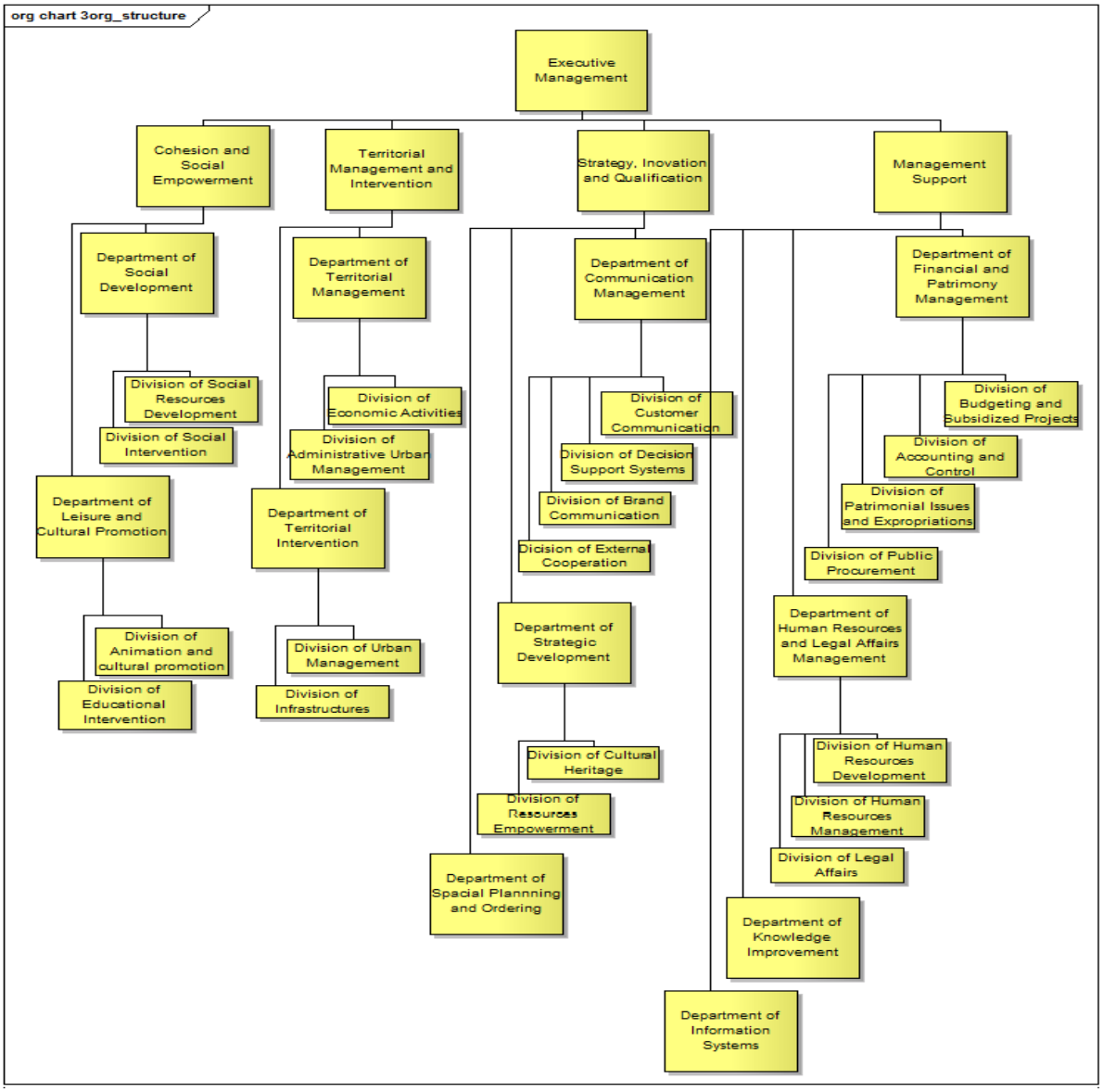


Figure 14 - Third iteration organization structure.

- <u>Identify and define business processes and information entities:</u>

Business processes		Business sub-processes	Objectives
Operation processes			
	Economic activities	**Management of licensed activities**	Promoting licensing, where each commercial entity has its historical process since the beginning of the activity.
		Licensing new activities	Licensing of taxis, coffee shops, bars, stores, hotels and all the allowed commercial activities in CMC.
		Survey commission	Survey commission, that ensures the compliance with the law by economic entities.
	Customer service and communication	**Clients in person requests treatment**	Answer clients in person through Balcão Único service. The client in collaboration with the CMC employee creates a request that is entered on the computer system for further t treatment.

		Online requests treatment	Answer client's requests through Balcão Cascais service. Those requests can be for private (housing, commerce, etc…), or public intervention, allotment, building construction, changes on existing buildings, demolition, certificates, etc.
		Customer service survey and archive treatment	Classification plan, in order to evaluate the effectiveness of the processes treatment.
	Municipal works	**Monitoring activities**	Measurement of activities information to help the management units on the control of specific processes.
	Urbanism and urban rehabilitation	**Create and manage urban projects**	The primary focus is to perform appreciations of information requests and proposals for projects, allotment operations and implementation of detailed plans
		Urban projects administrative support	Ensure all the administrative operations related with the municipal urbanism processes.
	Territorial planning	**Spatial ordering**	Spatial ordering and planning of land use.
		Infrastructures planning	Planning of infrastructures, equipment and mobility.
	Police & Civil Protection	**Report occurrences**	Report occurrences to police and/or civil protection.
		Collaborate with the police/civil protection	Collaborate with police and/or civil protection by sharing information.
	Sport, environment, education and culture	**Execution of social projects**	Projects with sport, environment and culture as a way to educate and evolve the population.
		Execution of public leisure events	Public events such as music festivals, open air cinema and other leisure events.
	Habilitation and social inequity	**Execution of intervention projects**	Realization of projects that aim to help the poorest people among the population, as a way to reduce the existing inequity. Those can be construction projects, food related campaigns, money raise, etc. Those projects can also be related with the renewal of old buildings or even the providing of new equipment.
Management/support processes			
	Financial and patrimony	**Accounting and External financial control**	Tax executions, expropriation, financial control and subsidies.
		Manage transactions	Management of payments and receivables.
		Manage possessions	Management of provision, CMC patrimony (buildings and lands) and goods.
		Projects financial management	Subsidized projects, search for potential funding, candidatures.
		Management of services necessities	Management of services necessities, goods, services purchase process and procurements.
	Information systems	**Manage and support the IT infrastructure**	Provide inside support with information systems related problems.
		Develop IT infrastructure	Develop and manage the IT strategy, including the partnerships and contracts, according to the necessities of the organization.

	Human resources	**Recruitment process**	Recruitment of new employees.
		Development and appreciation of employees.	Development of employees through the realization of training courses. Appreciation of the employees through an evaluation system.
	Legal affairs	**Management of legal internal and external relations**	Treatment of advices, information, internal and external contentious, administrative, disciplinary actions, inquiries, replies to the Ombudsman, IGF, IGAT and Courts.
		Notary and municipal support issues	Treatment of municipal support issues, such as minutes, certificates, Boletim Municipal, council deliberations.
		Internal audit	Internal audit.
	Statistics	**Business knowledge improvement**	Create, develop and manage an efficient knowledge of the business performance.

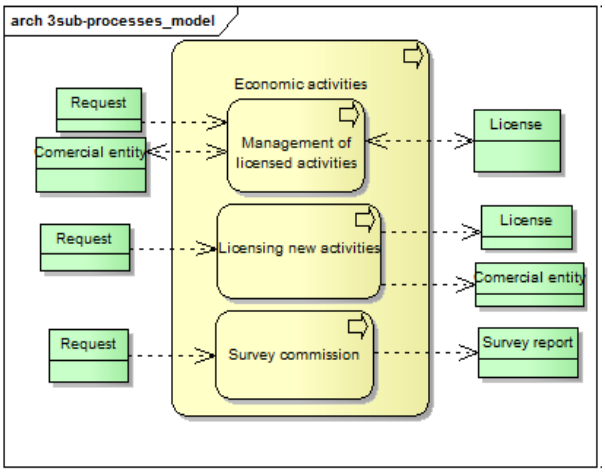
Table 17 - Identification of business sub-processes.

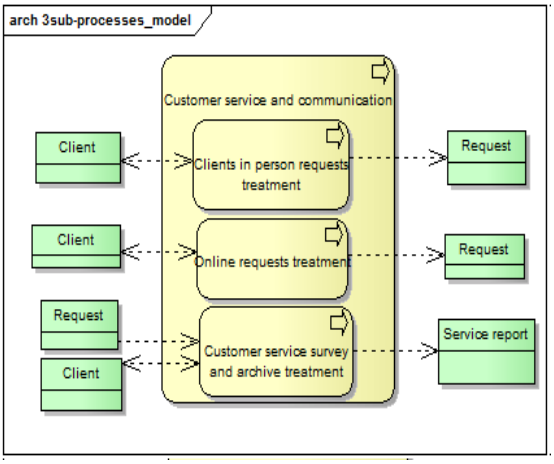
On Table 17, we describe the information entities identified on this third iteration. We will only present the new entities that had not been identified and described before on the process. Although we don't repeat here the description of all the entities showed on the second iteration, we will still be using them on this part of the process.

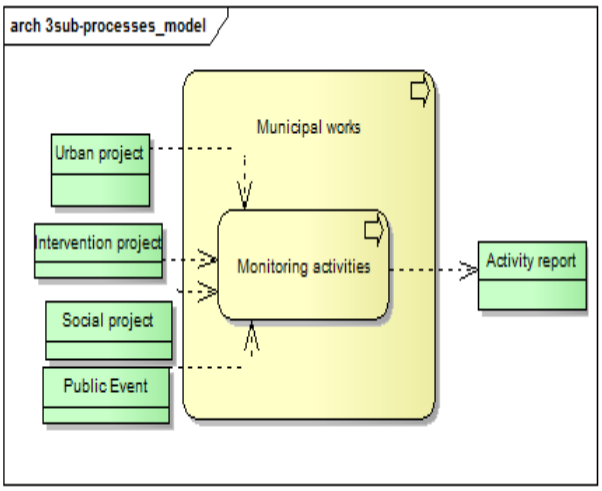
Information Entities	Description
Public event	Represents the events that are organized and manageded within CMC and that can be considered leisure events. These can be music events, sports competitions, open-air cinemas, etc.
Occurrence	Represents any incident reported to CMC and for which is necessary a special procedure, including the collaboration with the police and/or civil protection. Those can go from natural catastrofies reports, fires, outpouring of harmful material, testimonies and reports of offences, etc.
Service report	Report that results from the survey done to the requests treatment process.
Social project	Represents the projects that try to have a positive social impact on CMC population, in terms of culture, health, financialy and education. Those can be educative courses, free professional training for the ones with bigger necessities, etc.
Statistic report	Report that results from all the statistical analysis made to the overal processes and the reports resulting from the other activities.
Audit report	Report that results from all the internal audits perform within the organization. This audits aim to ensure the regularity of all the projects and activities.

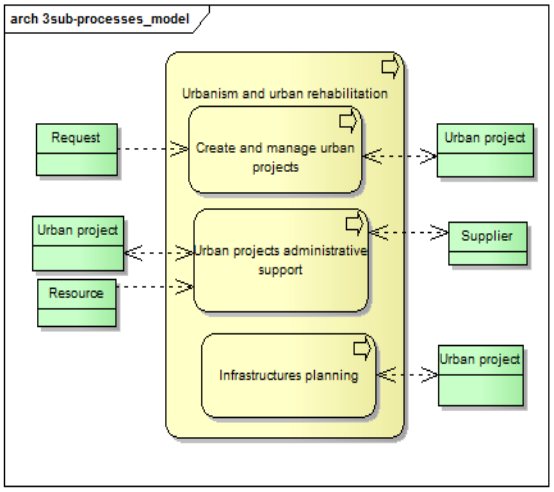
Table 18 - Identification of business processes.

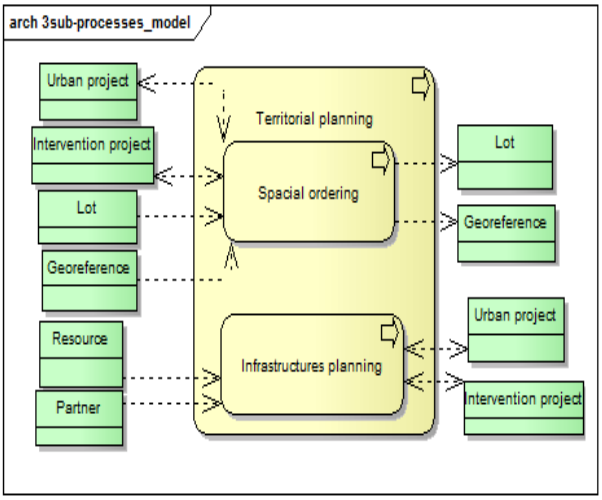
- Document the business processes model, distribute and present it back to the business community for comments:

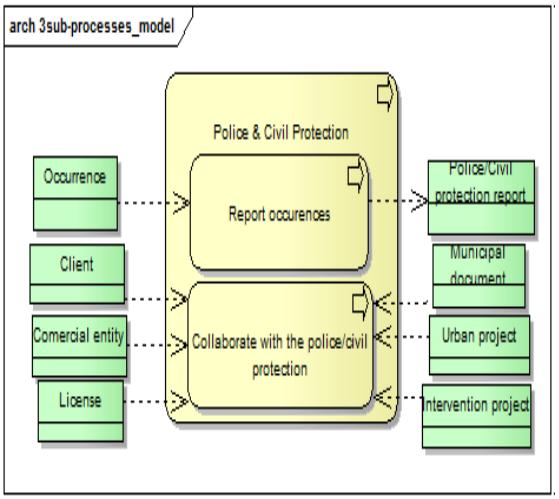

arch 3sub-processes_model
Economic activities
Request
Comercial entity
Management of licensed activities
License
Request
Licensing new activities
License
Comercial entity
Request
Survey commission
Survey report

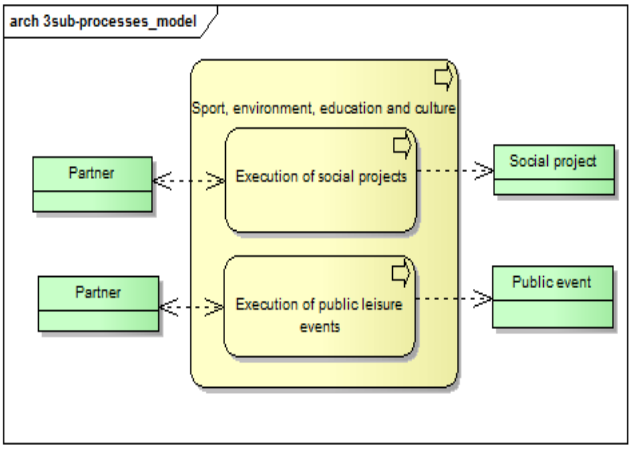

arch 3sub-processes_model
Customer service and communication
Client
Clients in person requests treatment
Request
Client
Online requests treatment
Request
Request
Client
Customer service survey and archive treatment
Service report

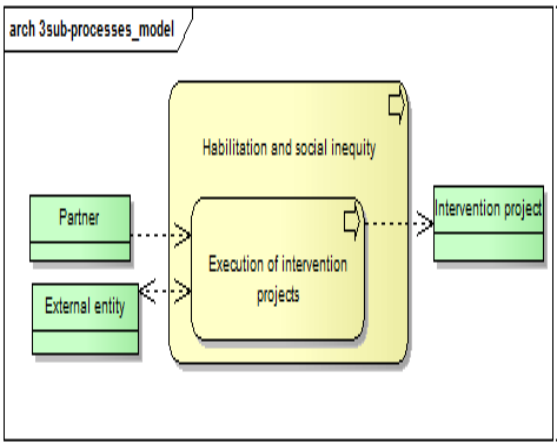

arch 3sub-processes_model
Municipal works
Urban project
Intervention project
Monitoring activities
Activity report
Social project
Public Event

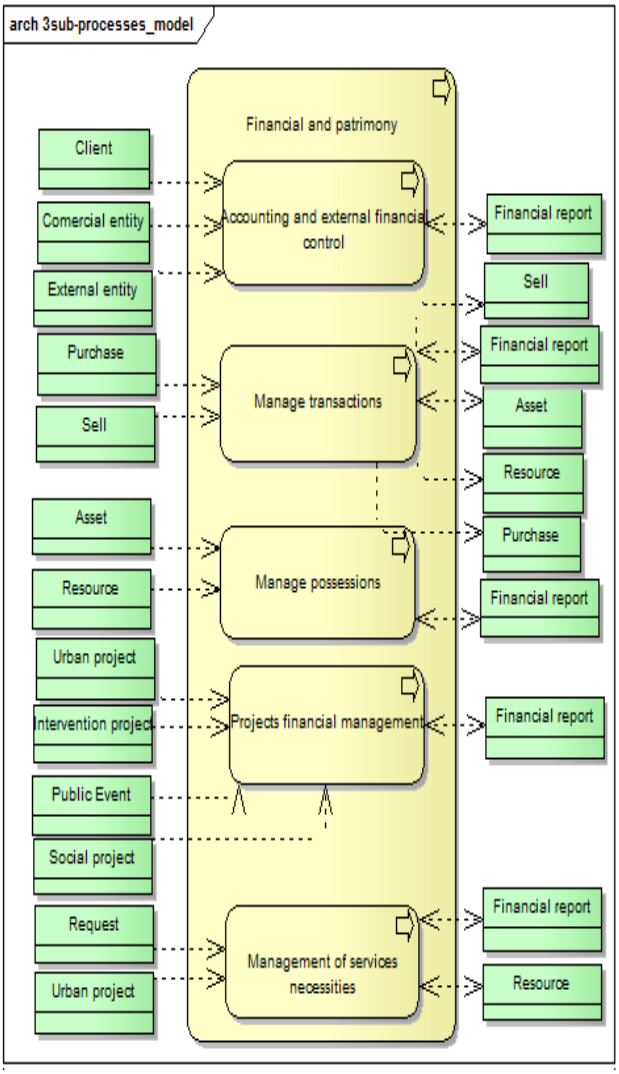

arch 3sub-processes_model
Urbanism and urban rehabilitation
Request
Create and manage urban projects
Urban project
Urban project
Urban projects administrative support
Supplier
Resource
Infrastructures planning
Urban project

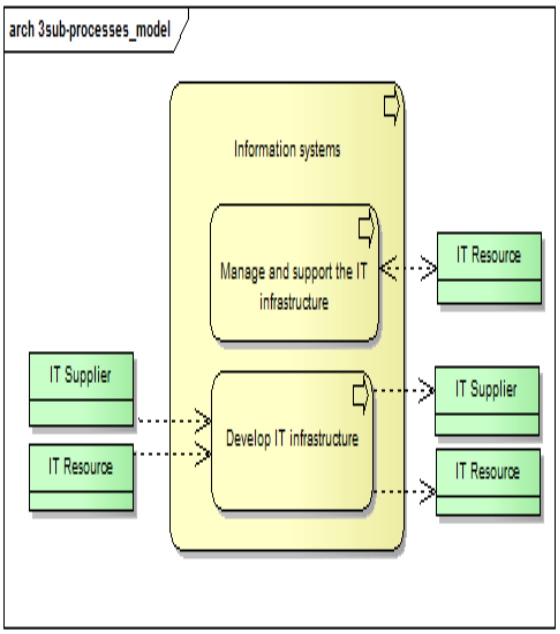

arch 3sub-processes_model
Urban project
Territorial planning
Intervention project
Spacial ordering
Lot
Lot
Georeference
Georeference
Resource
Infrastructures planning
Urban project
Partner
Intervention project

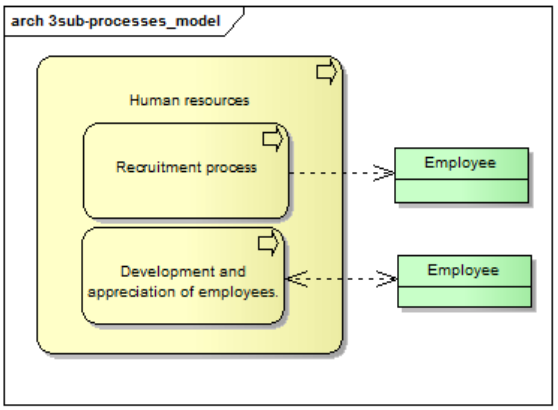

arch 3sub-processes_model
Police & Civil Protection
Occurrence
Report occurences
Police/Civil protection report
Client
Municipal document
Comercial entity
Collaborate with the police/civil protection
Urban project
License
Intervention project

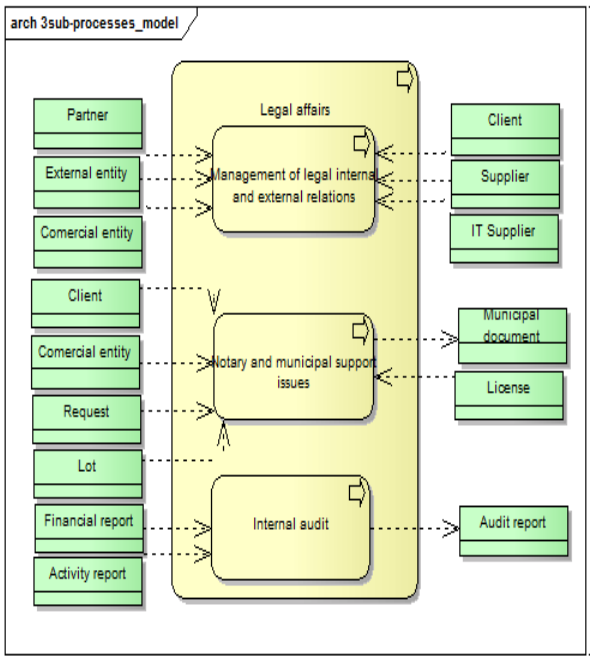

arch 3sub-processes_model
Sport, environment, education and culture
Partner
Execution of social projects
Social project
Partner
Execution of public leisure events
Public event


arch 3sub-processes_model
Habilitation and social inequity
Partner
Execution of intervention projects
Intervention project
External entity


arch 3sub-processes_model
Financial and patrimony
Client
Comercial entity
External entity
Purchase
Sell
Accounting and external financial control
Financial report
Sell
Financial report
Manage transactions
Asset
Resource
Purchase
Asset
Resource
Manage possessions
Financial report
Urban project
Intervention project
Projects financial management
Financial report
Public Event
Social project
Request
Urban project
Management of services necessities
Financial report
Resource


arch 3sub-processes_model
Information systems
Manage and support the IT infrastructure
IT Resource
IT Supplier
Develop IT infrastructure
IT Supplier
IT Resource
IT Resource


arch 3sub-processes_model
Human resources
Recruitment process
Employee
Development and appreciation of employees.
Employee



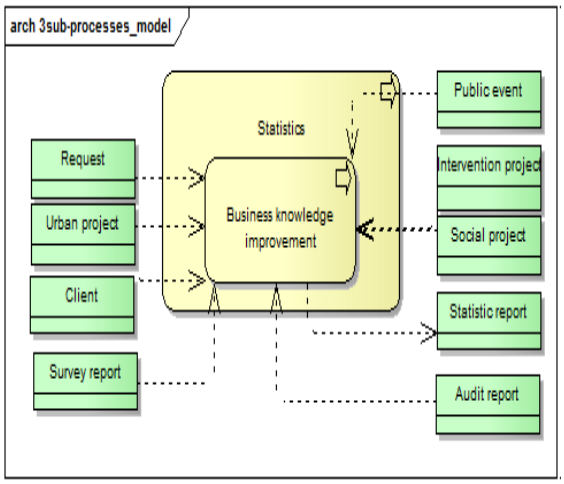


Table 19 - Business sub-processes model.

Current Systems & Technology

On this third iteration, we will be doing an update to the list of systems described on the previous one and therefore, we describe only the new systems identified. Those systems belong to the ERP solution of AIRC 2000. This contains a complete set of integrated modules and information management systems, which we present next.

System name		Description
AIRC 2000	**Economic Activities System**	System dedicated to the management of information from all the economic activities running in CMC.
	Budgetary Accounting System	Used for the budgetary, patrimonial and cost accounting.
	Contracts Control System	Used to manage the contracts inherent to the development of all the projects running in CMC.
	Purchase Management System	Used to manage procurement and contracting procedures, including the purchase of goods and services.
	Stocks Management System	Include the supply and warehouse management.
	Tax Foreclosures System	Include the registration and control of all the procedures inherent to the execution of tax foreclosures.
	Treasury Management System	Includes the registration of treasury daily movements, refreshing automatically the daily cash sheet summary, banks current account and documents current account.
	BIS POCAL	Decision support system, including business reporting and data-mining tool.
	BIS-RH	Collection and reading of preponderant information, through conventional exploring of back office applications consulting.
	BIS-PESSOAL	Provides important information aimed to fulfil the board necessity for information about the organization activities and performance. Furthermore allows the customization of searches and analyses to a big variety of sources.

	Performance Evaluation System	Includes the management of the staff evaluation process.
	Staff Management System	Includes the management of internal payments, vacations, off days and casualties.
SPSS Statistics Base		System that allows scanning all the information in order to obtain statistical results. Have the capacity to create explanation regressive models of a specific event, and identify the factors that explain it.

Table 20 - Third iteration identified systems.

Data Architecture

- Entity-relationship diagram:

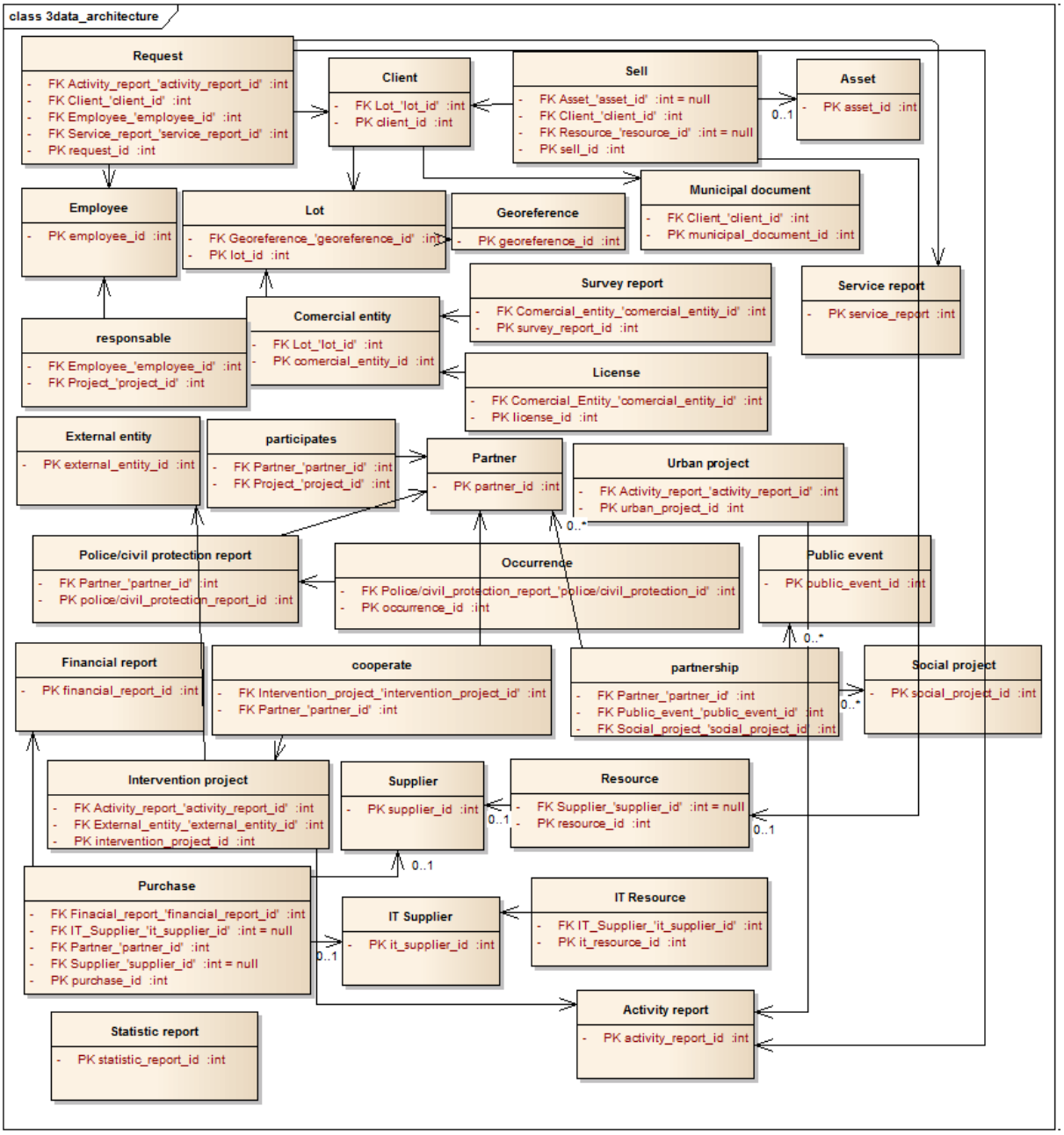


Figure 15 - Third iteration entity-relationship diagram.

- <u>Entity-to-sub-process</u>

	Comercial entity	License	Client	Request	Service report	Survey report	Activity report	Supplier	Urban project	Georeference	Lot	Intervention project	External entity	Partner	Social project	Public event	Police/civil protection report	Occurrence	Financial report	Resource	Asset	Purchase	Sell	IT Resource	IT Suplier	Employee	Municipal document	Statistic report	Audit report
Operational sub-processes																													
Management of licensed activities	x	x		x																									
Licensing new activities	x	x		x																									
Economic activities survey commission				x		x																							
Clients in person requests treatment			x	x																									
Online requests treatment			x	x																									
Customer service survey and archive treatment			x	x	x																								
Monitoring activities							x		x			x			x	x													
Create and manage urban projects				x				x	x											x									
Urban projects administrative support									x																				
Spatial ordering									x	x	x	x																	
Infrastructures planning									x			x	x							x									
Report occurrences												x	x	x			x	x											
Collaborate with the police/civil protection	x	x	x						x			x						x									x		
Execution of social projects														x	x														
Execution of public leisure events														x		x													
Execution of intervention projects												x	x	x															
Support sub-processes																													
Accounting and external financial control	x		x										x						x										
Manage																			x	x	x	x	x						

transactions																												
Manage possessions																		x	x	x								
Projects financial management									x			x			x	x			x									
Management of services necessities				x					x									x	x									
Manage and support the IT infrastructure																							x					
Develop IT infrastructure																							x	x				
Recruitment process																									x			
Development and appreciation of employees																									x			
Management of legal internal and external relations	x		x					x					x	x										x				
Notary and municipal support issues	x	x	x	x							x															x		
Internal audit						x	x											x										x
Business knowledge improvement			x	x		x			x			x			x	x											x	x

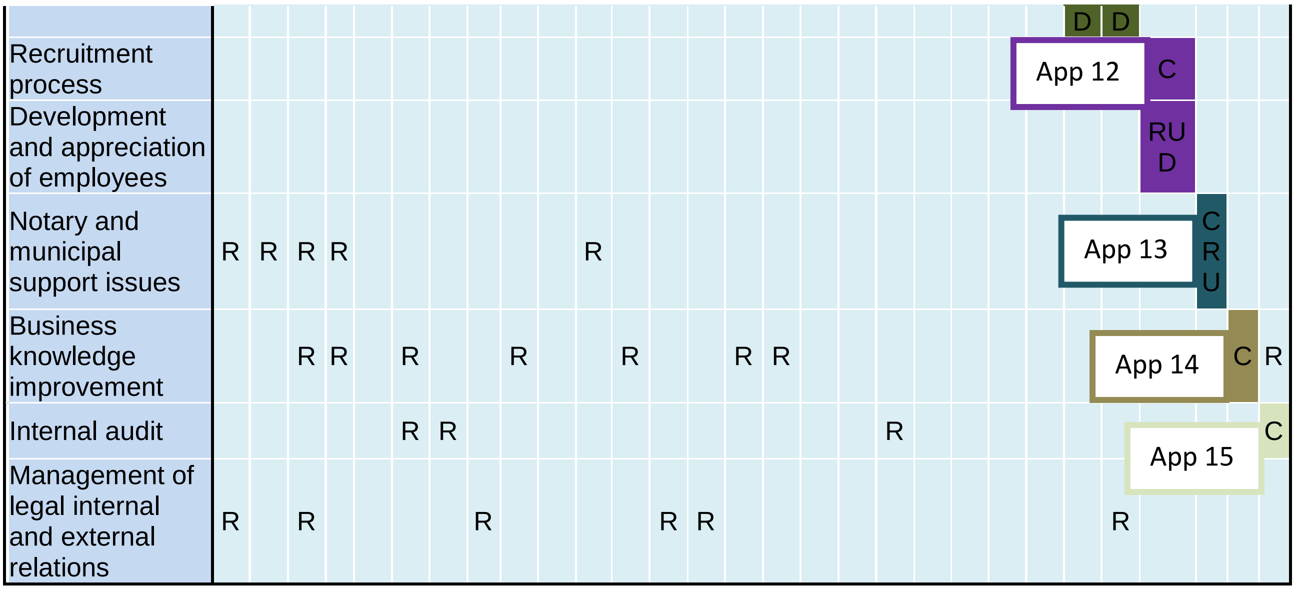
Table 21 - Relations between information entities and business sub-processes.

<u>Applications Architecture</u>

- <u>Candidate applications:</u>

CRUD Matrix	Comercial entity	License	Client	Request	Service report	Survey report	Activity report	Supplier	Urban project	Georeference	Lot	Intervention project	External entity	Partner	Social project	Public event	Police/civil protection report	Occurrence	Financial report	Resource	Asset	Purchase	Sell	IT Resource	IT Suplier	Employee	Municipal document	Statistic report	Audit report
Operational sub-processes																													
Management of licensed activities	R U	C R U D	App 1	R																									
Licensing new activities	C	C		R																									

Clients in person requests treatment			CRU	C	App 2																								
Online requests treatment			CRU	C																									
Economic activities survey commission			R	R		C	App 3																						
Monitoring activities								C		R			R			R	R												
Create and manage urban projects				R					R	CRU	App 5	App 4								R									
Urban projects administrative support									CRU	RU																			
Infrastructures planning										RU			R	R						R									
Spatial ordering										R	CRU	CRU	R																
Execution of intervention projects								App 6					CRU	C	R	App 7													
Execution of social projects															CR	CRU	App 8												
Execution of public leisure events															CR		CRU												
Report occurrences																		CRU	RU	App 9									
Collaborate with the police/civil protection	R	R	R							R			R						C									R	
Support sub-processes																													
Accounting and external financial control	R		R											R						CRU				App 10					
Manage possessions																				RU	R	R							
Projects financial management										R			R			R	R			RU									
Management of services necessities				R						R										RU	RU								
Manage transactions																				RU	C	CRU	CR	CR					
Manage and support the IT infrastructure																									RU	App 11			
Develop IT infrastructure																									CRU	CRU			



																								D	D				
Recruitment process																										C			
Development and appreciation of employees																										RUD			
Notary and municipal support issues	R	R	R	R							R																CRU		
Business knowledge improvement			R	R		R			R			R			R	R												C	R
Internal audit						R	R												R										C
Management of legal internal and external relations	R		R					R					R	R											R				

Table 22 - Third iteration CRUD matrix.

App 1 → Application responsible for the management of economic activities. It must be capable of creating and maintaining a profile of each activity, and also associate them with the licenses that they possess.

Organization units: Division of Economic Activities.

App 2 → Application responsible for the treatment of the client's requests. Those requests can be created online by the client or locally by the employee, when receiving in-person instructions from the citizens.

Organization units: Division of Customer Communication.

App 3 → Application capable of analysing economic activities and documenting what results from the surveys, for an accurate quality and legal control. Here we include every kind of activities already with running businesses. This should include tools and options to construct structured documents.

Organization units: Economic activities survey commission.

App 4 → Application with the capability to gather, treat and present important metrics concerning all on-going projects. This application will have the necessity to be integrated with App 5, 7 and 8, which will contain the information of each particular project.

Organization units: Executive Management.

App 5 → Application supporting the processes related with urbanism and urban rehabilitation. This includes creation, evaluation, management and monitoring of urban projects and the planning of infrastructures involved on those projects. The administrative support to this kind of projects should also be addressed by App 5.

Organization units: Division of Administrative Urban Management, Division of Urban Management and Division of Infrastructures.

App 6 → Application to be used by architects, engineers and all the technical staff that is responsible for the territorial planning and ordering. Here should be possible to manipulate graphical elements and do the projects planning.

Organization units: Department of Spatial Planning and Ordering.

App 7 → Application capable of creating and managing intervention projects. Here we expect to be able to store and control all the information related with each project, such as its schedule, progress, reports, etc.

Organization units: Division of Social Intervention, Division of Social Resources Development and Division of Education Intervention.

App 8 → This should be similar to App 7, but applied to different needs, once it will be expected to monitor the information of different kinds of projects and events, such as cultural conferences, sports tournaments, educative workshops, music festivals, etc.

Organization units: Division of Animation and Cultural Promotion.

App 9 → Application that makes the communication between CMC and both the police and civil protection. It must give the possibility to create occurrences reports and forward them into the authorities, without the need of a "translation" to their reports formats.

Organization units: Division of External Cooperation.

App 10 → Application responsible for all the financial and patrimony management of the organization. Here we include all the incomes and outcomes, the payrolls, assets, sells and purchases control, etc. The application being currently used by CMC, for this purpose, was said to be very efficient and the one with best performance, and therefore the best choice is to keep using it.

Organization units: Division of Budgeting and Subsidized Projects, Division of Accounting and Control, Division of Patrimonial Issues and Expropriations and Division of Public Procurement.

App 11 → Application responsible for the management and monitoring of all the information systems supporting CMC business. Here we include the information about accounts, permissions, contracts, IT partnerships, performance, etc. This will be used not only to manage and improve current systems, but also to develop improvement strategies, that may include the purchase of new ones.

Organization units: Department of Information Systems.

App 12 → Application responsible for the management and development of CMC human resources. It is expected to contain all the information of each employee, including their salaries, record of working hours, projects involved, curriculum inside CMC, etc.

Organization units: Division of Human Resources Development and Division of Human Resources Management.

App 13 → Application responsible for the management of municipal documents and requests related with municipal issues. Here must be possible to create and associate the documents to the clients. The different layouts of the several types of documents must be supported by App 13.

Organization units: Division of Legal Affairs.

App 14 → Application that needs to be able to extract information and transform it into statistic knowledge, capable of bringing precious indicators of what is being done successfully, and what needs to be reviewed or changed.

Organization units: Department of Knowledge Improvement.

App 15 → Application capable of capturing and registering some specific information, to be used and analysed on the internal audit process.

Organization units: Department of Knowledge Improvement.

Technology Architecture

- Define the platforms and distribution:

On this step we present only the systems not presented previously. Following the same approach of the correspondent step of the previous iteration, we do an analysis of the existing systems, including recommendations on what to do with each system, and which new ones should be included on the IT structure.

System name		Recommendation
AIRC 2000	Economic Activities System	Should be kept.
	Budgetary Accounting System	Should be kept.
	Contracts Control System	Should be kept.
	Purchase Management System	Should be kept.
	Stocks Management System	Should be kept.
	Tax Foreclosures System	Should be kept.
	Treasury Management System	Should be kept.
	BIS POCAL	Should be kept.
	BIS-RH	Should be kept.
	BIS-PESSOAL	Should be kept.
	Performance Evaluation System	Should be kept.
	Staff Management System	Should be kept.
SPSS Statistics Base v17		Should be kept.
Municipal Documents Management System		A new system to be added to CMC IT structure. The municipal documents are being managed in a disorganized way without a common place and system of creation, access and edition.
IT Infrastructure Management System		A new system do be added to CMC IT structure. The management of the IT resources and the information involved is managed in a disorganized way. There isn't a common place where to manage all the IT resources, including its contracts. The structure of the IT is not documented and this should be addressed by this system as well.

Table 23 - Third iteration platforms identification

- Relate the technology platforms to applications and business sub-processes:

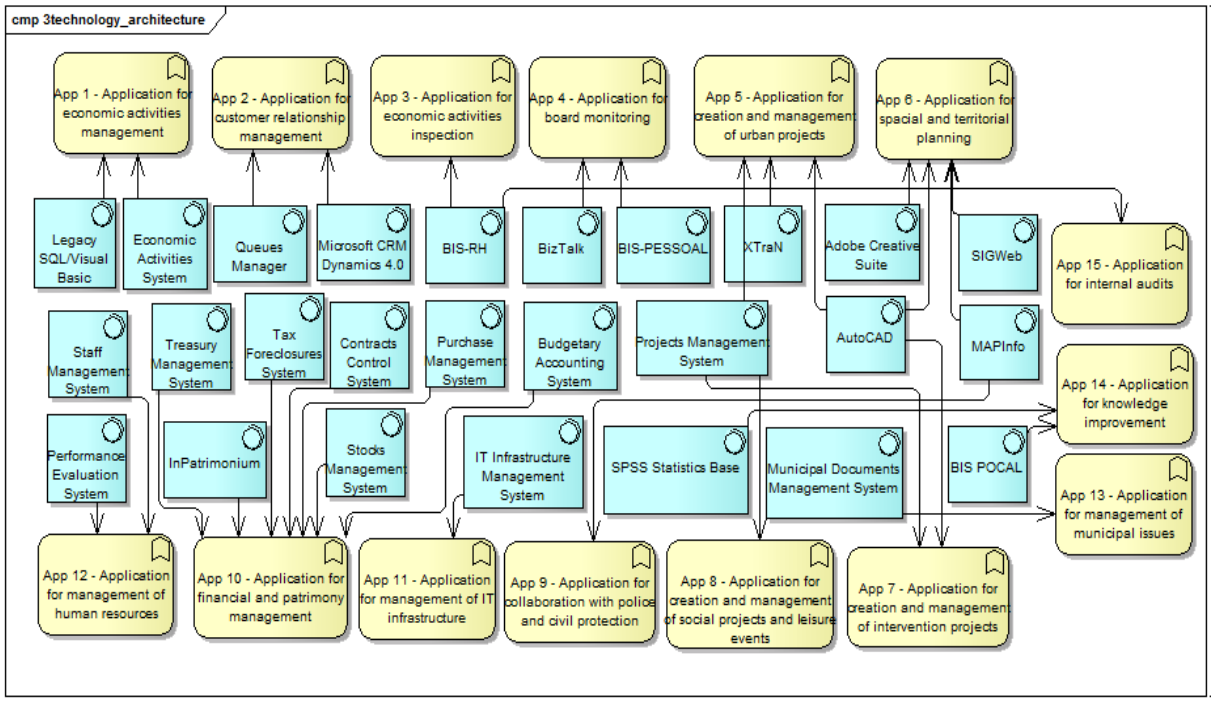


Figure 16 - Third iteration relation between systems and applications.

<u>Implementation/Migration plan</u>

- <u>Applications implementation sequence;</u>

Having into account the information provided by CMC on the beginning of the project, the bigger priority was to rehabilitate the IT structure of the operational area, once the support area was considered to be more efficient and less problematic.

In EAP, there is a fundamental applications sequencing principle that says: “Applications that create data should be implemented before applications that use data” (Spewak, S. & Hill, S., 1992)

Based on the two factors outlined above, our proposal for the applications implantation sequence is as follows:

1. App 2 – Application for customer relationship management;
2. App 1 – Application for economic activities management;
3. App 3 – Application for economic activities inspection;
4. App 6 – Application for spatial ordering and territorial planning;
5. App 7 – Application for creation and management of intervention projects;
6. App 5 – Application for creation and management of urban projects;
7. App 8 – Application for creation and management of social projects and leisure events;
8. App 4 – Application for board monitoring;
9. App 9 – Application for collaboration with police and civil protection;

10. App 11 – Application for management of IT infrastructure;
11. App 12 – Application for management of human resources;
12. App 13 – Application for management of municipal issues;
13. App 10 – Application for financial and patrimony management;
14. App 14 – Application for knowledge improvement;
15. App 15 – Application for internal audits;

- Plan for converting and/or replacing existing systems;

When defining the technology architecture of both iterations, we decided to do this replacing plan on that moment, as a way to have a better organization of the information. Take a look at the steps "Define the platforms and distribution" in order to see the systems that need to be replaced and the new ones that are meant to replace them.

- Final recommendations:

Finally, we do some considerations that we think, can be useful to help CMC on this delicate transition period that is still to come:

- There are, in CMC infrastructure, a relevant number of applications that require the use of a sequence of two or more different systems, in order to obtain all the information that they need. By analyzing the results that we are providing, CMC should identify which are the applications that use the bigger number of systems, in order to increase the level of integration between those systems, reducing the time and effort of the final users.
- Should be implemented a policy of equipment assignment that takes into account the computational weight of the systems used.
- Should be performed a review of the existing IT contracts, in order to suit the investment on each system, to the real needs of the organization.
- CMC should have a special concern with the process of evaluation / selection / acquisition / installation of new technologies required to implement the new architecture. Delays for the appraising technology acquisition can retard the entire plan.
- In this transition process is important to have an overall collaboration inside the organization. Each department within CMC should have its roles well defined regarding the implementation phase
- Should be performed an overview of all the organization. The need to adapt to the implementation may require some changes and shifts of responsibilities, as a way to ensure the successful implementation of the architectures and plans.

Chapter 5

Evaluation

On this chapter we present the evaluation process of our work. As we said before, our demonstration process was performed in an enterprise environment and that also gives us the possibility to evaluate the results that we achieved, by making a comparison with the project being developed by GFI. To evaluate our proposal, we compare the timings of our methodology outcomes with the ones obtained by GFI when developing the same project, but using a different approach.

GFI's methodology is very similar to traditional EAP, and that seems to constitute the perfect condition to analyze and test the differences between the original methodology, and the extension that we try to develop with this work.

Next we describe, in a non-exhaustive way, the methodology used by GFI, that as we said before is very similar to EAP, but with some particular characteristics, influenced by the type of projects that they already had, and the know-how acquired throughout the years.

Phase 0 → Identification and definition of commitments.

- Project Launching;

Phase 1 → Understand the context and the technological environment.

- Current IS context;
- Business model definition;
- Current IS and IT structure;
- Assess the systems adequacy to the business needs;

Phase 2 → Development of the IT Strategy and governance model.

- Benchmarking and analysis of new technologic trends;
- Proposal of new IS architecture;
- Proposal of new IT architecture;
- Risk and impact calculation;

Phase 3 → Planning change and identification of critical success factors.

- Develop a detailed transformation plan;

As we can notice from the description of this approach are the steps involved on the four different phases, with a very similar organization as the ones found on EAP. Those similarities are not pure coincidence, and as GFI stated, they are the result of a gradual adaptation of EAP methodology to the

reality of the company through the years and different projects, but with very solid base composed by the characteristics of Spewak's methodology.

GFI's approach follows, naturally, a waterfall development process, without explicit iterations. One unique iteration performed, where the current business model and the complete set of systems supporting it (AS-IS state), are followed by the final definition of the IS (data and applications) and technology architectures (TO-BE state).

Milestones comparison (with deliverables)	GFI	XEAP
	Resources: 2 persons	**Resources: 1 person**
Week 0	• Project plan	First Iteration (based on reference model): • Project plan; • Business macro-processes model; • Data architecture; • Applications architecture;
Week 1 → 3	(Business interviews and development)	
Week 4	(Business interviews and development)	Second Iteration: • Business processes model; • Current Systems & Technology; • Data architecture; • Applications architecture; • Technology architecture;
Week 5	• Current IS context; • Business model; • Current IS and IT structure;	(Business interviews and development)
Week 6 → 9	(Development)	
Week 10	• IS architecture; • IT architecture;	Third iteration: • Business sub-processes model; • Current Systems & Technology (update); • Data architecture; • Applications architecture; • Technology architecture;
Week 11	(Development)	
Week 12	• Transformation plan	• Implementation/Migration plan

Table 24 – Milestones (deliverables) comparison between GFI methodology and XEAP.

5.1 Results Discussion

After resuming and presenting the results comparison through table 24, we can start the discussion about the effectiveness, or not, of our methodology. To do so, we present next, some points that help us understanding the comparison made through table 24:

- On the very first week of project, we were able to deliver a data and applications architectures, providing, in the earliest stage of the process, a high-level view of the final stage result. The very limited knowledge about the organization was surpassed by the usage of reference models capable of representing in a superficial, but elucidative way, the client's business model and organization structure.
- The need for fewer interviews on the process of building our second iteration, allowed us to have a second architecture, with an intermediary level of processes detail, ready to present to the client before the traditional approach had finish its complete set of interviews.
- We were able to maintain a separation between Operation and Management and Support processes, during all the development of our work. This intended to show that there is a level of independence between processes, that, when explored, can be used to introduce the solution partitioning agile characteristic into this type of project.

5.2 Results Analysis

We will now analyse the obtained results, by trying to understand their impact on the questions that we identified in the very beginning of this document, has the base for our entire research problem:

Q1 → Is it possible to successfully develop an EA using agile characteristics as a way to overcome the uncertainty of requirements and the demand for fast results?

R: Through table 23 it is possible to see that we could deliver results in a very early stage of the process, when compared with a standard methodology, while having less human resources available.

During our demonstration process, we came across several requirements changes, especially when passing from the interviews with the board and higher managers, to the interviews with the responsible for each specific department. Those changes were accepted and addressed naturally like any other new requirement, once we were building all the architectures in all the iterations. XEAP ends up treating any requirement change in the same way as a new requirement, and that represents a big reduce on effort when performing changes.

Q2 → Is a standard and traditional enterprise architecture methodology capable of "accepting" the introduction of agile characteristics?

R: Although EAP has a very well defined process with several clear steps, it seems to be flexible enough to accept the introduction of such big changes as the ones we proposed. Due to the independence that exists between EAP phases and the freedom that the architects have to perform each step, end up preserving the results that are expected from the use of a methodology like EAP.

Q3 → Are the "intermediate" outcomes that result from each XEAP iteration, valuable to the client?

R: Although being conscious that the intermediate results presented (first and second iterations) were not final results, there was a very positive feedback from the client concerning their utility and value to the project. The main and most clear advantage of those intermediate deliveries lies in the possibility that the client has, to start planning and performing changes on the organization, without having to wait for the end of the project. An architectural problem that is identified on the second iteration does not need to wait for the end of the project to be addressed by the client. The results that we deliver on an intermediate iteration give the client the basis for a correction of that problem, independently of the rest of the result that are still to come.

Q4 → Is it possible to have such independence between processes that an enterprise architecture solution can be delivered in several "pieces"?

R: During our demonstration process, we referred several times, the deliberate separation between operational and support business processes. The independence that we were able to maintain, in terms of data entities manipulated and applications supporting the processes, clearly allows the achievement of our goal of a partitioned solution. On our demonstration in particular, we present all the architectures in one piece, but the separation is there, and this two independent parts of the business could have been presented in two completely separated documents.

Our evaluation process is not complete until we make an analysis of the goals that we proposed for our work. Next we identify the success or failure of each goal, and give a particular explanation for either case:

G1 → Reduce time to value of enterprise architecture development process.

Successfully achieved on the demonstration process. With a first delivery being performed at the time of the first interview with the client, we manage to deliver value on the earliest stage of the project. Furthermore, we presented intermediary results that bring an even bigger value to the client, on a phase, where a standard approach is still describing the "AS-IS" state of the target organization.

G2 → Introduction of iterations on the EA development process with strong feedback and information flow between them.

Partially achieved on our demonstration process. We did manage to introduce iterations into the EA development process, but the feedback between them ended being limited, compared to what we had in mind on the beginning of the project. Due to the tight schedules of some of the stakeholders, the bigger stake in terms of feedback between iterations, came from our own perception of the project, and some of the GFI collaborators, that were constantly available to

provide their vision and knowledge, which revealed to be a considerably helpful, when taking into account their experience and deeper knowledge on this specific client.

G3 → Keep the client feedback constant throughout the all EA development process.

Not achieved on our demonstration process. As stated before, the client feedback was limited and not constant. We manage to have some feedback after each delivery, but we were not able to maintain that feedback during the develop process and between deliveries.

G4 → Reduce the response time for changing requirements.

Successfully achieved on our demonstration process. During our demonstration process, we came across several requirements changes, due to misinterpretations of ours, to misunderstandings or simple "arrival" of new information. The response time for those changes became, in the worst case scenario, as long as the longest iteration.

G5 → Eliminate the aversion to changing requirements.

Successfully achieved on our demonstration process. Those changing requirements were handled as naturally as any other new requirement. With a new set of architectures being developed at each iteration, we guarantee that a change on an old requirement will not bring more difficulties than a newly identified one.

G6 → Introduce incremental delivery of the EA solutions.

Partially achieved on our demonstration process. Our incremental delivery was supported by two different aspects. The different set of architectures with different level of detail, presented at the end of each iteration, and the partitioning of the business processes allowing delivering the same architectures in different dates, when considering different processes.

G7 → Partition the EA solutions without compromising the quality of the final project.

Partially achieved on our demonstration process. Although we did manage to maintain such independence, between business areas, that we could have delivered our final solution in separate "pieces", we delivered all the final results together, in order to maintain the consistency with GFI's outcomes.

Chapter 6

Conclusion

In this work we used the Design Science Research methodology in order to identify and describe our problem, and design and develop the solution capable of solving it.

Our work addresses the difficulties faced by the today's companies when performing projects of enterprise architecture. The client's high exigency for fast results and the constant change of requirements were identified as main demands that needed to be fulfilled and were was a flaw on the existing enterprise architecture development methods.

The demands that motivated the emergence of agile approaches in software development industries and their similarities with the ones described above, guided our solution into an extrapolation of the main and more adequate characteristics of those approaches into a well-known EA development methodology. XEAP came naturally, as the result of our literature review combined with the research problem identified. The clear objective of achieving a shorter time to value while developing enterprise architectures, is by itself, the main reason that lead to the introduction of iteration and solution partitioning into EAP methodology. That ended up guiding our proposal into the final artifact that we present on this document.

With the clear inattention of demonstrating our approach on an enterprise environment, we received the preponderant help of GFI Portugal, which gave us access to all the tools, materials and information about one of their projects. This allowed us to apply XEAP to a real case study, providing us the results that we can consider as being very accurate.

As a conclusion note, we would like to state that our solution will never be ideal for all type of businesses or enterprises. Although that, XEAP provides a new approach to the problem of defining an enterprise architecture which we believe, is definitely interesting for innumerous projects that keep failing using traditional approaches, due to the problems identified on this document.

6.1 Contributions

Here we review what we settled at the beginning of the work, as being the main contributions of our work. Once again, we divide these contributions into academic and enterprise spectrums.

First we present the academic contributions, once this work raises a thesis for a Master degree in Information Systems and Computer Science Engineering:

- **C1** → Understand how and which agile software development practices can be extrapolated to enterprise architecture development;

C2 → Understand how Enterprise Architecture Planning methodology can be extended and accept the introduction of "agile" characteristics;

This work, and particularly, the demonstration process, was executed under an enterprise environment, by applying our proposal into a real case study provided by GFI Portugal. The enterprise contributions achieved by our thesis were:

C3 → Understand how the introduction of "agile" characteristics in EAP can help with the delivery of faster results and quicker response to environment changes when compared with the standard approaches;

C4 → Understand if characteristics like process iterations, small releases and continuous client are the responsible for achieving faster results and bigger response capacity to changing requirements;

6.2 Communication

To communicate our work, we used the submission of scientific papers in international conferences, as this seemed to be the best way to reach the target community with interest on our work.

We submitted two papers that address the same issues treated on this thesis:

- Ramos H. & Vasconcelos A.: eXtreme Enterprise Architecture Planning In: *16th International Conference on Enterprise Information Systems - ICEIS (2014).*
- Ramos H. & Vasconcelos A.: eXtreme Enterprise Architecture Planning In: *29th Symposium On Applied Computing - SAC (2014)*.

6.3 Limitations

During the development of our work, we experienced some limitations that inevitably had some influence on the demonstration process, and consequently, on the final results obtained.

In first place, it should be said that we had the luck to have GFI Portugal as our partner. GFI, through its collaborators, helped us in every way possible, by providing all the necessary resources and being constantly available. The time that we spent collaborating with GFI, coincided with a transition period, where the ongoing projects were reaching a final stage, but without a final documentation, and the scheduled new projects were yet being discussed, with contracts being signed and with an unknown official starting date. Having this into account, we and GFI decided that the right thing to do would be to start applying our proposal to a finished project, to which GFI had already applied their methodology, and reached final results.

When we choose Camara Municipal de Cascais to be our "client", we already knew that the level of interaction would be lower than previously expected. This fact, immediately emerged as our first and bigger limitation, once the client feedback was a key element on our proposal, having into account that

the introduction of iterations implies the intervention of the client between deliveries, has a way to keep track of its requirements.

As a second limitation we can highlight the lack of experience on the development of enterprise architectures. The growing experience in projects of this type allows us to start having some predefined ideas and solutions for enterprises operating in specific fields, and even start developing our own particular reference models, after several projects in the same field. With this being said, it is easy to understand that XEAP still have some good margin to improve its performance, especially when being used in parallel with previous knowledge on a specific operational area.

6.4 Future Work

Has we said before, XEAP still has margin to improve its performance. The use of reference models is something that although being based on the idea of creating a generic solution that can fit several different problems, still has a huge adaptability that can be explored in order to construct less generic models that focus on fitting a specific business area. Combining the existing reference models, such as PCF, with some more projects of municipal councils (such as CMC), it would be interesting as a future work, to try to develop a reference model that could be specific enough to address this area, and at the same time, general enough to fit the majority of the Portuguese municipal councils.

Taking advantage of other characteristic of our approach, it would be extremely interesting to see the solution partitioning characteristic being further explored in the future, by developing an enterprise architecture project, using XEAP with two or more completely different time schedules. This means, if possible, dividing the project in several independent “pieces” (as for example Operational and Support processes) and develop them in two completely separate schedules.

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Appendixes

A – BPMN diagrams describing the proposed solution phases

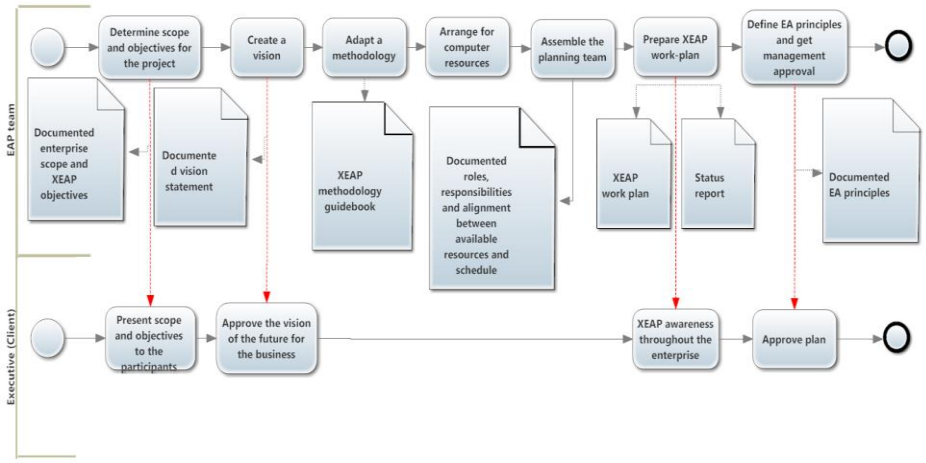

Figure 17 - Values & Principles phase (1st iteration)

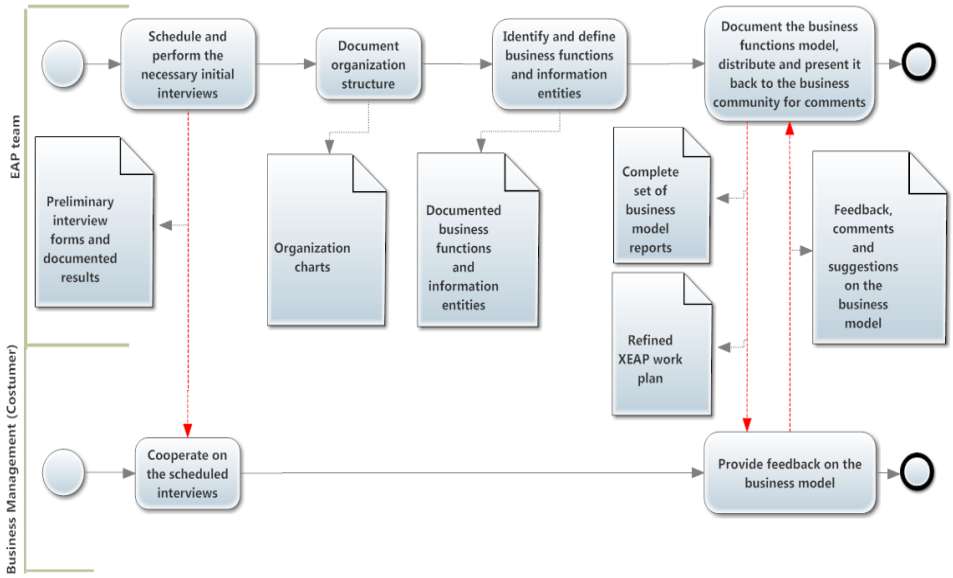

Figure 18 - Business Functions Modelling (1st iteration)

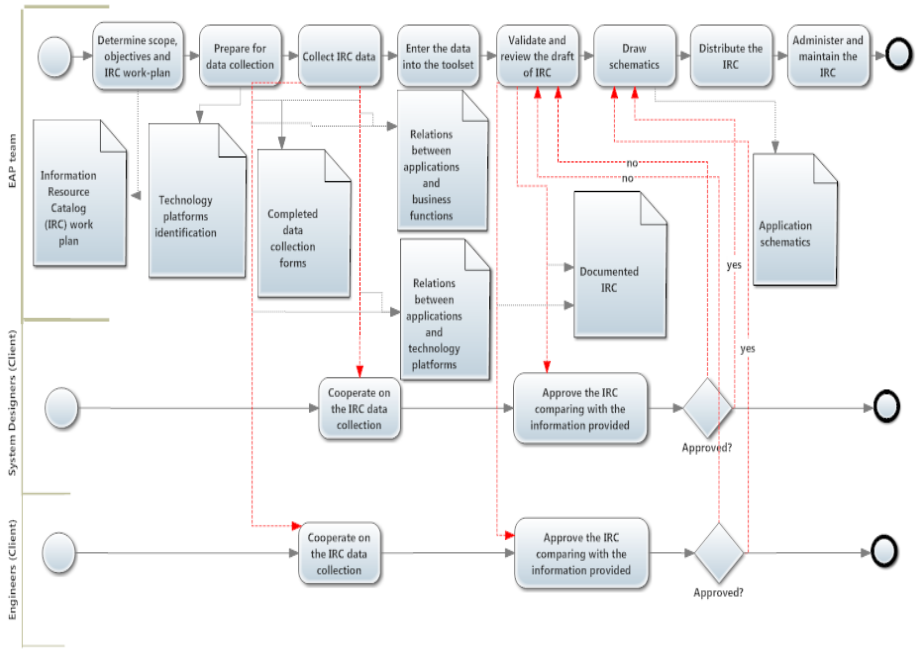

Figure 19 - Current Systems & Technology (1st iteration)

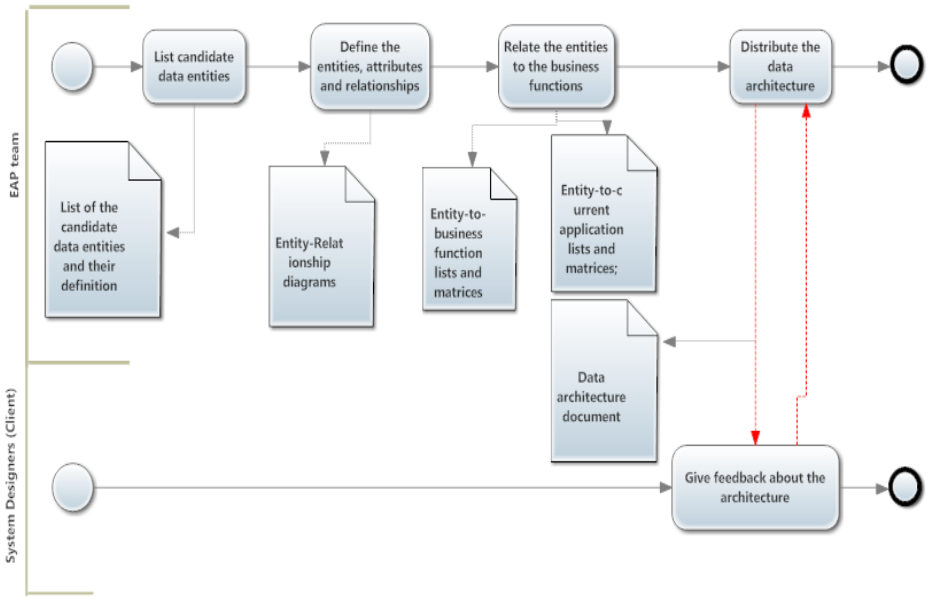

Figure 20 - Data Architecture (1st iteration)

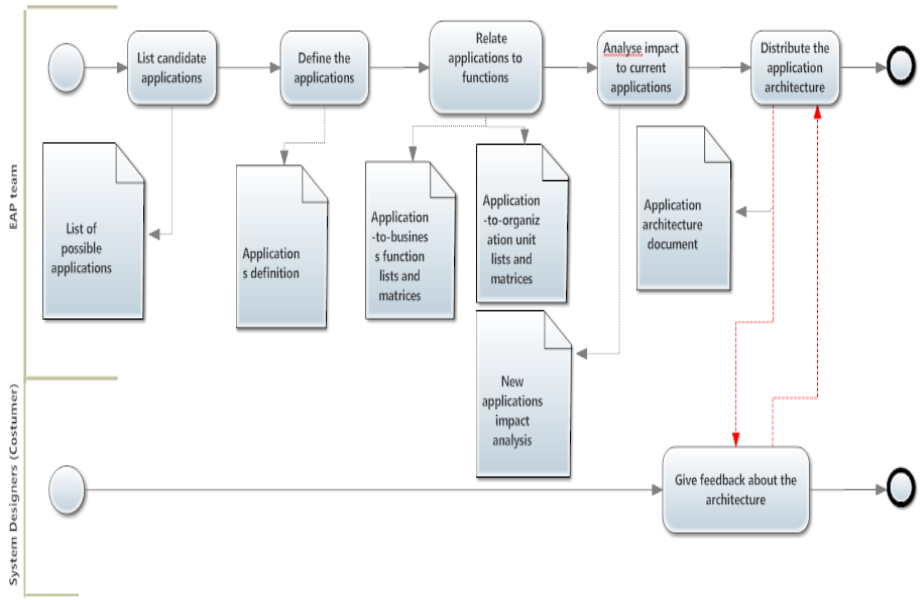

Figure 21 - Applications Architecture (1st iteration)

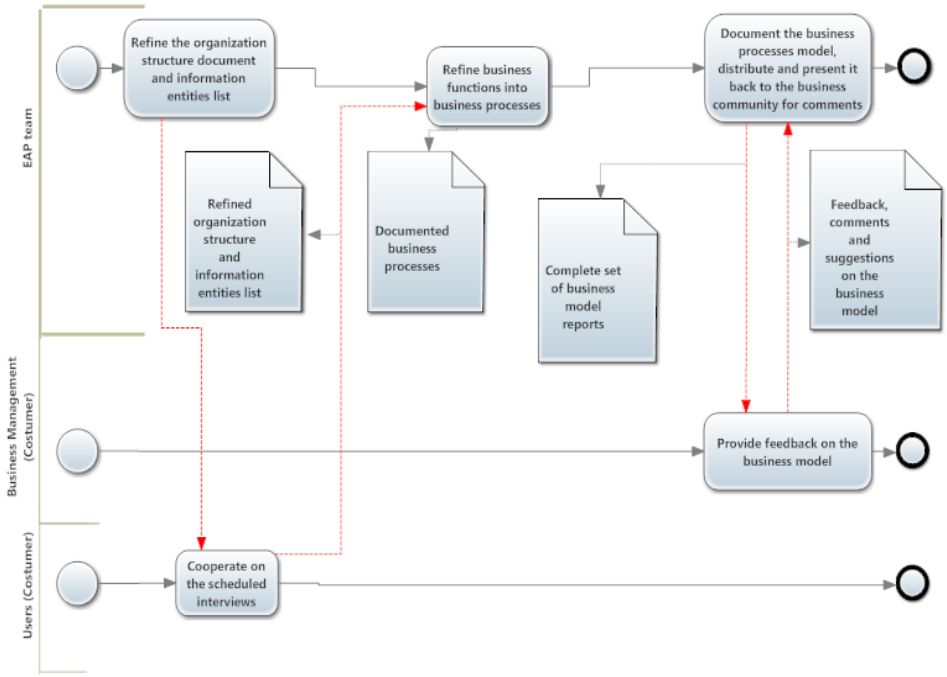

Figure 22 - Business Processes Modelling (2nd iteration)

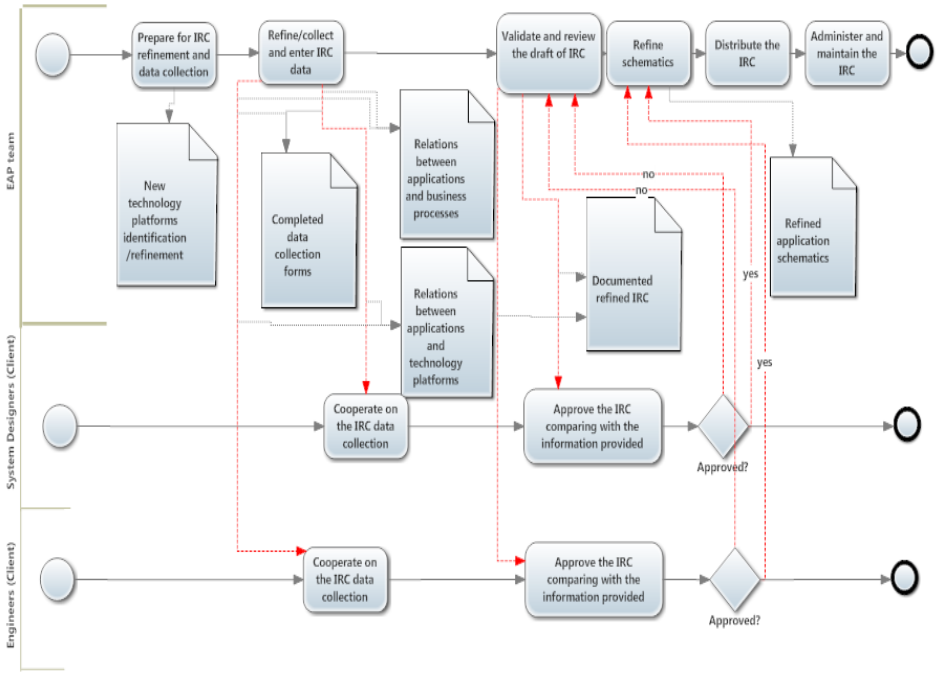

Figure 23 - Current Systems & Technology (2nd iteration)

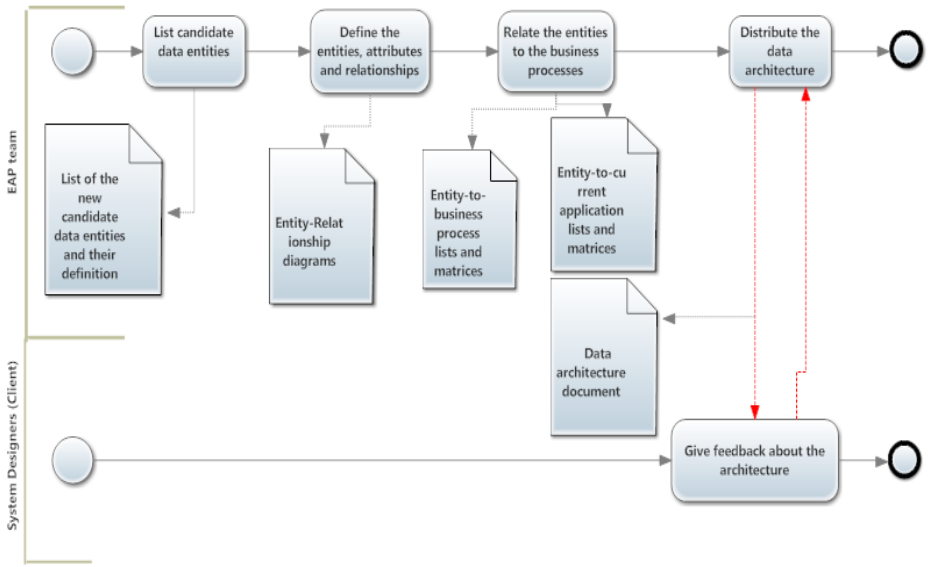

Figure 24 - Data Architecture (2nd iteration)

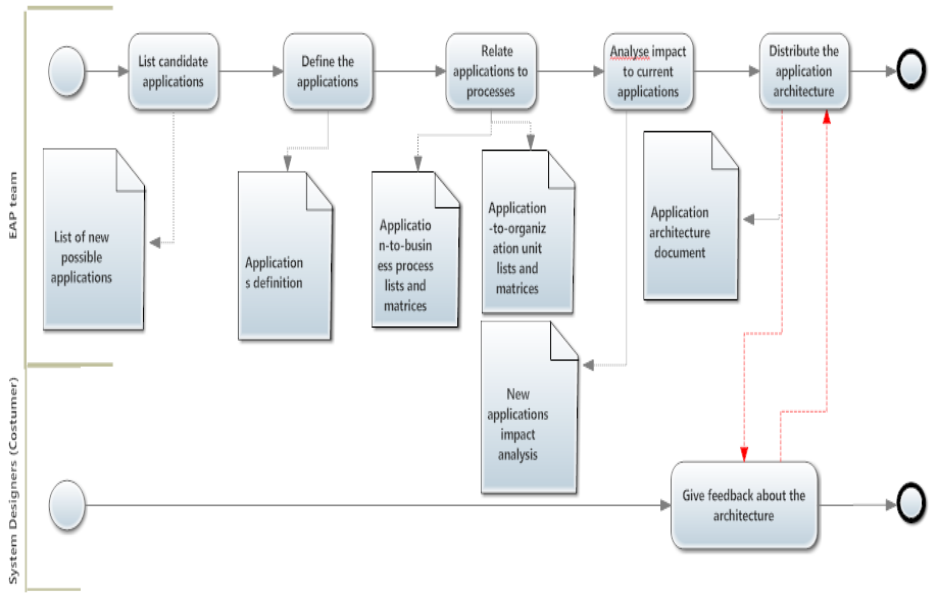

Figure 25 - Applications Architecture (2nd iteration)

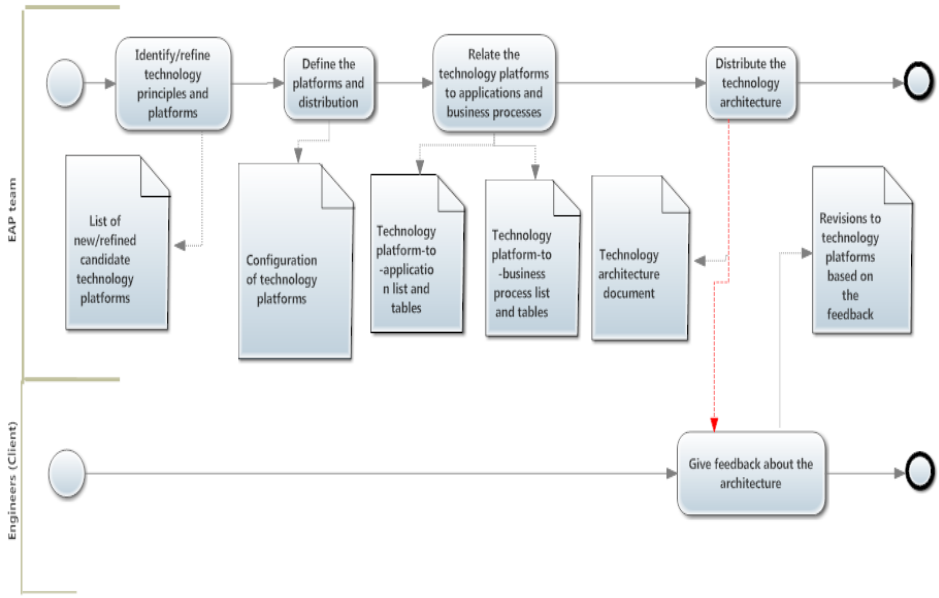

Figure 26 - Technology Architecture (2nd iteration)

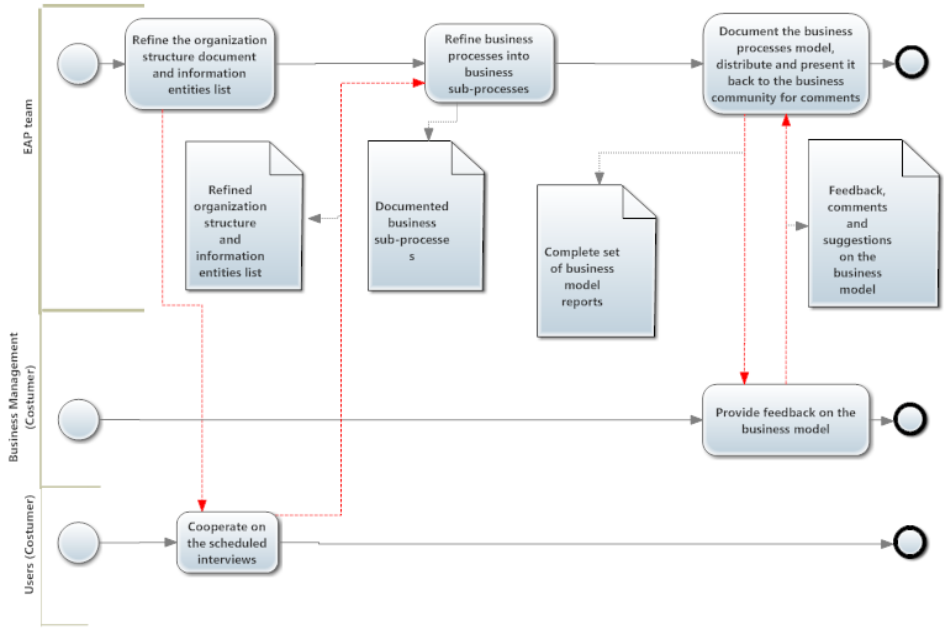

Figure 27 - Business Sub-Processes Modelling (3rd iteration)

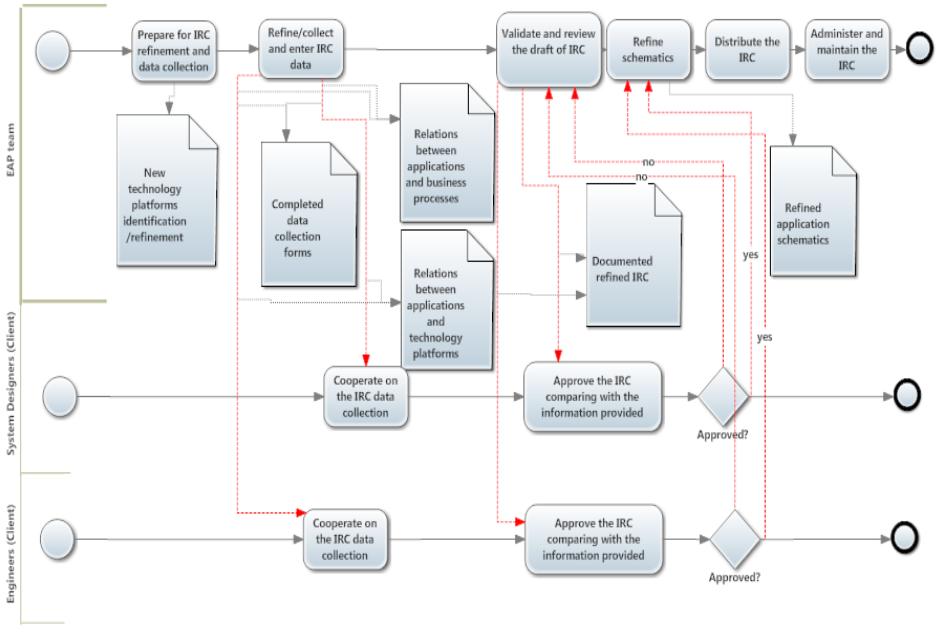

Figure 28 - Current Systems & Technology (3rd iteration)

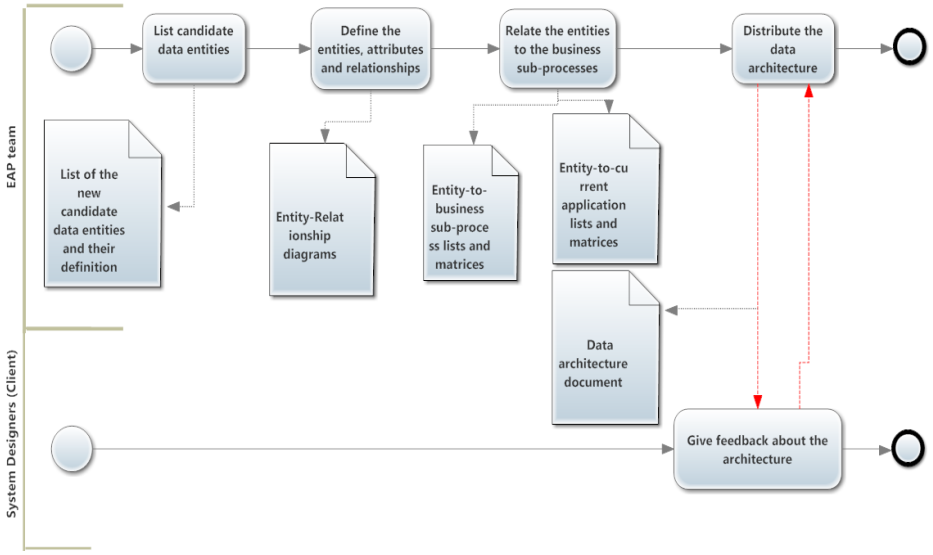

Figure 29 - Data Architecture (3rd iteration)

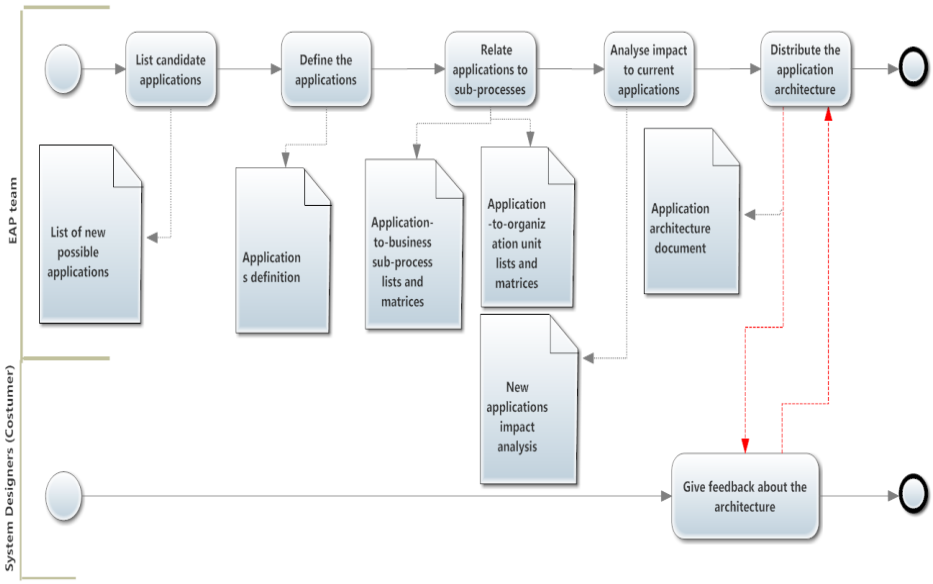

Figure 30 - Applications Architecture (3rd iteration)

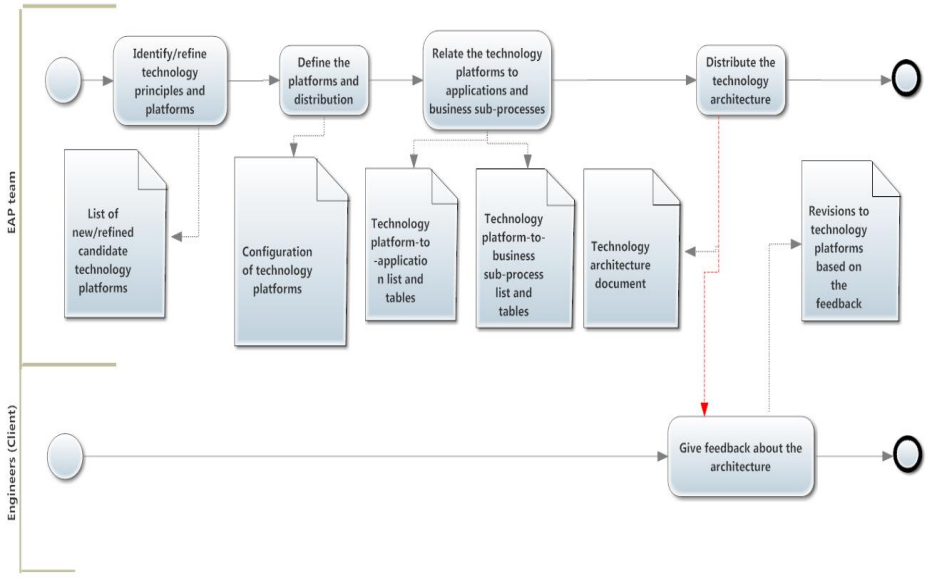

Figure 31 - Technology Architecture (3rd iteration)

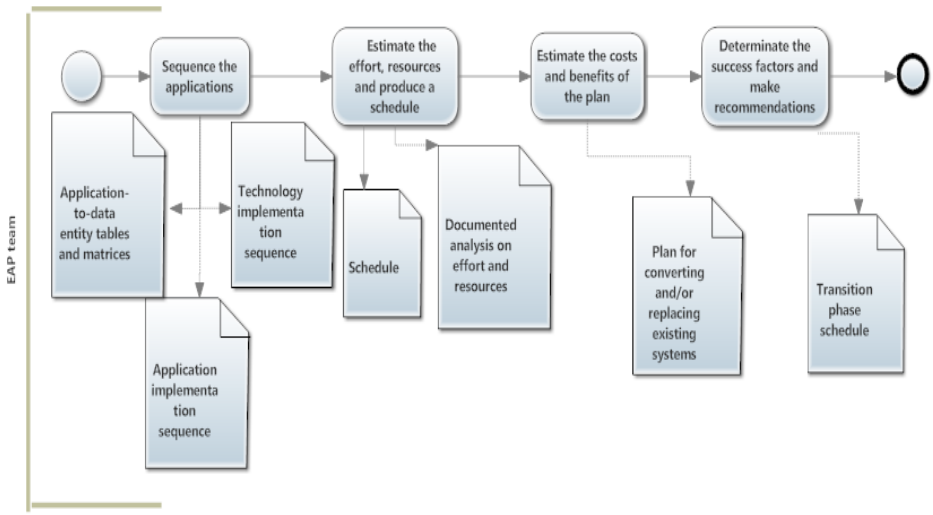

Figure 32 - Implementation/Migration Plan (3rd iteration)