Implementation of an Enterprise Architecture in SPMS and the eSIS Ecosystem using Enterprise Architecture Management Tools and Cartography Methods

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Abstract—Enterprise Architecture is a discipline that focuses on the structure and organisation of information and the layers, such as strategy, business and IT infrastructure, within an enterprise, helping it maintain a coherent vision throughout all its levels. However, many organisations still struggle with succeeding with the implementation process of this discipline. In this project, we will focus on the specific case of the implementation of an EA project at a national healthcare IT system and management provider and the organisations that use its systems, all with no previous experience on the field of EA. Following an Enterprise Cartography approach, supported by an enterprise architecture management system (Atlas), this project includes an analysis to pinpoint the main struggles of the subject organisation, such as the non-existence of an architectural meta-model, difficulty in managing different information sources and entities and the effort of gathering said information, the short-lived value of views produced at a certain point in time, the negative perception regarding the use of Enterprise Architecture and political pressures regarding change projects. The later part of this project focused on designing solutions that would tackle these problems with a focus on the breadth of the solutions. Using an EC project framework and the help of an application development team, a set of solutions, such as easier and more agile ways to register information, batches for mass centralisation of different sources of information and a feedback based Meta-model, allowed for the creation of a solid baseline for existing and future EA efforts.

Keywords—Enterprise Architecture, Enterprise Cartography, Project, Knowledge-Base, ATLAS, Meta-model

1 INTRODUCTION

The subject of this thesis is the implementation of an Enterprise Architecture (EA) project in a low-maturity organization [1] (an organization without defined architectural processes and/or these are poorly defined [2], [3]), along with entities that make up the information ecosystem "eSIS" (Ecossistema da Informação da Saúde) [4], that includes all public health entities that use the systems managed and produced by SPMS.

Serviços Partilhados do Ministério da Saúde (SPMS) is an organization whose business model is to develop, build and manage information systems and the information used by these to serve the Portuguese national healthcare service, which leads it to have a high production rate due to the constant demand by healthcare professionals and users. The project at hand is not only focused on the SPMS organization itself, but the whole network of healthcare entities to which SPMS provides systems to. This network is named "eSIS", which is an information ecosystem composed by all the public health institutions that adhered to this initiative (66+) and use systems produced by SPMS.

These systems are responsible for the management and production of large quantities of information, requiring coordination between a nationwide grid of systems that share large amounts of information every day. Given the number of systems and quantity of data pro-
duced, altered and disposed of (as well as the maintenance that some information requires), keeping track of all these variables becomes a difficult task. This results in a situation that the organizations from eSIS themselves are aware: the need to have a mechanism/platform that allows for an easier control and management of said information, and the cataloguing of that same information.

SPMS accepted to participate in an EA project in order to implement an Architecture within the organization and the eSIS ecosystem, with the objective of consolidating all the information present in these entities, along with SPMS’s, into a single shared platform, with the author being responsible for accompanying, providing input, managing (to a degree) and advising in this same project, all with the supervision of the mentoring Professor. The main issue is that since none of the organizations have any previous experience with EA or EA projects, many of the concepts and procedures behind such effort are not familiar to the them, which leads to appearance of many problems and difficulties. These issues are the focus of this thesis, as these will be studied and possible solutions for them will be proposed.

2 Identified Restraints in SPMS & eSIS

In an initial phase, an analysis to pinpoint and identify the problems that both SPMS and the eSIS entities suffered from due to the lack of an established Enterprise Architecture (EA) was conducted.

2.1 SPMS and eSIS members show lack of motivation to perform EA the effort

This problem could also be phrased as the difficulty to see value in Enterprise Architecture. Despite the promises of helping the organization align all it’s components, map their reality and help plan future decisions, the individuals that are part of this organization and ecosystem seem reluctant of the benefits that EA can bring to the table. Individuals within the organizations showed great reluctance when presented with the prospect of introducing an EA within their organization. One possible explanation for this issue is that EA is a very C-level (Chief) and M-level (Management) oriented discipline, meaning that those who are the end receivers of the information are typically people with decision-making responsibilities, while at the same time, the information retrieval is performed by the operational workers, who feel that the effort of registering and collecting information does not directly benefit them (at an operational level). This can cause frustration that possibly leads to the lack of motivation to perform EA or other activity that helps improve the it’s state.

2.2 Information collecting for EA reveals to be a cumbersome task

In order to successfully implement an Enterprise Architecture, one should first have a "Knowledge base" [5] or centralized information source, that may or may not feed from other sources. This base represents the whole information that makes up the EA, the source from where EA collects all the information it needs to describe the organization, it’s future plans, dependencies between concepts and instances, among other things. The problem is that this organization does not have a fully standardized way of storing information, or in some cases, the information itself does not exist. The effort of collecting information was needed, but that same process also proved to be very inefficient, with large quantities of Excel sheets having to be manually completed, previous sheets had to be evaluated to check their current validity (to check if the information present still relevant/accurate), different sources had to be checked, ranging from Microsoft Word documents, PDF files, printed models that had once been created, etc.

2.3 SPMS struggles to find a way to use EA to solve operational problems

The organization struggles to understand and/or find a way to use EA resources, such as maps and metadata analysis to directly help perform efforts of an operational level. Finding this “missing link” could translate not only in a more efficient use of the existing resources, but
also provide more support to those operational
tasks.
Operational workers did not see this project as something that would directly benefit them, since the information produced by EA is more oriented to upper hierarchy levels of an organization, and given that EA is a governance oriented discipline [6], its main focus is of course, not (directly) the operational part of and organization. This situation creates a sort of “conflict” of interests between the upper hierarchical levels and the lower levels.

2.4 Views generated by EA become obsolete very fast
In this day and age, organizations change at a very fast rate [7], and SPMS, due to the nature of its business, is no exception, meaning that the creation of a static map based on the information collected about an organization may become obsolete in a short-term period. In the specific case of SPMS, as of June 2018, around 16 structure altering projects were either approved or ongoing, meaning that a static representation of the organization’s structure produced at that time will very probably lose its accuracy in a time-span of 5.6 months. This situation also gives rise to another problem: Even if we manage to bridge the representation of the present with the future, how can we take into account the volatility of change.

2.5 No uniform language to define concepts of the organization’s reality
One of the main issues the organization faces is the lack of a unique way of communicating information, since there exists no singular way of defining a certain concept such as "system", "application" or "service". The same concepts appear to have different meaning for different people. This lack of structure causes communication problems since, for example, two members from different teams, when discussing some concept, such as internal structure of a system, may not have the same mental model of each part of the system and what it means in the bigger picture. Consensus on this topic was also a very debated theme, since each team preferred their own vision over another.

2.6 Lack of awareness of what the main point regarding the management of an EA effort should be
Since SPMS has no previous experience with EA projects, knowing where to correctly focus efforts and resources can be a challenging task. Should information collecting be the main focus? Is the meta-model being built a definitive one or should it offer some flexibility? Pinning down certain areas where most of the members of the organization have more difficulties can also be a demanding task in the initial phases.

Given the failure rate (about two thirds [8]) among EA projects, the commitment to an effort of this nature requires a set of preoccupations that organizations must have, main worries and points those responsible should be specially aware of. However, those are not formally defined within the context of EA projects, with many being theorized but never effectively confirmed [9]. Given the specific context of this project, what should be the main preoccupations and concerns an organization, and more specifically the project manager should have? What methods can be used to make sure that these problems are formally documented, so that can can be more easily mitigated in the future, assuring the organization is prepared to tackle them.

2.7 Difficulty coordinating multiple repositories
Perhaps the the most challenging problem this project is facing, is the coordination of the information coming from various sources and to be imported from and into multiple repositories. The goal of the project is to consolidate the whole information of the 66+ repositories, including SPMS’s individual one, into a single repository, adequately named eSIS, following a federalized approach. Given that face-to-face meetings with every single health entity to present the whole project, as well as the theory behind it, specific cases and other concerns with the information is impossible, the information produced and imported by some of the entities will inevitably be bound to error. Some of the entities have already been in contact directly with the project team,
while others are planned, most of them will only be given official documentation, due to time and budget constraints. This of course, proves inefficient, but for now necessary. The issue is then finding mechanisms, features and methods that can allow for the diminishing of problematic situations, and of course, being able to successfully merge the information in each individual repository into a single one, as well as monitoring the information imported to each repository to be certain that it follows the established rules and principles.

3 RELATED WORK
Due to the nature of the project, a set of sources considered relevant were taken into account for the proposed solution.

3.1 Enterprise Architecture
According to Federation of EA Professional Organizations [10] Enterprise Architecture can be defined as “a well-defined practice for conducting enterprise analysis, design, planning, and implementation, using a holistic approach at all times, for the successful development and execution of strategy. Enterprise Architecture applies architecture principles and practices to guide organizations through the business, information, process, and technology changes necessary to execute their strategies”. EA is therefore helpful in safekeeping the essentials of the business, while still allowing for maximal flexibility and adaptability. Without good architecture, it is difficult to achieve business success.” [11]. EA provides then, not only organizational benefits, but also helps boost and organization’s economical value [12].

Another great value addition provided by EA is the alignment it provides to an organization, since a well defined holistic architecture helps align business and its operations with information technologies, structure and their evolution, making the practice of EA the bridge between the organization’s current and future states. This alignment is also valuable in understanding how an enterprise can shape it’s internal and external forces, by exposing flaws and strengths within a complex organizational organism. EA also allows for an holistic perspective and the clear definition of concepts within a certain context [13], [14]

3.2 State of the Art
In [14], the author provides a deep insight on the current trends (as of 2013) in EA and explores how the discipline is positioned within the context of corporate and IT governance. Frameworks such as Zachman’s offer a way to structure an enterprise through the use of a “schema” that the author states allows to map” the intersection between the roles in the design process: that is, owner, designer, and builder”, which provide insights to the project team on the benefits and scope with which EA should be taken into account.

The IEEE 1471-2000 [15] is a formulated standard that describes what rules an Architecture for “software-intensive systems” should follow, offering ”a solid theoretical base for the definition, analysis, and description of system architectures”. The main offering of this standard is the conceptual model of architecture description. This model offers a list of concepts integral to the description of an architecture, and how these concepts influence each other. This helps understand how to manage and have a perspective of the influence each of the concepts can have on each other, which should be taken into account when making decision at a micro level, that will eventually affect the macro.

Regarding the development of an EA and the steps that should be taken TOGAF’s ADM [16] is an iterative and generic (meaning it can be used on any enterprise, requiring only an adaptation of the concepts to the enterprise’s reality) method for the development of an enterprise architecture. This method can be used in conjunction with other methods or frameworks, namely the Zachman Framework. This iterative approach allows for constant improvement of the architecture, since it allows the implementation of changes resulting from the feedback of previously implemented decisions. This situation creates then a looping-cycle of self-improvement that helps an architecture grow, and allowed the team to systematize improvement.
Since most of the software built within SPMS and eSIS followed a “Service-Oriented Architecture”, it was important to understand this concept at a fundamental level, as the organization of software would have a direct impact in how it served the business. Service-Oriented Architecture (SOA) [14] is a paradigm that follows a “set of design principles that enable units of functionality to be provided and consumed as services. These services provide the ‘units of business’ that represent value propositions within a value chain or within business processes. The use of SOA directly benefits the practice of EA by enabling an higher degree of interoperability, flexibility, cost effectiveness (calculating cost per service unit).

3.3 Enterprise Architecture Tools

The use of software tools to support EA is fundamental, since they allow for an easy and fast creation of architectural views. These tools, due to the demand of more complex features and deeper analytic capabilities, have evolved, but a low market offer exists, when compared to other types of software. Tools like Enterprise Architect [17] by Sparx Systems, IBM’s System Architect [18] and Plainview’s EA solutions [19] were studied in order to understand the state-of-the-art in terms of EA tools.

These tools where studied to understand what features, limitations and common concepts they had, in order to focus the best of each one in the creation of features that enabled a better solution. It was noticed that EA tools have a very high degree of dependency on the information that is imported/inputted in them, making the human factor a major influence. Tools that allowed for greater user flexibility, metamodel extension and analysis capacities were also the most praised, with special attention given to the analysis features.

Authors such as [20] focus on analysis capacities a EA tool can provide, highlighting capacities such as measurement of concepts like security, availability, reliability and cost. The major disadvantage noted regarding tools was the lack of a standardized interoperability model [11], which would allow standard transfer of information from one format to another.

3.4 Enterprise Cartography

Formalized in [5], Enterprise Cartography (EC) provides a new approach to traditional practice of EA. In this publication, the author exposes this new concept from the theory behind it to the actual implementation in real-life projects. EC is a discipline that does not regard itself with the purposeful design normally associated with EA, focusing instead solely on the representation of an enterprise’s reality. According to the authors “with the introduction of the concept of EC, we can decouple the problem of design from the problem of building a consolidated set of representations of the enterprise”. EC is based on a set of principles:

1) The enterprise’s metamodel. This includes all the artifact types and allowed relations.
2) Architectural statement, a proposition stated using only the relations and artifacts described in the metamodel.
3) Architectural Map, a visual representation of architectural statements.
4) Alive Artifact refers to an artifact that as an active part in the organization, participates in architectural statements.
5) Transformation Initiative is set of planned activities that causes change in associated artifacts.
6) Enterprise observation is a construction of architectural statements through the observation of the enterprise’s reality.
7) AS-WAS is the state that relates to enterprise realities at a given point in the past.
8) Knowledge Base (KB) repository that holds metamodel, architectural statements and the conceptual maps.
9) AS-IS state that describes enterprise reality in the present.
10) emerging AS-IS is the state of the enterprise after the completion of ongoing transformation initiatives.
11) TO-BE state of the enterprise at a certain point in the future.
12) Enterprise Architect, person responsible for the design of the enterprise; makes architectural statements about the future.
13) Enterprise Cartographer, person responsible for the collection of architectural
statements from observations of the enterprise’s reality.

The authors also provide an insight on how EC project should be structured, which given that both SPMS and the eSIS already have existing structure, meaning the project is not designing an EA from the ground up, understanding what already is seem the most appropriate way:

1) **Identify project goals**, define the scope of the project and understand what is trying to be modeled.

2) **Define the meta-model**, understand the most important artifacts and the relations between them

3) **Identify the best sources of information**. After defining the metamodel, find where information is keep (ex: structured repositories).

4) **Structure the processes and tools to capture information**. Setting up the methods to import information from the sources to the KB

5) **Define and Configure Architectural Maps**. Definition of the maps that allows views relevant to the client.

6) **Populate the KB with initial baseline**. Loading the information from sources using developed methods, in order to populate KB.

### 3.5 Enterprise Architecture Projects

Since the project at hand was a EA project, learning from previous experiences was valuable exercise. [8] provides an insight on the causes for the very high failure rate of 66% (2010) found in EA projects, naming lack of EA awareness, not enough C-level endorsement, financial and political issues, the time it takes to set up an architecture and the misalignment between intention and implementation.

Regarding the “critical success factors” for an EA project, [9] provides an insight on how EA project are not similar to traditional engineering projects. The author points out that EA in nature, does not follow the typical engineering field, in the sense that there are no rigorous guidelines on how the activities should be performed, and that different projects with the same input do not produce the same results (due to context), while also providing a critical position towards the theory-heavy approach many of the literature as to EA, stating that “how architecture is practiced, how it’s routines are performed, is the Critical Success Factor for architecture”, pointing toward a more hands-on and circumstantial approach to EA. [21] presents a proposal for the effective management of Enterprise Architecture projects, while also providing a valuable list of factors that distinguish EA projects from other types of projects:

1) **Project**: usually associated with organizational processes and systems.

2) **Structure**: Usually several projects depend on these with a high degree.

3) **Scope**: Less Defined and constantly under change

4) **Change Control**: Changes can be defined but are difficult to track.

5) **Stakeholders**: Large number and difficult to identify.

6) **Resources**: Efforts are “part-time” (not the main preoccupation).

7) **Risk**: High Impact, but difficult to identify.

8) **Budget**: Poor

9) **Evaluation Indicators**: Subtle, more qualitative and difficult to measure.

10) **Speed Changes**: High

### 4 IMPLEMENTATION

Given the analysis of the existing problems and of the relevant literature, a set of solutions was implemented. These proposed solutions had the goal to tackle a specific problem and/or mitigate, directly or indirectly, another one.

#### 4.1 Standardization of Concepts/Language

Following the guidelines from [5], the first step in the implementation process was the definition of a meta-model for the specific context in which the project would take place. Since most of the communication and systems would only exist within a closed environment (eSIS), the scope of this meta-model only includes eSIS. This model however, following the previous
statement that SPMS and eSIS are both subject to continuous change,

To guarantee that the meta-model defined would be flexible (so that it could allow change during the project) and accurately represent the reality of SPMS (mapping meta-model concepts to real world concepts had to be an effortless task), some requirements had to be put in place:
(1) The team would not strictly follow previously existing meta-models, such as the one defined by Archimate. This decision was based on the lack of flexibility presented by these, since most of them were “written in stone”, meaning, their definition was absolute and required the following of a set of rules that might limit our capacity to accurately represent this specific context, and would force those reading the representations to have a deeper knowledge of that specific meta-model. (2) If this meta-model was meant to represent the reality of SPMS and eSIS, it had to be as accurate as possible to the day-to-day concepts that existed within this organization, and above all, it had to be understood by the people that worked in it and would, in future, use it. This means members of the organization had an active role in the creation of the meta-model (Due to time and cost constraints, eSIS members participation in this process was limited). With these principles established, a meta-model composed of 15 unique classes was created, with expected concepts such as "Actor", "Application" and "System Software", and some context specific ones such as "Solution Typology" and "Node Typology"

4.2 Utilization of Forms to Streamline Information Collecting

Atlas’ Forms were the new feature developed to tackle the problem of cumbersome information collecting and to make the lives of the organization’s members easier in that aspect. Instead of manually searching for the instances and creating them, the users only need to click of the Form corresponding to the type of object they wish to create/update. Each field in the Form corresponds to a property of the object being created.

Forms are also customizable, meaning that if new classes were registered, a new form could be created specifically for it and the types of relations it had with other classes.

This feature allowed for a more intuitive and easy information collection process, by abstracting the user of the technical aspects of the meta-model, and presenting information in a much more user-friendly manner (ex: instead of asking the user with what object the newly created one as a relation of the type "aggregates", the forms asks the user were it "belongs").

4.3 Separation of Design and Representation

Following the methods described in [5], this project was approached entirely as an Enterprise Cartography project, meaning that a specific set of principles and rules was followed, focusing on creating a feedback loop between what is represented in the views constructed using retrieved information and the changes the analysis of these views (and other information) cause:

1) Identify Project Goals: The main goal for the EA project at SPMS is to map the existing information systems, Infrastructure and Business Processes (ordered by importance). The organization wishes to have a way that allows it to intuitively visualize the information that makes-up the whole structure within it.

2) Define the meta-model: As described in it’s entirety in section 3.2, a new meta-model was built from the ground up, using a set of already described methods. This model will allow the architectural team to find a “language” to represent the information within the organization and be understood by its members.

3) Identify the best sources of information: In order to represent the reality of an enterprise, we must first retrieve the information necessary for that representation. As previously mentioned, the main sources of information used were the Excel and XML files extracted from existing documentation, as well as the organization members input directly into the architectural tool being used. For the eSIS
entities, the Forms and Excel files were the main source of information.

4) Structure the Processes and Tools to Capture Information: As previously mentioned, two main sources of information were established: the Excel and XML files provided by the different entities (SPMS and eSIS) and members of the SPMS organization, and the forms members filled. A schedule for the retrieval of information was also established, with for example, in a determined week, a specific entity was asked to provide information regarding their infrastructure in a week's time. This was done continuously throughout the project’s duration.

5) Define and Configure Architectural Maps: In order to fulfill the needs of the members of the organization, these were inquired about the views they wished to have of the information collected in the Atlas tool, and using the tool’s capabilities, these maps were created. The following subsection will focus on the maps produced for this project.

4.4 Use Atlas to Support Management
Using the features available in the ATLAS tool, we found ways to present information to support these managerial tasks, using both views and Charts. The Charts feature allows the user to visualize information in the form of coloured charts. The information presented on said charts can be configured, since both and the Architectural maps are created by queries that retrieve information from the repository. Architectural maps are also another way M-level personnel can have access to more holistic and aggregated information that can be used to support management strategy and decision. Both these feature enable a more informed management practice.

4.5 Use Atlas to Support Planning
Since time is how we measure change, and the organization’s projects measure themselves with schedules and deadlines, we introduced the concept of time to architectural maps. In truth, time became a property of objects, in the form of dates. We may not be able to monitor in real-time how the Business Processes, Actors, Information systems or Infrastructure change, but we know that certain dates have a meaning to these, for example, we can know that solution A become productive at a certain date, and that it will be decommissioned at another, according to the schedules defined by the organization. With this information, we can then visually represent these dates and how they changed the state of the objects, as explained in [5]. Additionally, to complement the time feature, in the Atlas repository were also given a set of 4 states (Under implementation, Productive, Decommissioned, Deprecated) that objects have attributed to them depending on the dates they have attributed to them. The effects of time can them be checked while visualizing a map and sliding the time-span option. This allows the user to better understand the impact of the planned changes and the how the architecture is affected by them.

4.6 Use Enterprise Architecture to Solve Operational Issues
In the context of SPMS, two ways to use EA to solve operational problems where formulated: First, a set of maps was created along with a set of properties to certain classes, in order to be able to represent concepts regarding the GDPR regulation. The architecture team saw in this situation an opportunity to use EA and the ATLAS tool to satisfy, while partially, some of the requirements imposed by GDPR. The thought behind this idea was not to completely satisfy GDPR auditing requirements, but find a way to support the organizations in this aspect, since ATLAS representation does not hold legal value when presented to the audit authorities, however, they can help the organization understand their internal access rights, permissions and influence each actor has on certain information. This would also help members of the organization effectively perform operational tasks, since the collection of information to correctly answer audit evaluations was a task that the organization had to perform by law. While the view and information deposited
in the ATLAS repository regarding data protection concepts would not automatically be transformed into legal documents, it could help members of the organization have more direct access to it, and then create the respective legal documents.

Secondly, following the same approach and logic used in the GDPR problem, we can use EA as a means to perform other operational task, namely, if the task at hand is planning. For someone responsible for the scheduling and planning of changes to the structure, creating information regarding those aspects is in fact an operational task. Using the already explored planning features available in the ATLAS tool, the person responsible for the planning of these projects or changes to the objects can use the ATLAS tool to save these changes, making them available to everyone involved, instead of having to later distribute the information through emails that can easily be forgotten.

4.7 Document Relevant Points of the Project

During the project’s development the architectural team gradually and continuously built a set of documentation and supporting material to register information regarding the biggest difficulties the organization had with EA. This was a solution that was more oriented to the future, since many of those working in this project may no longer be in the future, and with approval from the organization’s management, registering certain aspects of the project would provide long term benefit, should the organization embark in a new architectural endeavour or continue this one with a new team working on it. These include Atlas configuration & maintenance guide (specific for this project), meta-model guide, Data importation guide, weekly reports, problem mapping etc.

4.8 Use Charts, Information Structuring Rules and Pilot Testing to Facilitate Multi-repository Management

Due to the size of the task at hand, the tackling of this challenge had to be planned with considerable care in order to maintain the order between repositories. The first decision to attain this goal was to use the same meta-model to describe the internal structure of each entity. This was done since if we plan on aggregating all the information into a single unified repository, all information had to be subject to the same rules. The architectural team also decided that most views created for the SPMS repository made sense in the context of the entities repositories, with slight changes made to their configuration in order to accommodate specific cases regarding how information was structured (ex: Hierarchies in entities are organized differently from SPMS). Others where specifically created for these repositories.

4.8.1 Meta-model and information Training for Entities

Since most of the meta-model and tool use was performed within SPMS, entity members required meta-model and information “training”. While deep knowledge of this information was needed, those coordinating the project on the entities should at least have basic understanding of it. In order to overcome this, a schedule was established for meetings with the representatives to take place. The goal of these meetings was to give insights on the project and begin the input of information to each entities respective repository. After this step, we had an initial KB to work with.

4.8.2 The Batch Feature

To make bulk transfer of information between repositories much easier and faster, a new feature was added to the Atlas tool. Batches allow for big amounts of information to be transferred from multiple repositories to a unique one. This represents a considerable advance for the creation of a centralized repository that contained in it the information from all 66+ others. This model of importation also features redundancy detection and error detection, by including a repository where the user performs textual verification (Master), and a following one for data treatment (Staging).

4.8.3 Charts as an Quality Control Tool

Charts present statistical meta-data regarding the information that exists within a repository,
as such, they also exist in the eSIS repositories and have their purpose there. In the eSIS Staging repository, charts play a particular role. In order to further improve the efficiency of the quality control that occurs within this repository. By being able to present meta data analysis, one can use it to identify, for example, projects without a manager (something that should not happen). This aligned with a set of queries that track other errors, provide a basis for quality control.

4.8.4 Scenario Manager: Controlled Change

The Scenario Manager works by following a hierarchy of responsibilities. Users with permissions to edit the information can create their own scenarios, which consist on proposing changes to both existing information, be it creating new relations or simply alter the values of some given property, or adding or erasing information. These changes are then submitted for approval. The approval of the changes proposed by a scenario are the responsibility of the repository manager. The manager must evaluate the quality of the alterations before putting them in the structure of the repository. This would allow for better gate-keeping of the changes implemented in each repository, allowing someone with a better understanding of the EA to approve or not the changes.

5 Results

- Creation of meta-model that is currently in use by all of the eSIS ecosystem entities (along with its documentation). This meta-model allowed for communication to standardized and concepts mapped.
- Creation of 20+ views/maps, tailored to the necessities of members of the organization. These provide an important strategic and management tool, as they are not static and can change dynamically through management approved changes.
- Successful implementation of Forms, a simpler and easier way for users to register information in the Atlas platform.
- Identified and capitalised on strategic sources of information (existing excel files, VIPs in each entity) to facilitate the upload of information into the Atlas repositories.
- Implementation of systems within the Atlas tool that guarantee information quality and consistency, along with documentation on these.
- Introduction of EA concepts and mindset in an organization with no previous experience, while introducing features that allow EA to play a role more operational tasks.
- Fulfilled the objective of having 25% of the initially agreed systems accurately mapped in the Atlas tool.
- Kick-started an EA initiative that covers over +66 public health-care entities.
- Created comfortable baselines for the rest of the project (meta-model, upload mechanisms, quality control, views etc).
- Created entire multi-repository structure, capable of centralised information and quality control features, guaranteeing a valuable network for information gathering and management.

6 Conclusions

To solve/mitigate the issues identified during the analysis phase, we created a set of solutions based on the framework proposed in [5], [22]. The results (far from definitive) since the full implementation of an EA into an organization (when it becomes an active part of the organization as something that is used consistently and managed and maintained in that same way ) is a process that can take a very long time, since this effort varies with the complexity of the organization, as well as it’s size. It was also noted that the implementation of an EA is a effort that includes not only a technical component (know-how, tools etc.), but also a “political” one. Within an organization, different ideas and agendas exist, which translate into opinions that are sometime hard to balance, which in our case showed that in some cases, one must resort to pressuring the upper hierarchy of the organization to make sure progress is made and that changes are accepted, highlighting the importance of upper level support.
REFERENCES


