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Integrating Organizational Design and Architecture: A Case Study

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Dedication

There are a number of people without whom this thesis might not have been written, and to whom I am greatly indebted. I dedicate this thesis to them with their open mind suggestions and for taking their personal time to help me.

- My advisor professor Rito Silva for being an excellent advisor, for guiding me in all this process and for always being available to meet me. His sage advice, insightful criticisms, and patient encouragement aided the writing of this thesis in innumerable ways.
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Abstract

Nowadays markets are rapidly changing and organizations need to adapt to these new conditions. An organizational design and architecture analysis could help with the alignment between organizational self-awareness, organizational culture and information systems to improve the efficiency and effectiveness of an organization.

This dissertation studies organizational design and organizational architecture and it is aimed at an approach of an analysis of both concepts applied to an organization. Moreover, the approach is applied in a real organization and solutions for the identified problems are shown.

**Keywords:** organizational design and architecture analysis, approach, efficiency, effectiveness.
Resumo

Hoje em dias os mercados estão em constante transformação e as organizações tem de se adaptar a estas novas condições. Uma análise do desenho e arquitectura organizacional pode melhorar o alinhamento entre a consciência organizacional, a cultura organizacional e os sistemas de informação para melhorar a eficiência e eficácia de uma organização.

Esta dissertação de mestrado estuda o desenho e a arquitectura organizacional e apresenta uma abordagem de uma análise de ambos os conceitos aplicada a uma organização. Além disso esta abordagem é aplicada numa organização real e soluções para os problemas identificados são descritas.

Palavras-chave: desenho e arquitectura organizacional, arquitectura, eficiência, eficácia, análise.
Research Methodology

This dissertation research has two main books as back bone: "Organizational Design: A step-by-step" [Burton et al., 2006] and "Enterprise Architecture at work: Modelling, Communication, and Analysis" [Lankhorst, 2005], which give the principle concepts to help construct an organizational architecture and design analysis approach, however the research will be complemented with articles, books, white papers and referenced websites that will add value to this dissertation.

The proposal will be applied to the "Departamento de Investigação e Acção Penal" of Lisbon (DIAP) of the "Ministério Público de Portugal".
Acronyms

RUP  Rational Unified Process ................................................................. 27

TOGAF  The Open Group Architecture Framework ......................................... 27

UN/CEFACT  United Nations Centre for Trade Facilitation and Electronic Business .................. 27

BPMN  Business Process Modeling Notation

DIAP  "Departamento de Investigação e Acção Penal" of Lisbon ...................... VIII

OPC  Criminal Police Organ ................................................................. XI

SGI  Inquiries Management System ........................................................ 41

PGDL  "Procuradoria Geral Distrital de Lisboa"

NUIPC  Unique Identifier Number of Criminal Process ................................... 43

IS  Information System ............................................................................. 59

CRUD  Create, Read, Update and Delete ..................................................... 46
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Introduction

Nowadays with the aggressive competition, demanding customers, global market organizations have to be more competitive and adaptable to change. Developing an architecture for an organization is a serious challenge and needs to understand all the organizational aspects.

A successful architecture of an organization must be effective and efficient, simple in design, flexible enough to adjust when facing new conditions as well as support an organization to evolve or transform. Creating and developing an architecture for any organization can only thrive if it takes an organizational design and architecture analysis, into account to fully understand the organization alignment between structure, goals, strategy, information flow and business processes.

1.1 Scope and Motivation

This dissertation focuses on an organizational design and architecture analysis which should be capable of expressing the strategy, environment, organizational complexity and all tangled relationships between the business processes, infrastructures and tasks of an organization.

Organizational design and organizational architecture are two different essential concepts bound together by the same principle of understanding and capturing an organization as-is. Analyzing both concepts can improve an organizational architecture in terms of efficiency and effectiveness.

Organizational design is a guided process to integrate information, people, technology and their relationships within an organization. It also uses approaches to capture each concept, such as, environment, strategy, goals, task design, information systems or people, in the organizational design process.

Organizational architecture defines the relationship between the users of the system and the design of the system. In fact architecture forms the basis for analysis, optimization, and validation and is the starting point for further design, implementation and construction of that system. [Lankhorst 2005]

So the motivation to further study in depth an organizational design and architecture analysis approach is the existence of diverse drivers needed by organizations. Such as having a clear understanding of its structure, strategies, goals and demanding more efficient communication and productivity.

1.2 Dissertation Objectives

- Study organizational design and architecture concepts.
- Propose an approach of an organizational design and architecture analysis.
- Apply the referred analysis to a real organization.
- Suggest a solution for the problems found in the organization.
- Understand what benefits this approach has in an architecture specification.
1.3 Problem

The rhythm of organizations is changing with the boom in technology, everything is faster, communications, transactions which force fast decisions. However humans don’t have the capacity to manage all these transactions and need applications to support their decisions. The Magalhães & Trbolet [n.d.] presents the organization as a flux in permanent transformation where there is a natural integration of organizational self-awareness and culture which helps to understand the necessity for better integration of both perspectives. These concepts can be described as follows:

- Organizational culture represents the comprehension of the relationships and values - organizational being;
- Organizational self-awareness represents the strategies, processes, tasks and activities - organizational processes;

In reality many organizations have a misalignment between the organizational self-awareness and culture. The problem is described in figure 1.1, the organizational culture is supported by the people, if employees of an organization have a common awareness of what is the organization and what their real capacities are then there is a necessity to represent this in the organization.

![Organization misalignment problem](image-url)
On the other hand the organizational self-awareness is supported by the business processes, information and service architectures. In addition, technology architecture represents the machines which support the organizational architectures.

In fact if we look at business process architecture as sentences, information architecture as names and service architecture as verbs we immediately understand that the language mechanisms have to be aligned with humans and machines for an organization to run successfully.

A possible solution would be to analyse an organization using an approach of organizational design and architecture analysis. See chapter 2 - "State of the Art" to understand the methodologies used in each concept.

Neither the organizational design or the organizational architecture can reflect an organization as-is in all the aspects that cross an organization. The organizational design captures the behaviour and strategic aspects of an organization: social-relations, goals/meta-goals, strategy, organization complexity, environment, and people, within an organization and it’s surroundings. However, organizational architecture captures the structure of an organization, its business processes, communication between processes/actors, information flow, applications behaviour and infrastructures.

The decomposition of the architecture followed by [Lankhorst 2005] is divided in three layers: business, application and technology, this gives us a formal architectural focus on the organization internal and external inputs/outputs with processes, actors and information flows.

Nonetheless, organizational architecture disregards important aspects, such as, organizational complexity, environment or strategy for the success of the architectural design which decays the well-functioning of an organization. As stated earlier, this dissertation uses the metaphor organization as an organism, see sub-section 2.1.1 existing in a wider environment to satisfy its needs, if the environment and the organization itself is always mutating as a living organism. In fact the organization architecture should also analyse design aspects for a much improved architecture to meet the goals of efficiency and effectiveness.
State of the Art

2.1 What is an Organization

"We consider an organization to be a set of constraints on the activities performed by agents." [Fox et al., 1997]

Defining an Organization it’s by itself a research theme, however its essential to describe in relative terms what an organization is, its purpose, objectives and further in, other chapters realise why researching about organizational design and architecture integration is of great significance for developing systems.

2.1.1 Organization as Organisms

One practical way to understand what is an organization is using metaphors, one of the most known metaphors is "Organizations as Organisms" [Morgan, 2006].

Thinking about organizations as living systems, existing in a wider environment that they depend to satisfy their needs, makes it possible to identify different species of organizations in different kinds of environments, which gives us an overview that some organizations are better at adapting a specific environment than others, as an example a bureaucratic organization work most effectively in a stable and protected environment and a high-tech firm more in agonistic and riotous environment [Morgan, 2006].

Fig. 2.1. How an Organization Can Be Seen as a Set of Subsystems [Morgan, 2006]
Organizations as Organisms are "open" to their environment and must achieve an appropriate relation with that environment if they are to survive. Further instance organizations can be conceived as sets of interacting and interrelated subsystems (see figure 2.1), like cells or organic tissues are interrelated. For example organizations contain individuals (who are systems on their own), groups, departments and sections, this is all subsystems that interact, interrelate and cross information. Looking at a macro perspective all this subsystems constitute the organization as-is with its proper behavior, culture and structure which are adapted to a specific environment where the organization operates. [Morgan, 2006]

Characterizing an organization as a set of subsystems leads to the open system theory which views organizations not as "closed" bureaucratic structures separate from their surroundings, but highly complex entities, facing considerable uncertainties in their operations and always interacting with their environment. This system also assumes that organizational components will seek equilibrium among the forces pressing on them and their own responses to their forces as illustrate in figure 2.1 [Morgan, 2006; Burton et al., 2006]. This aspects will be taken in account on organizational design more further in this article (see sections 2.2.3 and 2.2.7).

2.2 Organizational Design

"Organizational Design is a formal, guided process for integrating the people, information and technology of an organization."

As stated earlier with aggressive competition and global markets demand that organizations rethink their strategies, making organizational design a serious test for any manager whether of multinational organization or a small enterprise, however its an important process for organizations to achieve Effectiveness and Efficiency. As stated by Roy Autry organizational design is a formal guide which bounds and integrates every relevant aspect of an organization and looks at the convoluted relationship between tasks, workflow, responsibility and authority and making sure these all support the goals and strategies of the organization. For understanding the necessity of organizational design and architecture integration, its imperative to comprehend with some detail what organizational design (and in further chapter 2.3 organizational architecture) stands for and what is its guideline and approach for portrait an organization. In addition is important to understand that each aspect design present in the next subsections represent the building block of the organization, each building block are mapped onto a series of two-dimensional graphs and are interlocking such that a specific quadrant in any one graph corresponds to the same quadrant in all other graphs. In this way, is easy to visualize the relationships among the organizational design components and identify where there are misfits in the organization design.

2.2.1 Organization scope definition and goals evaluation

Before starting an organizational design process, its essential to define the organization scope and understand two complementary problems which involve organizational design and are correlated with defining the scope: "(1) how to partition a big task into smaller subunit tasks, and (2) how to coordinate these smaller subunit tasks so that they fit together to efficiently realise the bigger task and organizational goals." [Mintzberg, 1983]

1 Roy H. Autry, http://www.inovus.com/organiza.htm - Ph.D in Organizational Psychology
In one hand smaller tasks have to be defined, arranged and well understood prior to performing it having a simple proposition in account: "the greater the uncertainty of the task, the greater the amount of information that has to be processed" [Galbraith, 1974]. Normally if a task is uncertain probably it can be broke in smaller tasks which have to be defined and well understood to allow effective coordination.

In other hand design process can be viewed as a set of cascading organizational design tasks which are separate in different levels (see figure 2.2) permitting a focus on tasks design in each level. Usually design starts at corporate level which should permit a macro-view design from an organization, once that part has been done, is just a question of iterating the other levels (this is a top-down approach but other approaches like bottom-up can be used).

The point here is keeping the unit of analysis consistent [Burton et al., 2006]:

- Consider only one organization
- Not mix the design of a determined level with the design of another specific level, such as, not mixing the design of the whole organization with the design of any specific division.

Another important subject is the design cascade process may have to be iterate many times as many options surge in the process, this is relative to the equifinality model which state an organization, which differ from initial conditions and by variety of paths can reach the same level of organizational effectiveness. [Doty et al., 1993]

Goals evaluation

One important subject for an organization is its goals, fundamentally two specific goals: efficiency and effectiveness. Yet rarely these goals are test empirically and with this lack of experimental support puts a serious constraint on the ability to expand the understanding of organizations and management [Phelan, 2005]. However effectiveness and efficiency are not the same thing, Richard Burton describes effectiveness as "a focus more on outputs, products or services, and revenues" and efficiency as "a primary focus on inputs, use of resources, and costs" which are competing priorities [Burton et al., 2006].

Nevertheless all organizations value both efficiency and effectiveness but some place higher priority on efficiency, others on effectiveness and some equilibrate both. Thus for organizational design its important to understand what is the priority for the organization and in which quadrant it situates as shown in figure 2.3 representing efficiency and effectiveness as two dimensions on a single scale [Burton et al., 2006].
2.2 Organizational Design

Figure 2.3 as four quadrants where organizations can be situated in terms of high/low efficiency and effectiveness:

- **Quadrant A** - Organizations in this quadrant demonstrate low emphasis on both efficiency and effectiveness, can’t manage resources well and have little or no goals relative to higher level ideas. Normally this organizations are in a very controlled environment like a monopoly where competition doesn’t exist having no priority on effectiveness and efficiency goals or can be an early new start-up organization. [Burton et al., 2006]

- **Quadrant B** - In this case organizations focus on efficiency, most of this organizations work in a stable environment giving them a strong position which only need to compete in efficiency. The main goal is reducing costs of resources: the use of the smallest amount of resources necessary to produce a product or service. [Burton et al., 2006]

- **Quadrant C** - In this instance the focus is in effectiveness, showing low value in efficiency, this means organizations focus on their high level goals but don’t manage its resources in a proper manner for cutting resources costs. This organizations work in a volatile environment or are constantly developing new ideas making the treats of the costs of resources a secondary concern. [Burton et al., 2006]

- **Quadrant D** - Finally in this quadrant organizations manifest high value on both efficiency and effectiveness, requiring product innovations and low cost in order to compete in a competitive, complex and volatile environment. [Burton et al., 2006]

The efficiency and effectiveness goal state has profound consequences for the information-processing demands and capacity of an organization and significantly affects the organizational design process. Consequently from this model approach can be denoted a direct relation between the effectiveness-efficiency goals, the environment and a strategy of an organization (see sub-sections 2.2.2 and 2.2.3).

2.2.2 Strategy

Strategy can be seen as the operationalization of the organization’s goals of efficiency and effectiveness, operationalization means "the adoption of courses of action and the allocation of resources necessary for carrying out these goals". [Chandler, 1962] Thus has to be taken in account the "need to be a fit between strategy and organization and between these and the technological, legal, and competitive environment" to achieve high performance in business goals. [Roberts, 2007]
This approach follows from Chandler’s dictum that "structure follows strategy" meaning that for some strategies exists organizational structures that can implement that strategy better than others. Strategy is the end; structure is the means.\cite{Chandler,1962}

Strategy can be described in a number of ways, for example marketing strategy can be describe as the choice of the four P’s: product, promotion, price and place that is which product should the organization produce; what is its price; how should be promote and advertised\cite{Kotter,2000} or using the five forces of Porter: the entry of new competitors, the threat of substitutes, the bargaining power of buyers, the bargaining power of suppliers, and the rivalry among the existing competitors, these collective strength of five forces yield three possible strategies: cost leader, product differentiator, or niche player.\cite{Porter,1985}

This article will focus on a simple but powerful way to describe organizational strategy using the typology: (1) reactor, (2) defender, (3) prospector and (4) analyser without or with innovation, this typology has proved to be very robust.\cite{Miles et al.,1978} Strategy can be seen in a two dimensional graphic to form the basis for categorization of a organization strategy into one of four types, see figure 2.4.\cite{Burton et al.,2006}

Looking at figure 2.4 representing the Miles et al. \cite{Miles et al.,1978} typology let’s consider these strategic types in more detail:

- **Reactor**: usually are unstable organizations because they do not possess a set of mechanisms which allow them to respond consistently to their environments over time, such organizations fall into an unpleasant cycle of responding inappropriately to environmental change with poorly performance as a result.\cite{Miles et al.,1978} Normally the reactor strategy is neither efficient nor effective in terms of achieving the organization goals, there is no innovation, it acts without a focus on exploration or exploitation.\cite{Burton et al.,2006} Being reluctant to act aggressively in the future, it tries to adjust to the situation with the possibility to capture any opportunities that are long gone. The Miles et al. \cite{Miles et al.,1978} identified three reasons why organizations become reactors: (1) "top management may not have clearly articulated the organization’s strategy", (2) "management does not fully shape the organization’s structure and processes to fit a chosen strategy” and (3) "tendency for manage-
ment to maintain the organization’s strategy-structure relationship despite overwhelming changes in environmental conditions.”

- **Defender:** it’s high in exploiting its resources and situation but low exploring new things or create innovation. The management is focused on keeping the organization’s position in the market which maintains by being efficient in the utilization of resources [Burton et al., 2006]. This reflects how defenders enact a stable environment opposed to their counterparts within the same industry even when this industry changes rapidly. [Miles et al., 1978] However defenders are slow to make significant change and rely on the continued viability of a single narrow domain, making a defender organization perfectly capable of responding to "today’s market to the extent that the world of tomorrow is similar to that of today". [Miles et al., 1978]

- **Prospector:** is high on exploration of its opportunities but low on exploiting its current situation, its main focus is on innovation of new things to the detriment of being efficient and exploitative of existing opportunities [Burton et al., 2006]. Prospectors enact an environment that is more dynamic than other types of organizations within the same industry, they do it to maintain its competitive position and by being innovative on its product-market domain to take advantage of perceived opportunities which lead to a competitive situation that competitors must adjust to. [Miles et al., 1978] One thing to note is that prospectors can make larger changes in products and services much more promptly than defenders. Nevertheless prospector strategy has several risks in one hand since prospectors have a time frame for success with new products or services, it could exhaust resources for products, services cycles, could fail to innovate and provide services or products within life cycle demands. [Burton et al., 2006] Briefly prospectors are effective because they respond to the demands of tomorrow’s world, however they cannot maximize profitability because of their inherent inefficiency. [Miles et al., 1978]

- **analyser**
  - **without innovation:** it’s an organization with a strong focus on exploitation and weak focus on exploration. This analysers look to what other organizations do with success and try to imitate the same businesses with similar products or services. [Burton et al., 2006] This strategy is similar to defender in terms of focus on keeping the organization’s position in the market, but always keeping alert to what others are doing. The analyser without innovation is efficient on using resources and following other’s successful businesses, it primarily pursues the efficiency goal, however effectiveness is moderate. [Burton et al., 2006] Its vulnerability comes when following wrong trends or fails to imitate successful other businesses strategies (like failing to imitate quickly enough so that products or services are still desirable in the market). Thus if customers stop purchasing its products this type of organizations won’t be in a good position since is difficult to easily and quickly imitate others organizations successful businesses strategies. [Burton et al., 2006]

  - **with innovation:** is a dual strategy which combines aspects of both prospector and defender strategies and focus on both efficiency and effectiveness. It exploits its market position, resource utilization and in parallel tries to innovate creating new products, services and their delivery processes. The analyser with innovation is active in exploration, on search for new products and services and while observing what other organizations are doing in the market it prefers to search for new opportunities that can help it to create new business strategies. For an analyser with innovation it’s difficult to maintain the balance between defending the organization market position while at the same time trying to innovate new products, services and businesses strategies. This requires a great skill and
management expertise for to not fail to maintain the combination of exploration and exploitation
needed to keep its existing markets and emphases on innovation. [Burton et al. 2006]

2.2.3 Environment

The Environment is "everything outside the boundary of the organizational unit of analysis" where the
organization operates [Burton et al. 2006] (see section 2.1). Environment means what could have affect
on the organization performance, it could be: its costumers, its suppliers, its competitors, the market or
political system so the organization performance depends on how organization is fit in environment. Also
strategy, as referred on sub-section 2.2.2, must fit the organization environment and both, environment
and strategy, are determinant for organizational design. [Burton et al. 2006]

There are many ways to describe an organization’s environment. For example, Burton & Obel 1984
use a four dimensional description: complexity(number of factors in the environment and their interde-
pendency), uncertainty (variance among the factors), equivocality (ignorance and confusion about the
existence of some factors) and hostility (extent of malicious external threats) Burton et al. 2006.
Duncan 1972 argued that imperfect knowledge about the environment created uncertainty for firms,
he believed that “uncertainty and the degree of complexity and dynamics of the environment should not
be considered as constant features in any organization. Rather, they are dependent on the perceptions
of organization members and thus can vary in their incidence to the extent that individuals differ in
their perceptions” Duncan 1972, this article focus on the use of environmental change or dynamism
and environmental complexity. Recently, Sigglkow & Rivkin 2005 describe the environment in terms
of turbulence and complexity trying to respond to a neglected question: "How do environmental turbulence
and complexity affect the appropriate formal design of organizations?".

However among all of these descriptions, there are some common aspects. First they are general propri-
eties of an organization's environment and second the measures are perceptions made by the management
of the organization which are not necessarily objective. Finally whatever the particular environment de-
scription use, the environment is a large determinant of the organizational design Burton et al. 2006.
Thus environment creates both limits and opportunities for an organization strategy and its structure.

This article will describe organization environment using two dimensions, figure 2.5, complexity (mea-
sure the number of factors in an organization’s environment and their interdependency) and unpredictabil-
ity (lack of understanding or ignorance of the environment factors and their variance; greater variance
means less predictability) Burton et al. 2006.

This two environmental characteristics are general attributes, where complexity measures the number
of powerful forces affecting an organization and unpredictability the degree of uncertainty about the
forces that impact a firm. Applying this dimensions to describe the environment, they create four types of
environment as show in figure 2.5, calm environment, a turbulent environment, a varied environment and
a locally stormy environment. Burton et al. 2006 Normally there are increased information-processing
demands on the organization as it moves from a calm environment to a turbulent environment, mainly
because an organization has more issues to consider and coordinate as the complexity and unpredictability
increase.

Lets analyse furthermore this four types:

- **Calm environment** - has low complexity and low unpredictability, thus it’s simple and high
  predictable with few surprises. If an organization has few products and sells them into predictable
markets then it has a calm environment, normally in this situation political and financial issues usually are not major challenges for management except if the firm is a monopoly. An executive in a calm environment doesn’t need much time to assess his organization environment, because today’s environment will be tomorrow’s as well, there will be few surprises and he can focus on other organizational design issues like addressing more internal concerns. However a presumption of a calm environment by an executive is risky because his perception can be wrong or likely any change in the environment will be ignored or missed and can drive a calm environment to an other type of environment (i.e a turbulent environment). 

- **Turbulent environment** - has both high complexity and high unpredictability, this type of environment is normally associated with many of interdependent factors which are not predictable, this is analogous to that faced by the farmer who as not only the rain to consider but also the market price for the beans, and the rain and price may be correlated and both are hard to predict. This is the most difficult environment to operate because it requires limited forecasting and also the flexibility of quick and coordinated adjustments as inputs become known which leads an organization to have a fast information-processing capacity so that it can choose quickly among alternative courses of actions for the organization.

- **Varied environment** - has high complexity and relatively unpredictability, in this environment there are many factors to take into consideration and they can be interdependent, however this factors are relatively predictable or/and they tend to change within known limits. If an organization has many products and sells them into markets where the markets are predictable, it’s in a varied environment. In such varied environment there are many factors for an organization to consider, but it is possible to predict what will occur, thus the focus of the executive is on planing and coordination that will allow the organization to manage in the face of the interdependencies among the factors that are in its environment.

- **Locally stormy environment** - not very complex but has high unpredictability, there are few factors in the environment which are relatively independent but they are unpredictable. As example organizations that are dependent on a patent right or the result of a particular outcome of a clinical trial are in this type of environment. Executives in stormy environment are most concerned about the unpredictability of environmental factors that can affect the organization. Therefore the Law of Requisite Variety proposed by [Ashby, 1964], which states that ”a system’s internal flexibility must
meet the outside uncertainty for the system to survive”, which in an organization means that it’s information-processing capacity should be able to adjust when unpredictable events occurs. Thus in a predictable environment an organization has time to plan for the future but in an unpredictable situation the peak of information requirement is much higher when unpredictable factors become known. [Burton et al., 2006]

2.2.4 Configuration and complexity of organizations

A critical decision for the executive is the choice of an organization structure/configuration [Burton & Obel, 1984], which will enable the organization to perform well for its given goals, strategy and in its environment [Burton et al., 2006]. A poor choice of structure can lead in long term to opportunity losses and affect the organization efficiency and effectiveness as well as its viability.

An organization configuration can be seen as a chart which tells how the organization partitions big tasks in smaller tasks either by specialisation or products and also indicates how are the communications between the parts. As discussed in section 2.2.1 organizational design involves two complementary problems:”(1) how to partition a big task into smaller subunit tasks, and (2) how to coordinate these smaller subunit tasks so that they fit together to efficiently realise the bigger task and organizational goals.” [Mintzberg, 1983].

An organization complexity further specifies the organizational design in horizontal and vertical differentiation, for example how many subunits are there as well as the number of vertical levels in the hierarchy.

Organizational design use two fundamental dimensions to distinguish the basic configurations: **product/service/customer orientation** which suggest that the total of organizational tasks will be partitioned by the outputs of the organization, giving an external focus, and **functional specialisation** which indicates that the work will be divided by specialized activities, figure 2.6 represent this dimensions.
These two dimensions indicate the focus of how the work will be divided and how must be coordinated, this dimensions generate four basic configurations which are simple, functional, divisional and matrix [Miles et al., 1978]. Furthermore this four basic configurations can be combined in different patterns, thus this are the building blocks of more complicated configurations (e.g. each of the several divisions of a divisional configuration can be functional, divisional, matrix or another divisional) and should be designed using a top-down approach described in section 2.2.1 [Burton et al., 2006].

Looking at figure 2.6 there is four basic types:

- **Simple configuration** - it’s low on both the product/service/customer dimension and functional specialisation dimension. Usually this type of configuration is used in small organizations, consisting of an executive and perhaps some few other employees, the executive is at the center of the information flows, makes decisions, coordinate the activities and assigned them to the employees, and controls operations. On the other hand employees don’t have specific tasks or activities to perform, mainly because the total task of the organization is broken down into smaller tasks and assigned to the employees by the executive on an as-needed basis. However the executive also is the main contact with the market, customers and suppliers, figure 2.7 is a example of a organizational chart of the simple configuration. The simple configuration is flexible but not usually effective or efficient, there isn’t specialisation, employees are asked to do many tasks for which they may not be skilled which degrades the efficiency and it depends mainly upon the vision of the executive for its effectiveness orientation.

![Simple Configuration](image-url)
• **Functional configuration** - it’s low on the product/service/customer dimension and high on functional specialisation, it focus on work based in functional specialisation. Once more the executive is at the center of the organization, makes decisions, and coordinating activities of the subunits, although information flows through the top of the organization. The total firm task is broken down and assigned to subunits which are coordinated by the hierarchy combining rules and directives. The functional configuration is more complex regarding the information-process when comparing to the simple configuration, there are department managers with specified subunits, each of which with well defined jobs, its more machine like and can accommodate large-scale organization as well a high degree of information-processing. Figure 2.8 shows a organizational chart representing the functional configuration with three functional departments, the executive coordinates the manufacturing, sales and is concerned with matters such as planning/realisversus projected expectations of organization productivity. Although information flows from the top to bottom of the organization, departments processes information on its own for coordinating subunit activities. In this type of configuration the main advantage is the specialisation which provides the rationale to assign individuals and subunits to specific tasks, whereas tasks are attributed conform the skills of an individual. \[Burton \ et \ al., \ 2006\]

![Fig. 2.8. A functional configuration \[Burton \ et \ al., \ 2006\]](image)

• **Divisional configuration** - it’s high on the product/service/customer dimension and low on specialisation, the focus here is not so much in specialisation but rather in outside products and services that the organization produces. Subunits are relative independently of each other and have limits on their contact with the headquarters, are overseen by an executive level, and normally each subunit is frequently organized as simple or functional configuration within the subunit with external focus on its own markets and costumers. \[Burton \ et \ al., \ 2006\]. The divisional configuration works best when there is limited coordination from the headquarters and each division is left to run its own business and coordinate its activities to focus on the market for its products or customers. \[Burton \ & \ Obel, \ 1984\]
In figure 2.9 is represented the divisional configuration where the product flows and information flows have been added. This type is more market-responsive than the functional configuration, thus aiming to be effective with its external focus on the product, customers or region. However, the main disadvantage of the divisional form is that each division is relatively independent of the other in its operations and markets and does not handle interdivisional dependencies well (e.g., two divisions selling competing products to the same customer which requires joint efforts will find it difficult to coordinate). The goal is to have divisions with minimal interdependency.

**Matrix configuration** - it’s high on both dimensions: product/service/customer and functional specialization, thus demanding a need for a high information-processing capacity to achieve the twin goals of efficiency and effectiveness. The matrix configuration has both functional and divisional hierarchy for the same organization, where the top executive is responsible for both - to set policy, set priorities and resolve conflicts among the subunits. However, the top executive oversees the entire organization but is not involved in the details of operations in each subunit, thus the most of the difficult coordination problems are handled by the matrix managers. Below figure 2.10 shows a matrix in which functional specialization is combined with product orientation to yield coordination of functions across the product groups.

The matrix configuration requires simultaneous coordination of the functional specialties across products, services, projects or customers, so when there is a change of timing of an activity, it propagates across the whole organization - called the jello effect. The matrix advantage is that it can be very flexible, dealing with new information and adjusting to the new situations rapidly to utilize limited resources to meet organization priorities and can realize both efficiency of the functional form and the effectiveness of the divisional form. Therefore if the matrix configuration is not well managed, it can
be neither efficient or effective, thus matrix requires managerial skills that include focus on the entire organization as well as one's own function or division. It’s relevant to emphasize that the matrix can also lead to poor performance and the dual coordination across the functions and the divisions can lead to conflicts of priorities between managers of subunits.\cite{Burton et al., 2006}

**Organizational complexity**

The organization’s complexity is a property or characteristic of the organizational configuration, it’s the vertical and horizontal differentiation of task management in an organization, on other words how the organization configuration is broken down into its several subunits.

![Organizational Complexity Diagram]

**Fig. 2.11.** The organizational complexity space \cite{Burton et al., 2006}

Figure 2.11 illustrates the organizational complexity space; the horizontal differentiation, or width, is the degree of task specialisation across the hierarchy and the vertical differentiation, or height, is the depth of the hierarchy - top to bottom, choices regarding the degree of an organization’s horizontal and vertical differentiation, which are made in terms of efficiency and effectiveness goals, result in four types of organizational complexity \cite{Burton et al., 2006}:

- **Blob** - it’s low on both vertical and horizontal differentiation, is undifferentiated and it represents an organization which does not formally divide its work into subunits. The blob has little specialisation of task, although the organization can be quite flexible and quick to respond to ongoing changes and the job descriptions are very loose or may not exist. The top executive defines who is to do what, requiring decision making for new situations; executive can become overloaded and not be able to give a adequate response. \cite{Burton et al., 2006}

- **Tall** - it’s low on horizontal differentiation and high in vertical differentiation, the tall firm has middle management which focuses on information-processing, they are the bridge between the top and the lower levels, making information from the top precisely for the lower levels in the hierarchy and vice-versa. The middle management takes directions and orders from the executive and breaks them down into smaller tasks which then must be coordinated across the subunits and from the bottom. Middle management summarizes what is happening and passes it up the hierarchy, in a simply way for decision making and control for the top executives. \cite{Burton et al., 2006}

- **Flat** - it’s high on horizontal differentiation and low on vertical differentiation, in this type there are fewer middle managers (or subunits) to coordinate between the top executives and the lower levels in the organization and normally their focus are on resource allocation, general policy and finance. The
2.2 Organizational Design

2.2.4 Organizational Design

Information is aggregated and minimal and the scope of the organization work across subunits can be quite varied. An advantage of this type is that each unit has autonomy to focus on its own work and therefore subunits can attend to needs of the customers, suppliers or new products. However, the top executive level of the organization has to coordinate among these subunits which may lead them to be out of sync, lack of coordination or leading to inefficiencies for the organization. [Burton et al., 2006]

- **Symmetric** - it's high on horizontal differentiation and high on vertical differentiation, the organization is broken down into many task specialties as well as many vertical reporting levels. Horizontally breaking down tasks in smaller tasks means that work can be done simultaneously in the horizontal subunits which help to facilitate organizational effectiveness. A middle level or multiple middle levels are created for aggregating work from bottom to top and vice-versa for helping top executives levels to coordinate and make decisions. The symmetric organization tries to hit the ideal balance of vertical and horizontal breakdown of work into subunits. [Burton et al., 2006]

2.2.5 Structures for managing knowledge exchange

One particular problem that affects organizations is to structure in the way that maximize efficiency and effectiveness of knowledge exchange. Knowledge is information that corresponds to a particular context, and therefore knowledge exchange is the sharing of information that requires interpretation to understand and apply. Structures for managing knowledge exchange constitute the infrastructure on which the basic organization configurations rely and can help the organization to increase its information capacity. Structures for managing knowledge exchange have two dimensions: IT infusion dimension refers to the extent to which a firm relies on information technology-based systems (like computer-based communication systems) and Virtualization dimension which refers to the degree of boundary-spanning or organizational "reach" that an organization uses as the basis of knowledge exchange. These two dimensions have four major types of organizational designs for knowledge exchange: informated, network, ad hoc communications and cellular. [Burton et al., 2006]

![Fig. 2.12. Structures for managing knowledge exchange](image)

Looking into each of the four categories:

- **Ad hoc communications** - manage knowledge exchange on an as-needed basis, it’s both low in IT infusion and Virtualization. Typically this organizations rely on small, loosely created groups whose
members are all from inside the organization or person-to-person contacts. Group members try to adjust the way they organize work and report to one another and their boss depending on the nature of the particular task. However, Ad hoc communications can be a way to generate information to meet the specific knowledge needs of a given task. [Burton et al., 2006]

- **Informed**: It’s low in virtualization and high in IT infusion, an informed organization uses computer technology in the design and monitorization of work processes such that tasks can be streamlined, closely linked with one another and continually managed for improvement in quality and cost. The informed organization increases the intellective demands of work and the possibilities for creative ways of rearranging and linking work activities. [Burton et al., 2006]

- **Cellular**: It’s low in IT infusion and high in virtualization, cellular organizational forms are characterized by small and autonomous groups that self-govern and can grow, reproduce and forms relations with other units as needed. Cellular organizations developed extensive relationships with external parties for knowledge sustenance and rely heavily on rich forms of interaction between people for knowledge exchange. [Burton et al., 2006]

- **Network**: It’s both high in virtualization and IT infusion, network organizations links units within the firm with one another and develops active linkages between internal units and external organizations to meet the organization’s knowledge needs. Networks rely the use of information technology which is used to link units in multiple directions, not just vertically or horizontally. Combines the information intensity of the informed firm with the boundary-spanning approach to knowledge exchange found in the cellular organization. [Burton et al., 2006]

2.2.6 Task design

Task design is decomposing work into subtasks and coordination among them is needed to meet the organizational goals, therefore it determines the coordination requirements for the organization work and makes vital a fit between task design and the other design components. The organization’s approach to task design is related to its choice of efficiency and effectiveness goals and subsequently its structure and strategy. An organization’s task design can be categorized along two important dimensions: repetitiveness and divisibility. If a task is well defined such that it is used over and over then it has higher repetitiveness, denote that standardization in execution of the task enables repetitiveness. If the task varies in how it is done, then it has low repetitiveness and a higher uncertainty. When a bigger task is broken down into subtasks which require little coordination it is highly divisible, however if the subtasks require high coordination with one another, then the task has low divisibility. These two dimensions have four basic task designs which are called: orderly, complicated, fragmented and knotty [Burton et al., 2006], illustrated below in figure 2.13.

Let’s consider the four task designs in more detail:

- **Orderly**: It’s highly divisible and highly repetitive and requires little coordination among the subtasks to accomplish the work. This tasks design is appropriate when the work is broken up into pieces so that you can direct each work unit to perform independently of other units and when each units completes its work, the results flow to the executive level. An advantage of this task design is that slowdowns or other problems in one unit don’t affect or prevent other units from continuing progress on their tasks, because there is almost no coordination required between units performing the subtasks of the organization and no need for them to adjust to one another. [Burton et al., 2006]
2.2 Organizational Design

- **Complicated** - is low divisible but is highly repetitive and requires more coordination of the connected and repetitive tasks, that is, the subtasks can be performed by different units of the organization, but they are interdependent to get the work done. The executive level overseeing the organization’s work focuses on the coordination of the connected processes which gives the very reduce divisibility, a breakdown in any one small task can shut down the whole operation. [Burton et al., 2006]

- **Fragmented** - is highly divisible, but not very repetitive and requires a different kind of coordination to adjust to ongoing variations across the subtasks, however it doesn’t require adjustments for connectedness among subtasks. This type of design task means that the organization divides its work so as to accommodate the varied nature of its business, thus by breaking down the big task of the organization, the subunits are likely to be more innovative and aggressive, even some may outperform others or contribute more to the organization’s work. The executive just needs to assure that the subtasks (i.e., the subunits) have resources and a reading on the environment to manage a fragmented task design. [Burton et al., 2006]

- **Knotty** - it’s neither divisible nor repetitive and is the most difficult task design to coordinate as adjustments to both connectedness and non-repetitiveness are required simultaneously. Knotty tasks are not standardized, so this approach encourages those responsible for subtasks to develop innovative ways to do their work, adapting the unique demands of each customer and at the same time those performing subtasks must integrate their work with other units in the organization. The executive focuses on the coordination of the connected processes, which are continually changing, although given the non-repetitive approach the information-processing demands increase greatly. [Burton et al., 2006]

2.2.7 People

Effective management of people is an essential ingredient to a firm’s ability to reach its goals [Institute, 1994]. The organization and the people must fit together, although people bring skills having more people is not necessarily a better state from an organizational design standpoint. Mainly because organizational design is influenced by the organization size (e.g. large organizations are more decentralized than small ones) and as the number of people increases communication becomes very complex and problematic, for
example if each person talks to everyone else, then the communication links grow quickly and exponen-
tially with the number of people [Burton & Obel, 2004].

In organizational design it’s important to understand not only whether to employ many people or a
few but also what types of people are needed, given the organization strategy and structure. As said by
[Burton et al., 2006], the professionalization of the workforce is a measure of its skills, knowledge, and
capacity to both generate and produce information, on other words, it measures the basic characteristics
of the people dimension of the organization’s design as their capabilities for the work tasks at hand.

In figure 2.14 it’s represented two dimensions: professionalization and number of people, and four
general approaches possible to people management: factory, shop, office and laboratory.

Looking into each of the four categories:

- **Shop** - both the number of people and professionalization are low. This approach to managing people
  involves employing few people who are low on professionalization, normally the shop design works
  well if the individuals experience has not given them extensive skills and if they don’t have specialized
  training. The shop is not focused on efficiency or effectiveness and the information-processing capacity
  of the employees is low, routines must be simple; they must be easily understood and easy to learn.
  The manager is responsible for the coordination but it involves low coordination as long as there are
  few people. The shop design is appropriate if tasks are orderly an the available workforce is small and
  low-skilled. [Burton et al., 2006]

- **Factory** - has a large number of people, but relatively low professionalization. This approach assumes
  that people have relatively little specialized expertise and the routines are relatively simples, thus
  their work tasks can be executed repetitively following training. The factory approach is focused on
  efficiency, which requires high and detailed coordination for a large number of low skilled individuals.
  However if workers have high professionalization, then the factory approach to managing people is
  not recommended, since this design does not take advantage of the knowledge and skill capacities of
  professionals. [Burton et al., 2006]

- **Laboratory** - there are few people and professionalization is high. The high professionalization
  facilitates worker autonomy in opposition to strict supervision, so each worker does their own work
  alone and the manager’s job is to support the worker. The laboratory is more focused on effectiveness
  and in high quality than on efficiency, there are many high level work routines for the workers but these
  routines are largely under the control of the workers and not the organization. Detailed coordination

![Fig. 2.14. The people space [Burton et al., 2006]](image-url)
2.2 Organizational Design

is not usually required, instead workers coordinate in small groups for information sharing. [Burton et al., 2006]

- Office - there are many people with high professionalization. Professionalization comes from education, training and experience, due to large number of people, the office approach requires very high coordination. The organization must process lots of information and high level work routines are very important as they help define and manage work efficiently and effective. Normally employees are given autonomy to do their work but they also engage in high information sharing with others; subunits are also managed as an office, thus it operate with a combination of autonomy and inter-unit coordination. The office approach is recommend when an organization has large numbers of people with high professionalization. [Burton et al., 2006]

2.2.8 Leadership style

The Leadership style is the predominant mode used by the top management of your unit of analysis to manage employees. The [Burton et al., 2006] use two dimensions to describe the leadership style: uncertainty avoidance and preference to delegation. Uncertainty avoidance is the degree to which the top management makes choices or take actions that involve major risk. On the other hand preference to delegation is the degree to which top management managers or other employee who their direct reports to make decisions about what and how work is to be done in the organization.

Uncertainty avoidance is low if the top management tends to be risk taking and high if it tends to be risk averse. However preference for delegation is high if top management relies on employees to work autonomously and make decisions without top management approval and is low if top management prefers to make decisions about how/what work is done.

This leadership style space shown in figure 2.15 give four leadership styles: manager, producer, maestro and leader.

![Leadership Style Space](image)

Fig. 2.15. The leadership style space [Burton et al., 2006]

- Maestro - it’s low in both preference for delegation and uncertainty avoidance, the maestro intervene directly to assure that decisions are made congruent with his desires. An effective maestro requires a great deal of expertise to know when to take risks and how to lead people to make great progress for the organization, however he can become overload with much work when the lack of delegation creates a bottleneck for decision making. The maestro’s attention on ongoing decision and uncer-
tainty avoidance leaves top management open to long term vulnerabilities, thus there isn’t a focus on efficiency nor effectiveness. [Burton et al., 2006]

- **Manager** - has high uncertainty avoidance and a low preference for delegation, the manager focuses more on the control of operations than on strategic decisions and uses formalized rules to manage subordinates instead of delegate decision-making authority. He makes reactive and short-term decisions with a high detail to avoid uncertainty, achieving the goal of efficiency in operations where the utilization of resources is very important. The use of manager style of leadership by top managements can give an excessive attention to detail that can make organization vulnerable to those issues that are overlooked. [Burton et al., 2006]

- **Leader** - has a high preference for delegation and low uncertainty avoidance, the leader encourages new ideas and projects both its own and those of subordinates, has a focus on effectiveness and is willing to take substantial risk in order to achieve its goals. The leader is confident that others can make good decisions for the organization, finds delegation an efficient way to save time and does not avoid long-term uncertainty. A leader has a focus on effectiveness but is vulnerable to weak following behavior in the process of implementation, the organization can suffer if the subordinates do not live up to the confidence of their leader. [Burton et al., 2006]

- **Producer** - has both high preference for delegation and uncertainty avoidance, the producer assures that new services and products are developed and introduced. The producer wants to know what is going on, assigns work to others, but doesn’t need to make each decision the organization confronts. He exploits the subordinates managerial resources well, delegating to be efficient in use of time. His focus on both efficiency and effectiveness, thus his strength is the delegation to others, but does this with an oversight that can assure decisions are made according to his preferences. [Burton et al., 2006]

### 2.2.9 Organizational Climate

The [Burton et al., 2006] describes organizational climate as the "relatively enduring quality of the internal environment of an organization that a) is experienced by its members b) influences their behaviors, and c) can be described in terms of the values of a particular set of characteristics (or attitudes) of the organization". The organizational climate can be characterized in two dimensions: readiness to change and tension. Readiness to change is the degree to which the people in the organization are likely to adjust their work habits to meet new, unanticipated challenges. However tension is the degree to which there is a sense of stress or psychological "edge" in the work atmosphere. Which give us four climate types (see figure 2.16): group, internal process, rational goal, developmental. [Burton et al., 2006]

- **Group** - has both low tension and readiness to change, in this type of climate individuals trust each other, conflict is low and there is little readiness to change. This climate can be stressful to the leader, who must make decisions about how work is done and maintain the status quo. An organization with group climate will find that managing information flow is relatively easy and can handle complex sets of information. [Burton et al., 2006]

- **Internal process** - has high tension and low readiness to change, the individuals are less trusting and have more conflict. The managerial challenge is to keep people focused on work processes without letting trust or conflict become so low that they obstruct organizational success. The internal process
climate does not possess the capacity to process a lot of information through informal means, instead the organization structure must supply the requisite information-processing capacity. 

- **Developmental** - has low tension and high readiness to change, it’s pleasant place to work, people generally trust each other and conflict is relatively low. An organization with a developmental climate have a great focus on the growth of the individuals and their quality of work life, thus this is the basis for the high readiness to change. Compared to the group and internal process climates, the developmental climate is more externally oriented.  

- **Rational goal** - has both high tension and readiness to change, this type of climate is goal-drive and individuals are a bit on edge as the tension is high. People are willing to change and accept new challenges and opportunities if they believe goals can be met. The information processing in the rational goal climate is closer to the internal process climate, but with a greater emphasis on environmental/external information.

### 2.2.10 Coordination and control

Control and coordination systems assure quality and efficiency of information flow between the highest and lowest level of the organization. Control systems monitor and measure the performances of subunits and their people, providing feedback to managers, on the other hand coordination systems support flexibility and adaptiveness within and across departmental or divisional boundaries. To understand the design of coordination and control systems is useful to understand how formalized these system to be? And how centralized should control and coordination be?

Looking at figure 2.17 the coordination and control space have two dimensions: formalization is the degree to which the organization specifies a set of rules or codes to govern how work is done and decentralization is the degree to which responsibility for coordination and control lies in the subunits of the firm and individual managers. This two dimensions suggest five different approaches: machine, family, market, clan and mosaic.

- **Family** - is both formalization and decentralization are low, in this approach the coordination and control systems are designed to rely on informal and centralized means of control. There are few written rules and procedures, people know what to do based on what they are told by a centralized source. This approach works reasonable so long as people comply with directives from the central source. This approach tends to be dysfunctional, if members or the family leader are incompetent,
Fig. 2.17. The coordination and control space \cite{Burton2006}

however can be effective if the leader is competent and the members are cooperative. \cite{Burton2006}

- **Machine** - is high on formalization and low on decentralization (which means high in centralization), the machine model system is design with documentation of rules and procedures in mind. Considerable attention must be given to specifying how work should be done and how is monitored. Machine-based organizations can tend toward bureaucracy with many rules and procedures to govern work processes, but doesn’t meant this organizations are inefficient. The downside of the machine model is that it can lack creativity and flexibility, old systems have to be replaced on a regular basis. \cite{Burton2006}

- **Market** - is low on formalization and high on decentralization, the market model has variations in coordination and control across different departments or subunits of the organization, because it is difficult in a decentralized, informal approach to develop consistent ways of doing work and monitoring effectiveness. It can be an effective approach for managing coordination and control, especially for promoting innovation and customizing coordination and control needs to particular subunits of the organization. A market organization is risk taking, tactical and innovative, this is possible, because governance is relatively decentralized, meaning that groups or business units oversee themselves with high autonomy. The downside of the market model is that all subunits may not police themselves equally well and can be tendency toward conflict. \cite{Burton2006}

- **Clan or mosaic** - is both high in decentralization and formalization. The clan model tends toward greater formalization and less decentralization, uses strong norms to guide how work is done and these norms are deeply embedded in the hearts and minds of employees. The success of the clan depends heavily on having leaders who communicate a strong set of norms and values that underlie how work is to be accomplished. On the other hand the mosaic model tends toward greater decentralization and less formalization and it has a greater tendency for heterogeneity of systems than the clan model. So coordination and control systems include rules that are not identical throughout the organization, instead they vary as a function of the subunit. One main advantage of using mosaic model is if the organization decides to change its coordination or control systems in one are of the firm, it is not necessary that the entire organization change its systems too.
2.211 Information Systems

Informations systems are methods for providing meaningful data to decision makers, normally are computer based but this is not usually true for all organizations. Many types of informations systems are possible and although many factors can be used to determine the design of an organization's information system, this article focus on two critical dimensions: the amount of information, the overall volume of data that an organization must collect, process and store on a regular basis and the tacit nature of information, that is the exchanged within the organization. Tacit information is not readily articulated as a set of facts or rules, and so is difficult to transfer.

The two dimensions of the amount of information and tacit nature information are summarized in figure 2.18 and suggest four possible general approaches to information systems design.

![Figure 2.18](image)

Let's analyse furthermore this four approaches:

- **Event-driven** - both overall amount of information-processing and the tacit nature of information are low. Event-driven systems are reactive to needs as they arise and require little planning to implement or forethought, thus systems are designed to process information associated with specific results or occasions as they occur. Event-driven systems make sense in small and reactive organizations here the tacit nature of information is low - the meaning of information is clear and readily interpretable.

- **Data-driven** - when the amount of information to be processed increases insight and tacit nature of information is low, information systems design should become more data-driven. This approach is appropriate for organizations that must process a high volume of information in order to increase the organization’s information-processing capacity, on the other hand this approach assumes that information can be readily captured and store, and the low tacit nature of information is key to the efficiency.

- **People-driven** - organizations that process highly tacit information that is relatively low in amount of information, should use the people-driven model for information systems design. This approach emphasizes capture, processing and transfer of what is in the minds and actions of individuals. However it presumes that information of the organization is difficult to codify in a routine way. The people-driven approach makes sense wherever the tacit and relatively unique nature of information requires interpersonal interaction in order for information to be effectively transmitted.
• **Relationship-driven** - if both overall amount of information-processing and the tacit nature of information are high, then it is the most complex model for information systems design is also the one with the greatest potential for promoting organization efficiency and effectiveness. This approach emphasizes capture, processing and transfer of data that is embedded in relationships or links between people and data. The relationship-driven systems are complex to develop because they include both data-driven and people-driven elements, and integrate codifiable data with interpretation data for organizational decision making. [Burton et al., 2006]

2.2.12 Fits between organizational design concepts

Table A.2 in the appendix A shows the best fits between all concepts studied in this section 2.2. This table represent the correlations and alignment between all concepts of this section, each column represents the organizational space quadrants (A, B, C and D) and each line represents the concepts.

Each of this situations fit the concepts in the organizational space, in other words, for an organization to be align in a determinate quadrant its strategy, goals, environment, structure, complexity, tasks design, people and information systems must be of the same column.

Here are represented only the best fits between all concepts in the organizational space quadrants based on the [Burton et al., 2006]. However for more details, which are out of scope of this article, about fits and misfits refer to [Burton et al., 2006].

2.3 Organizational Architecture

*Organizational architecture is a coherent whole of principles, methods, and models that are used in the design and realization of an organization’s structure, business processes, informations systems, and infrastructure.* [Lankhorst, 2005]

An enterprise architecture captures the essentials of the business and its evolution, the most important characteristic of an enterprise architecture is that it provides a holistic view of the organization.

The business defines what is part of the enterprise architecture, and what is only an implementation within that architecture, so the architecture marks the separation between what should not be tampered with and what can be changed more freely. Therefore exists a high demand for quality on the architecture; quality means that the architecture actually helps in achieving essential business objectives. [Lankhorst, 2005]

2.3.1 Architecture Methods and Frameworks in a concise form

Architecture framework defines how to organize the structure and views associated with an organizational architecture, but don’t provide the concepts for the actual modelling. Although some frameworks are connected to a specific modelling language, it identifies and relates different architectural viewpoints and the modelling techniques associated with them, however most frameworks are precise in establishing what elements should be part of an enterprise architecture.

On the other hand an architecture method provides discipline to gather and organize data in a way that helps insure integrity, accuracy and completeness of an architecture, meaning that is a collection of techniques for creating and maintaining an enterprise architecture. [Lankhorst, 2005]

Some important methods for enterprise architecture:
2.3 Organizational Architecture

- **Rational Unified Process (RUP)** - is a comprehensive process framework that provides system delivery, implementation and effective project management, of interest because it defines an iterative process, as opposed to the classical waterfall process (see Royce [1970]). An extension to the RUP was given by McGovern et al. [2004] named Enterprise Unified Process (EUP) which includes new phases and several new disciplines to the RUP. For a more detail about the RUP process refer to Jacobson et al. [1999].

- **United Nations Centre for Trade Facilitation and Electronic Business (UN/CEFACT) Modelling Methodology (UM)** - is a incremental business process and information model construction methodology. The scope is to capture business requirements of inter-organizational business processes, omitting technology-specific aspects, see UN/CEFACT [2006]. Currently under development is the Business Collaboration Framework (BCF), will be a specialisation of the UMM aimed at defining an organization external information and their underlying business activities Lankhorst [2005].

- **The Open Group Architecture Framework (TOGAF) Architecture Development Method** - is a method for developing architecture for enterprise systems that address the needs of business technology and data systems, describes a phasing for developing an IT architecture and was developed by The Open Group. see Blevins et al. [2004]

**The IEEE Standard 1471-2000, and other frameworks**

The IEEE Standard 1471-2000 approve by the IEE Computer Society [IEEE, 2004] is a recommendation of the architecture description of software intensive system, with a number of valuable concepts and terms of reference, which ”reflects the generally accepted trends in pratice for architecture” and which ”codify those elements on which there is consensus”. Although it builds a solid theoretical base for the definition, analysis and description of system architectures. Lankhorst [2005]

The IEEE standard 1471-2000 doesn’t try to standardize the system architecture by fixing a number of the nature of views as in the case of the Zachman’s framework or standardize the process of developing architecture. The figure 2.19 show the conceptual model of architecture description based on IEEE [2004]

The standard provides a clear separation in the central role of the relationship between architectural viewpoint and architectural view and between architecture and its architecture descriptions. It gives a set of definitions for key terms such as architect, architecture description, architectural models, model, system stakeholder, mission, views, architectural viewpoint and others and also provides a conceptual framework (figure 2.19), which is meant:

- to explain the relation between key terms in a conceptual model for architecture description;
- to explain the role of the stakeholders in the creation and use of an architecture description;
- to engage a number of scenarios for the architectural activities;

Moreover, the 1471-2000 gives architecture description practices: architectural documentation, identification of the system stakeholders and of their concerns, selection of architectural viewpoints, architectural views, consistency among architectural views and architectural rationale for the selection of the current architecture choosing from a number of considered alternatives. Alson provides a relevant number of architectural viewpoints and more importantly to note that architecture descriptions that are compliant with the standard IEEE 1471 can be used to meet the requirements of other standards Lankhorst [2005]
To consolidate the enterprise architecture in terms of development it’s important to mention the following frameworks for architecture development:

- **Zachman framework** - provides a formal and highly structured way of defining an organization’s systems architecture, in such a form for classifying and organizing the descriptive representations of an organization that are important to the management. [Zachman, 1996; Lankhorst, 2005]

- **The Open Group Architecture Framework (TOGAF)** - provides a comprehensive approach to the design, planning, implementation of an organization information architecture, initially was a generic framework and methodology for development of technical architectures, but evolved into an enterprise architecture framework and method. TOGAF version 8 is dedicated to enterprise architectures\(^2\). See also [Putman, 1991; Zachman, 1996]

- **Reference Model for Open Distributed Processing (RM-ODP)** - provides a co-ordinating framework for the standardization of the Open Distributed Processing (ODP) and for architecture specification of large distributed systems. See also [Putman, 1991; Zachman, 1996]

### 2.3.2 Architecture Viewpoints

Viewpoints are specifications of the conventions for constructing and using views [Proper, 2004], on other words, provides a mean to focus on particular aspects of an architecture description, these aspects are determined by the concerns of the stakeholders when communication takes place. Although viewpoints can be used in uni-directional, informative conversations, they also can be in general use in bi-directional classes conversations: the architect informs the stakeholders and stakeholders consent or critique on the present aspects. In fact what is shown or not shown in a view depends on the scope of the viewpoint and on what is relevant for the stakeholders, ideally these are the same because the viewpoint is designed with the specific concerns of a stakeholder in mind. [Lankhorst, 2005]

In the context of architecture descriptions, exists a number of viewpoint frameworks such as Zachman framework [Zachman, 1996], Kruchten’s 4+1 view model [Kruchten, 1995], RM-ODP [Putman, 1991] and TOGAF [Blevins et al., 2004], but these frameworks have been constructed by their authors in an attempt to cover all relevant aspects and concerns of the architecture of some of the class systems, leaving the responsibility for architectures and designers of selecting the viewpoints for a specific situation.

However in practice numerous organizations have defined their own frameworks of viewpoints of their architecture, mainly because the existing frameworks aren’t flexible enough to accommodate all the viewpoints needed for the architecture description [Lankhorst, 2005]...

### Classification of Viewpoints

[Lankhorst, 2005] introduce a framework for the definition and classification of viewpoints and views, this framework is based on two dimensions: purpose and content dimensions. The purpose dimension of an architecture view is support by the following three types:

- **Designing** - support architects and designers in the design process from initial sketch to detailed design;
- **Deciding** - support views assisting managers in the process of decision making by offering an insight into cross-domain architecture relations;
- **Informing** - help to inform any stakeholder about the enterprise architecture;

The objective of this classification is to assist architects on the finding of suitable viewpoints given their task at the moment, e.g, the purpose that a view must serve and the content it should display. This framework doesn’t provide an orthogonal categorisation of each viewpoint into one of three classes - these classes are not exclusive in the sense that a viewpoint must only be in one category, instead it can achieve another type of support in the other categories [Lankhorst, 2005].

For characterizing the content of a view [Lankhorst, 2005] defines the following abstraction levels:

- **Details** - views of the detailed level typically consider one layer and one aspect; e.g., stakeholders are process owners responsible for effective and efficient process;
- **Coherence** - at coherence level multiple layers or multiple aspects are spanned; e.g., stakeholders are operational managers responsible for a collection of IT services;
- **Overview** - this level addresses both multiple layers and multiple aspects; e.g., such overviews are addressed to enterprise architects or decision makers such as CEOs;

Tables A.1 and A.3 in appendix A show examples and summarize the different purposes and abstraction levels.

### Basic Design Viewpoints

[Lankhorst, 2005] distinguish three main layers: Business (offers products and services), Application (support the business layer with application services) and Technology (offers infrastructural services). Figure 2.20 illustrates the elements of an enterprise architecture within this layers.

Also [Lankhorst, 2005] introduced the concepts of enterprise modelling using the concepts of ArchiMate [ArchiMate, 2004], which is a enterprise modelling language for enterprise architecture and base on the standard 1471 [IEEE, 2004].

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3 ArchiMate, http://www.archimate.org - The Open Group
### 2 State of the Art

A premise of the ArchiMate language is that the general structure of models within the different layers is similar, meaning that the same types of concepts and relations are used, although their nature and granularity differ. Therefore this uniformity permits the created models for the different layers easily be aligned with each other. Figure 1.1(a) in appendix D shows the ArchiMate symbols that will be used in the diagrams.

Based on [Lankhorst, 2005] experiences, he selected the most useful combinations in the form of a "standard" set of the basic viewpoints to be used with the ArchiMate concepts. For this article purpose it will refer the follow design viewpoints:

- **Organization viewpoint** - expound the structure of the organization in terms of its departments, roles, etc; figure B.1
- **Actor cooperation viewpoint** - relate the organization to its environment; figure B.2
- **Product viewpoint** - same as the actor cooperation viewpoint, relates the organization to its environment; figure B.3
- **Business process viewpoint** - describes the two main perspectives on the business behaviour; figure B.4
- **Business function viewpoint** - shows the main business functions of an organization and their relations in terms of the flows of information; figure B.5
- **Information structure viewpoint** - depicts the information and data used; figure B.6
- **Application structure viewpoint** - shows the structure of one or more applications or components; figure B.7

The above viewpoints figures and respective full description are in appendix B.

### 2.3.3 Architecture Analysis

Architects and stakeholders want to take well-informed design decisions regarding to an enterprise architecture. For that they need to compare alternative designs and make trade-offs between aspects like cost, quality, and performance and know the impact of a change on all aspects of an architecture and in their organization. Figure 2.21 illustrate the analysis dimensions, which classifies architecture analysis techniques according to different aspects. [Lankhorst, 2005] makes the distinction based on the types of analysis inputs and results: functional (e.g. structural and dynamic properties) and quantitative (e.g. performance and costs).
Functional analysis is used to understand how systems that conforms to an architecture works (evaluate the impact of a change on an architecture or the correctness of an architecture), on other words to gain insight into the functional aspects of an architecture. Although functional analysis do not answer quantitative answers like "how quick" or "how cheap".

Quantitative analysis techniques address the questions that functional analysis can’t give. Unfortunately architecture models normally do not provide sufficient data for perform detailed quantitative studies, but [Lankhorst 2005] said that is possible to do such studies based on structure and relate quantitative results obtained with existing detailed analysis methods (eg. simulation).

Also both functional and quantitative analysis distinguish two main types of techniques: analytical techniques and simulation. Simulation can be seen as the "execution" of a model; functional simulation is to gain insight into the properties and behaviour of an architecture and quantitative simulation is used to make statistical statements about the quantitative measures of a system based on multiple simulation runs. Analytical analysis provide a unique reproducible result; analytical techniques for quantitative analysis are normally more efficient than quantitative simulation, useful for providing the architect with an indication of performance measures and bottlenecks in an architecture model. [Lankhorst 2005]
Proposal

My assumption is that the analysis of organizational design and architecture identifies an important set of characteristics of an organization that must assure the development of an information system for that particular organization. I think this set of characteristics could help the interaction between the organizational culture and self-awareness, which could lead to a better communication between carbon processors (humans) and silicon processors (machines) Magalhães & Trbolet [n.d.].

3.1 State of the Art analysis

Since we have already studied some theories on organizational architecture and design, I propose an analyses of both organizational design and architecture to explore the possible relationships that I found, in the State of the Art chapter 2 between the architectural viewpoints with the aspects of organizational design.

The objective is to have views that can relate organization design aspects: strategies, goals, environment, people and others with organizational architectural aspects, such as: information flow, business processes and organization structure. Therefore, with these views it would be possible to infer a set of important characteristics that would benefit the organization and a development of an information system.

To clearly explain this proposal, I will use Lankhorst [2005] viewpoints which are in appendix B. I will hence show which organizational design aspects can be inferred from the architectural aspects of this viewpoints.

Starting with the organization viewpoint given by Lankhorst [2005], figure B.1 showing the structure of an internal organization (ArchiSurance organization), which is a view on how organization structure is today, but doesn’t reflect its goals or strategy that could be essential for adapting tomorrow’s organization internal structure.

In fact from this viewpoint I have analysed the structure and the organizational complexity design aspects. From this analysis I infer important characteristics such as: functional specialisation and service orientation of a structure design aspect, see sub-section 2.2.4, to measure the number of powerful forces affecting the organization and the degree of uncertain forces which have an impact on the organization. For organizational complexity, see sub-section 2.2.4, that also helps me to understand the vertical and horizontal differentiation of the sub-units in this viewpoint.

Looking at the actor cooperation viewpoint, figure B.2 I analysed the people (see sub-section 2.2.7) and the environment (see sub-section 2.2.3) design aspects. According to this viewpoint, it would be interesting to infer the characteristics of complexity and unpredictability of the environment to understand how these factors could affect the actor cooperation. On the other hand, infer from the people design aspect the relationship between the actors collaboration and their degree of specialisation and how this affects the capacity of information production.
In addition to the product and the business process viewpoints, figures B.3 and B.4 respectively, I analyse the environment, task and people design aspects. Therefore, as the actor cooperation viewpoint analysed in the above paragraph the same questions are raised here about the environment and people design aspects. However when analysing the task design aspect I infer characteristics such as: divisibility and repetitiveness of tasks (see section 2.2.6) and how this characteristics would relate to the composition of services.

On the one hand, the business function viewpoint, figure B.5, crosses the organization structure with the business functions. In fact, it would be logic do analyse the same design aspects that were analysed in the organization structure viewpoint, as well as the structure and the organizational complexity design aspects. Furthermore, I have also analysed the people design aspect, from which I infer the degree of specialisation of the actors from this viewpoint and understand how their specialisation is related to the business functions of the organization.

On the other hand the information structure viewpoint, figure B.6, shows the structure of information used in an organization. From this viewpoint I analysed the information system aspect (see sub-section 2.2.11), I also infer characteristics, such as the amount of information that must collected, processed and stored, and its tacit nature which corresponds to information that is not readily articulated as a set of facts or rules. These characteristics are important for the development of an information system that needs to understand what type of information must be processed in order to be aligned with the organization strategy.

The last example I would like to describe is the application structure viewpoint, figure B.7. In this case I have analysed the task design aspect, to infer from this viewpoint the divisibility and repetitiveness of tasks to understand its characteristics affects the application services.

Whether I analyse a viewpoint related with the organization structure or one related to the application structure are all transversal to the organizational design aspects. Examples of such situations are the people, the environment and the task design aspects which can be analysed from several standpoints. The characteristics inferred raise questions about these viewpoints which can’t be answered. However an organization needs to have self-awareness and be capable of understanding its organizational architecture and design and give an immediate response to the outputs that are read from its organizational design such as the organizational strategy alignment with its environmental complexity or optimise the efficiency or effectiveness of its business processes.

3.2 Proposal: Study case and methodology

How can organizational design and architecture benefit the organization self-awareness and the development of an information system for a particular organization?

Today’s business is changing at a faster rate and the organization information systems need to adjust to this reality. Unfortunately the truth is that the information systems are defocused from the strategy and business processes of the organizations. Nowadays everything is faster, communications are quick and global, millions of transactions are done in seconds. However, human beings cannot follow and make decisions alone, they need synchronisation techniques to be able to make pondered decisions. Tribolet 2005 said "the knowledge is manifested by action", three relevant points for an organization are mentioned in this sentence: the importance of the knowledge, the acts of the actors, and the actions (from the
people) that need to be done in order to accomplish a strategy. In fact this feeds the need of the alignment between the organizational self-awareness and organizational action, in other words, the alignment of the communication between humans and machines in order to achieve the strategies of the organization.

An organizational design and architecture analysis approach can identify a set of important characteristics for an information system to be more efficient, effective, capable of support a better communication between humans and machines, and that could be prepared for future strategy changes of the organization. As we see in the state of the art analysis section 3.1, I raised a series of questions that an organizational architecture analysis can’t respond. However, the organizational design aspects can identify non-explicit characteristics for the organizational architecture such as: the environment complexity, strategy, tasks divisibility or organizational complexity. In order to test this assumption I will analyse a real organization, ”Departamento de Investigação e Acção Penal” of Lisbon (DIAP) using a three step approach to demonstrate this assumption, see figure 3.1:

- **Step one** - Analyse DIAP in terms of organizational design and architecture, chapter 4
- **Step two** - Identify possible problems and requirements, chapter 5
- **Step three** - Identify a set of characteristics and possible improved architecture for DIAP, chapter 6

**Fig. 3.1. Summary of the analysis steps to achieve the macro objectives**

**Objectives to achieve with this proposal**

In addition to the important objectives explained in figure 3.1, it is necessary to achieve a set of sub-objectives to reach each macro objective presented in the figure. These sub-objectives can be accomplished in each analysis step, and their goal is to shape and understand the DIAP organization. The objectives which I want to accomplish when analysing DIAP are above mentioned in more detail:

- By analysing the organizational design aspects of the DIAP - I want to understand each organizational design aspect and in which quadrant it is best represented in the DIAP. This analysis shows the non-explicit characteristics that a traditional architecture analysis can’t retrieve.
- By analysing the organizational architecture of the DIAP - In fact to understand any organization it is necessary to analyse the different architectures that compose the DIAP organizational architecture,
such as: the structure architecture, information architecture, services architecture and business process architecture. From this analysis characteristics of the composition of the different architectures that could be improved can be retrieved.

- Identify requirements and problems in DIAP organizational design analyses - The non-explicit characteristics can show problems and misalignments between the strategy, environment, organizational complexity or other misalignments of design aspects of DIAP. This analysis can show the behaviour of DIAP and where it tends to go.

- Identify requirements and problems in DIAP organizational architecture analysis; - On the other hand the characteristics shown in the architectures can identify architectural design problems or identify possible improvements in certain architectures.

- Identify a set of characteristics and possible architecture solution for DIAP - Looking at the organizational architecture and design characteristics and problems as a puzzle and understand how architecture supports the design and vice-versa, how can it improve an organization with these characteristics and how to resolve the problems identified.

- Demonstrate that the integration of organizational design and architecture analysis can contribute to a better interaction between organizational culture and self-awareness - After the identification of the characteristics how they can improve the organization in terms of organizational culture and self-awareness, communication, efficiency and effectiveness.

**Evaluation metric**

I will use and test this approach in a real case: "Departamento de Investigação e Acção Penal" of Lisbon (DIAP), so the evaluation of my work will be based on how I demonstrate the analysis of both the organizational architecture and how design could help the improvement of the organization in terms of the information system, interaction between the organizational culture and self-awareness, efficiency and effectiveness of the organization and communication between carbon (humans) and silicon (machines) processors.
The DIAP organizational design and architecture analysis

This is the first step described in the proposal (chapter 3). Here I present the analysis of the Lisbon DIAP architectures (to simplify the writing I have written DIAP in detriment of the Lisbon DIAP). A particular stage of a law process in Portugal is the coordination of the investigation which has the responsibility to investigate assumptions and/or facts that support evidences of a criminal act. The DIAP is an organ of the Public Ministry of Portugal, see figure 4.1, and it is responsible for the coordination of investigations and criminal prevention. Its actions also follow the Portuguese law and a bureaucratic administrative process to asset each inquiry.

![Public Ministry of Portugal configuration diagram](image)

This chapter shows the DIAP architecture and presents an organizational design analysis which corresponds to the actual state of DIAP known as AS-IS architecture and design.

4.1 The DIAP organizational architecture: AS-IS

The DIAP represents the Public Ministry in the criminal instruction court of Lisbon and its mission is to prevent criminality. I have studied DIAP as a sub-organization inside the Public Ministry of Portugal (organization) [DIAP-Lisboa 2008]. The main responsibilities of the DIAP are three:

- Responsible for the coordination of investigations and inquiries of the penal action law in the "comarca"² of Lisbon.

² Comarca (circumscription of courts) represents a set of courts in a restrict geographical frontier
• Responsible for the coordination of investigations and inquiries concerning to violent or complex crimes in the judicial district\(^3\) of Lisbon.
• Responsible for representing the Public Ministry of Portugal in the criminal instruction court of Lisbon.

4.1.1 Organizational configuration and roles

The figure 4.2 represents the configuration of the DIAP composed by the coordination department and four types of sections: central sections, generic sections, semi-specialized sections and specialized sections. The central sections offer support processes throughout the organization. However, generic sections are responsible for investigating inquiries of any criminal type. Thus, semi-specialized sections are responsible for investigating inquiries of criminal type and inquiries that weren’t distributed to the specialized sections. Finally specialized sections are responsible for investigating only inquiries of criminal type.

According to the DIAP-Lisbon 2008, the central sections are composed by central I and II sections and the autonomous sections: 14\(^{th}\) section and 15\(^{th}\) section. They are central because, they offer support processes throughout the organization, for example central sections I and II are responsible for the registry of all the administrative documents of the organization. They are also responsible for the management of the IT system, storage area, archive area, real estate, vehicles flee and human resources management. On the other hand the 14\(^{th}\) section, deals with the expedient of death certificates, supporting other sections that request information on it. However, the 15\(^{th}\) section is responsible for the inquiries related to crimes committed by unknown people, for example, if a drug traffic crime is committed typically the 1\(^{st}\) section would deal with the inquiry, however if the investigation doesn’t lead to a suspect, the inquiry is dealt by the 15\(^{th}\) section.

On the other hand inquiries are distributed taking in account three factors: criminal type, complexity and deadline for an inquiry be resolved. Another factor that could contribute to its distribution is the section response capacity, for example if a section can only handle ten inquiries then the others are

\(^3\) A judicial district represents a set of judicial circuits in a restrict geographical frontier
distributed to other sections. So the most complex inquiries are distributed by its criminal type to specialized sections and semi-specialized sections. Following this the inquiries that weren’t distributed to the specialized sections are distributed to the semi-specialized sections. Finally, the rest of the inquiries that weren’t distributed are of the responsibility of generic sections.

Therefore, the specialized sections are separated by criminal type. For example the 1st section is responsible for inquiries related with drug trafficking and money laundering. The 3rd and 8th sections are responsible for inquiries related with fiscal crimes, scams, environmental crimes and counterfeit coin crimes. Notwithstanding, the 9th section is responsible for inquiries related with crimes of misbehaviour in public functions, IT crimes, real state value crimes and illegal acquirement of subsidies. Furthermore the 11th section is responsible for inquiries related with violent crimes, organized criminality, human trafficking and sport violence. Finally, the 13th section is responsible for crimes related with simplified homicides and inquiries, and prepared for a rapid intervention in special processes.

In addition the semi-specialized sections are also separated by criminal type but can handle inquiries of other criminal types that aren’t distributed to the specialized sections. So the 2nd section is a semi-specialized section and its responsible for inquiries related with abuse and sexual harassment crimes of minors. The 4th section is responsible for inquiries related with crimes against the police. The 6th section is responsible for inquiries related with body injury crimes and medical intervention homicides. Finally, the 10th section is responsible for inquiries related with military justice.

In contrast, the generic sections are responsible for the remaining inquiries that weren’t distributed to the specialized and semi-specialized sections, which can be related with crimes of any criminal type.

Furthermore an inquiry related with crimes of different criminal types is distributed taking main crime into account. For example if an inquiry is related with a drug traffic case and an IT crime, which is related with drug trafficking, it is distributed to the 1st section that will investigate both. So any inquiry even the ones related with crimes of different criminal types are investigated only by one section.

This reveals that only the specialized sections are truly specialized, because the inquiries given to these sections are according to the criminal types. However, since the remaining inquiries which are not given to specialized sections go to the semi-specialized and generic sections, they can be responsible by any inquiry regarding the criminal type. This, propose of this configuration is to distribute the most complex inquiries by the sections with more experience in resolving inquiries of a criminal type. That’s why semi-specialized sections also have a configuration separated by criminal type, firstly they receive inquiries regarding their criminal type expertise and then others less complex inquiries of other criminal types.

The figure 4.3 presents the roles and categories of the DIAP. The bailiff do administrative and support work, typically working within the same space as a prosecutor. He’s responsible for the distribution of information in the section, for example he manages incoming/outcoming reports, solicitations or dispatches documents and distributes them to the right people. However, the prosecutor (assistant-prosecutor or the republic prosecutor) have roles in the domain of coordination for example management of sections and its policies. He is also the only one who can be responsible for inquiries, so he can create, modify or archive an inquiry. Nevertheless, the general prosecutor can also be responsible for inquiries, however, he is responsible for the coordination of the entire organization, since this is a typical role of a director/manager.
In fact I came to the conclusion that the DIAP is an organization with its strategy based on a hierarchy, very bureaucratic policies and with a vision of department responsibilities by sections. According to [Magalhães & Tribolet, n.d.] organizational self-awareness must support not only the immediate operational plane but also the plane of being: the culture and values of the organization. Thus DIAP restrictiveness in its structure and rigidity in its hierarchy leads to a difficult integration of organizational self-awareness and culture.

### 4.1.2 External Entities

In fact the DIAP is responsible for inquiry coordination, however in it’s functional dependency the Criminal Police Organs (OPC) are execution entities which offer support to the inquiry. For example, if an inquiry investigation request more testimonials or more field investigation then the OPCs are the executers of those requests [DIAP-Lisboa, 2008].

The DIAP also equally promotes a set of relationships with other external entities (see figure 4.4) creating complex and demanding exchange information fluxes, where the most used format to exchange information is paper.
As shown later in sub-section 4.1.3 in the analysis of business processes, the relationship between the DIAP and other external entities is permanent and they are part of the inquiry life cycle. For this reason, the external relationships of the DIAP must receive particular attention, because the management of an inquiry could be compromised if we don’t see the inquiry life cycle as transversal to the various entities. For example during an inquiry investigation, the DIAP could request hospital information about a victim, talk multiple times with the whistleblower or request the OPCs, such as, PJ or GNR more field investigations. So in this case all these entities are part of the inquiry and cannot be neglected.

4.1.3 The DIAP business process architecture

In this chapter I present the functional analysis of the DIAP in two scopes, see figure 4.5. The first scope is relative to inquiry life cycle and the second scope is relative to the DIAP coordination and administration. Also I used BPMN to describe business processes workflows in detail and Archimate to describe business processes views.

In fact when analyzing each process and describing it in BPMN language, I try to adopt the Zachman framework which states that every existing thing is characterized by the answers of a set of six questions: What (data), How (function), Where (network), Who (people), When (time) and Why (motivation) [Zachman, 1996]. As stated by Magalhães et al. [n.d.] during the process analysis and modelling, “if activities A and B have no different when, what, where, who, how and why, then they should be regarded as a single activity. On the other hand, if an activity holds multiple answers for when, what, where, who, how and why, then it should be sub divided into different activities Sousa et al. 2006”. This helped me to distinguish activities from processes when analysing and modelling the DIAP business processes based on the document DIAP-Lisboa 2008.

Therefore in the inquiry life cycle scope I identified based on DIAP-Lisboa 2008 report nine macro business processes as shown in figure 4.5. Thus, these processes represent all the information exchange fluxes in the organization and the interactions with external entities. However, I decomposed the processes by their goals, which are: “(1) inquiry analysis and resolution, and (2) inquiry responsibilities change”.

Therefore the processes in scope of ”(1) inquiry analysis and resolution” are:
• DIAP complaint presentation process - describes the workflow of a citizen presenting a complaint in DIAP and subsequently all the iterations until the inquiry is resolved. A simply view of this process is shown in figure 4.6(a).

This process starts with a citizen filling and presenting a complaint. Thus, the complaint is subject to a pre-analysis to identify the criminal topology, then a new inquiry based on the complaint document is registered in the Inquiries Management System (SGI) system. The process ends when the inquiry is archived or lacks of information to proceed, however it’s important to note that the SGI system is always updated when an inquiry is modified or archived, see diagram C.2.

• OPC's complaint presentation process - the workflow of a citizen presenting a complaint in OPC and subsequently all the iterations until the inquiry is resolved.

This process is very similar to the "DIAP complaint presentation" process figure 4.6. However in this case a citizen doesn’t directly make a complaint to DIAP but instead to OPC which analyse and send it to DIAP, see diagram C.3.

• Inquiry and related documents entry process - describes the entry of inquiries in DIAP which are not yet created in the SGI system and the entry of documents which correspond to inquiries registered in the SGI system.

However the process starts when receive an inquiry or a document, thus, in the case of an inquiry its registered in the SGI system and the process ends. If it’s a document the SGI system update the correspond inquiry related with the document and the process ends, see diagram C.4.

• Definitive exit of an inquiry process - describes all activities and procedures related with the definitive exit of an inquiry from the DIAP to other entities.

In this case the process starts with the prosecutor analyzing the inquiry and creating the criminal dispatch. Then the inquiry is sent to the court, also the SGI system update the inquiry status and the process ends, see diagram C.7.

• Inquiry archive process - reflects all activities and procedures related with the archive of an inquiry.

So the process starts with an prosecutor creating a dispatch to archive the inquiry. If external entities such as courts or OPC don’t request the inquiry, then it is archived. The SGI system is updated and the process ends, see diagram C.9.

• Rogatory letter process - reflects the management of rogatory letters, in particular the management of this process by the coordination unit (international police cooperation). A rogatory letter is a formal request from a court to a foreign court for some type of judicial assistance.

In fact this process starts when an external entity sends a rogatory letter. Then the central section of DIAP receives and distributes it to an prosecutor. The process ends when the rogatory letter is delivered to the external entity. However, due to limitations of the SGI system, a rogatory letter is registered on a Microsoft Access database which creates an identifier. This SGI system registered the rogatory letter with the identifier as document related with a determinate inquiry, see diagram C.11.

Moreover I identify three of the nine macro processes having as goal the "inquiry change of responsibilities", this processes are:

• Investigation competence process - describes the request for competence of an inquiry investigation by a prosecutor or ministry public service.
Although the process starts with a pronouncement of incompetence dispatch by a prosecutor who wants to pass the inquiry investigation competence to another prosecutor. Then if he accepts the SGI system is updated and the process ends. If not the prosecutor who pronounced the incompetence dispatch has to accept the inquiry investigation. However, he could try to send it to another prosecutor repeating the cycle described above, see diagram C.1.

- **District competence request process** - describes the district investigation competence request for related inquiries.

So this process starts with an assistant-prosecutor sending a request of district investigation competence to the central section. Therefore if the section accepts the request, it is sent for the DIAP coordination and PGDL to be analysed. Finally if the request is accepted the assistant-prosecutor receives the data relative to the request, see diagram C.8.

- **Inquiry redistribution request process** - describes all activities and procedures related with inquiry redistribution.

Therefore this process starts with an assistant-prosecutor that wants to redistribute an inquiry. Then he sends a redistribution request to the central section. If the central section accepts the request, it goes for distribution to be given to a new prosecutor and the process ends. However, if the central section doesn’t accept, the assistant-prosecutor stays responsible for the inquiry and the process ends. On both situations the SGI system is updated, see diagram C.6.

Nevertheless, in the DIAP coordination and administration scope, I identified three macro business processes as shown in figure 4.5. Furthermore these are processes of support which have impact in inquiry life cycle and therefore in the processes described above:

- **Report process** - describes disclose illicit crimes giving origin to new inquiries, see diagram C.5.

In this process the citizen sends a report to the central section which sends it to the secretariat to be analysed and distributed to a prosecutor.

- **Solicitation process** - describes the entry of solicitations on under ongoing inquiries, directly to the direction of DIAP. Solicitations are requests that a citizen can make to DIAP.

In solicitation process, the citizen sent a solicitation to the central section and then to the secretariat to be analysed and registered in the SGI system as a document. Finally a prosecutor analysed the solicitation and sent an answer to the citizen, see diagram C.10.
4.1 The DIAP organizational architecture: AS-IS

- **Hierarchy flux process** - in contrary with the other processes analysed, this process doesn’t reflect a composition of actors and activities. However, reflects the DIAP hierarchy circulation and control mechanisms of an inquiry such as: processual accelerations and schedule control, see diagram C.12.

In fact, this analysis reflects a rigid structure and chain of command in DIAP. Reinforcing the idea that DIAP restrictiveness in its structure and hierarchy imposes difficulties in integration of organizational self-awareness and culture.

4.1.4 The DIAP information architecture

To provide more insight of the DIAP architecture, it’s important to define which business objects and representations of information are important and how they are related with the business processes.

According with the figure 4.7, the inquiry is a complex business object which agglomerates other business objects and representations of information. In fact, understanding which business objects and representations are part of the inquiry business object, helps to verify in concrete which business objects and representations are related with the inquiry and business processes.

Therefore, it is important to understand the meaning of a business object and a representation. A business object, in the Archimate language, represents the important “informational” or “conceptual” elements in which the business thinks about a domain may be accessed. A business object may be accessed (e.g., created, read, written) by a business process, function, a business interaction, a business event, or a business service. On the other hand, in the Archimate language, representations are the perceptible carriers of information that are related to business objects (for example, messages or documents). A single business object can have a number of different representations, but a representation always belongs to one specific business object.

**Fig. 4.7.** Inquiry Informational entity and aggregation of other informational entities

In fact, the inquiry is composed by four business objects and three representations. First, the representation NUIPC refers to Unique Identifier Number of Criminal Process (NUIPC) and identifies the criminal process which is aggregated with the inquiry. Second, the representation “Arguido” refers to the
"arguido" accused of committed crimes. However, "arguido" hasn’t a direct translation in English, but in Portuguese common law a person is "arguido", if exists suspicions that this person has committed crimes and then gains special rights to defend himself. Third, the representation responsible prosecutor refers to the prosecutor responsible for the inquiry and which conducts the investigation. The business objects aggregated in the inquiry are documents relevant to many of DIAP business processes. First the crime report represents the crimes that may be committed by the arguido. With this crime report is possible to understand the crime criminal type and distribute the inquiry to the competent section. Second the complaint represents the document in which a citizen or an entity presents a complaint of an action that could be a crime. Third the Rogatory letter is a formal request from a court to a foreign court for some type of judicial assistance. The most common remedies sought by Letters Rogatory are service of process and taking of evidence. Fourth dispatch represents a document that is sent internally in the sections or between sections to approve/disapprove orders, solicitations or change of responsibilities. However all the dispatches are aggregated in the inquiry.

(a) The DIAP complaint process and informational business objects and representations

(b) Rogatory letter process and informational business objects and representations

**Fig. 4.8.** The DIAP processes and information architecture

Therefore the figure 4.8(a) represents the relation between DIAP complaint process and, the business objects and representations. In addition with this degree of detail it is possible to analyse that this process uses two business objects and two representations that are both from the inquiry business object. On this case the DIAP complaint process is responsible for the creation of the complaint document, then uses the crime report business object and NUIPC representation to register and distribute the inquiry. Finally if the inquiry is archived it sends a notification to the citizen or entity responsible for the complaint.

Another example is the rogatory letter process represented in figure 4.8(b). Hence this process is responsible for the creation of a rogatory letter and uses the representation NUIPC to know what inquiry
is related with this rogatory letter and uses the business object Dispatch, as a mean of communication between sections and prosecutors.

![Diagram of the DIAP organizational architecture]

(a) Solicitation process and informational business objects and representations

(b) Report process and informational business objects and representations

Fig. 4.9. The DIAP coordination and administration processes and information architecture

In addition figure 4.9 represents the DIAP coordination and administration processes and its related informational business objects and representations. Thus the solicitation process is responsible for the creation of the solicitation document and uses an expedient dispatch business object for communication between sections. On the other hand the report process is responsible for the creation of the report document, using the NUIPC representation to know which inquiry is related with the report and the dispatch business object for the communication between sections.

As seen from the examples above each process manipulates different business objects and representations. This raised security questions such as: who can have access to this information? Should it exist different access levels? The levels to access this permissions are based in roles?

4.1.5 The DIAP service architecture

This sub-section presents the DIAP service architecture which helps to understand the relationship between processes, services, roles and actors. Therefore to understand this relationship I taking as example the DIAP complaint business process and its relation with services, roles and actors which is shown in figure 4.10.

In fact the DIAP complaint presentation process has six services, been the inquiry documents and inquiry registry services related with the SGI system. Also the services shown in the figure 4.10 are related with different roles such as: inquiries documents management, inquiries distribution, inquiry
responsible, complaint responsible and inquiries management. However each actor could have more than 
one role, for example, the central section actor is responsible for the inquiries documents management 
and inquiries distribution. On the other hand each service could be used by different roles, for example, 
the inquiry archive service is used by the inquiry responsible and inquiries distribution roles. Thus the 
coordination between the actors, roles and services are supported by a manual activity, there isn’t any 
type of application to help differentiate access levels to the information for each role.

So the management of roles and security is done trusting in each entity to follow the organizational 
procedures, however there isn’t a true secure system since there isn’t a rigorous control of the access to 
the information.

4.1.6 The DIAP application and technology architecture

This subsection presents the DIAP application and technologic architecture which are fairly simple, as 
seen in subsection 4.1.3 few activities use any type of application or technology. Nevertheless the DIAP 
has an system called Inquiries Management System (SGI) which is responsible for the inquiries and 
related documents management. Thus every inquiry and related document has an entry in the system 
and any change on their status is recorded as well. So the SGI makes use of the four basic operations: 
Create, Read, Update and Delete (CRUD) to manage the inquiries and related documents.

In addition figure 4.11 presents the DIAP infrastructure system which is composed by two systems: 
the SGI infrastructure system and a Microsoft Access database system. The SGI infrastructure system 
aggregates the oracle database system and a local computer responsible for the operations processed in 
the oracle database. Hence the Oracle database realise one service, the inquiry and documents registry 
database service and the Microsoft Access database system also realise one service, the rogatory registry 
database service.

The existence of the Microsoft Access database is due to a limitation in the SGI to treat rogatory 
letters. So the rogatory letters are operated by the Microsoft Access system and they are access by the
personal computer. The relationship between an inquiry and its respective rogatory letters are made by an ID generated by the Microsoft Access system and stored in the inquiry profile in the oracle database system.

Therefore the SGI and Microsoft Access database are in a local computer, there is no security in terms of who can access the computer and who can manipulate the information - who can create/read/update/delete a determinate information. Also there is no automatic backups, so in case of a major failure all the inquires information could be lost. Even so there are sometimes manual backups with pens, CDs or DVDs.

On the other hand the SGI infrastructure and Microsoft Access database systems support respectively the SGI application and Microsoft Access application. The SGI application realise directly two services: the inquiry documents registry/update service which manipulates the entity inquiry documents and the inquiry registry/update service which manipulates the entity inquiry. In addition the Microsoft Access and SGI applications collaborate in the rogatory letter management service, so the rogatory letter is created in the Microsoft Access and the ID generated from this application is introduced in the respectively inquiry in the SGI application. Thus the rogatory letter management service manipulates the entity rogatory letter.

In fact the DIAP application and technologic architecture needs to be restructured, it needs to cover more services such as the communications between sections or exchange of information (documents, inquiries) by an technologic mean.
4.2 The DIAP organizational design: AS-IS

In this section it is analyzed the DIAP taken in account the organizational design aspects studied and define where it fits in each quadrant of a design aspect. In fact each design aspect represents the building blocks of the organization, each building block is mapped onto a series of two-dimensional graphs and are interlocking such that a specific quadrant in any one graph corresponds to the same quadrant in all other graphs. In this way, is easy to visualize the relationships among the organizational design components.

The DIAP goals are to maximize efficiency, effectiveness and optimize resources management having insight on the best possible service for the citizen. Also it’s highly hierarchical and follows general procedures to coordinate and investigate inquiries, giving it flexibility to quickly adjust as inputs become known. In practical terms this means it tries to achieve more efficiency by resolving more inquiries per year. In fact I conclude that its strategy according with the strategic design aspect fall in analyser without innovation quadrant, see subsection 2.2.2. In fact DIAP isn’t a common organization, it hasn’t got competitors and consequently has always a high position in the market. Like so its pressures are made by the Public Ministry. After a meeting with prosecutor Dr. Manuel Magriço, I realized that DIAP is strong on exploitation, meaning that its efficient on using resources within its condition (many business processes are manual or use a simple application) and constantly searches for new ways to optimize its processes.

Furthermore the inquiry is transversal to many entities which demands that DIAP needs to communicate with many external entities, see section 4 which help in the investigation of an inquiry. An inquiry investigation is highly complex with many interdependent factors which are unpredictable or hard to predict and are bound with several external entities which serve as input to it. In fact my analysis suggest that its environment is in turbulent quadrant of the environment aspect design discussed in chapter 2.2.3. In addition its environment demonstrates high number of unpredictable and interdependent factors from its interaction with many external entities that contribute to an inquiry investigation such as: public institutions and Criminal Police Organ (OPC) (see chapter 4). Moreover the existence of an uncertain degree on how forces impact the organization, e.g how Criminal Police Organ (OPC) information can change the course of an inquiry investigation?

On the other hand this organization is composed by one central section and twelve process sections. Its focus is on inquiries which are after all a sort of a service for external entities such as the prosecutions1 which need the result of an inquiry investigation to make an accusation. Almost all sections have people with the same degree of specialization like sections 1st or 3rd which are specialized by criminality type, see subsection 4.1.1 but sections 5th or 7th are responsible for investigating generic crimes which have people specialized in different criminal types. Nevertheless besides a mist of specialized and generic sections, they are relative independent of each other and are overseen by an executive level (director and coordination division). Then sections are responsible for their activities with limited coordination from the executive level. So the configuration design aspect falls in Divisional quadrant, see sub-section 2.2.4.

As a matter of fact a section have their inquiries investigation tasks broken between prosecutors teams, meaning a vertically distribution of subtasks across the section. Thus being an inquiry an aggregation of documents it is relatively easy to separate the work such as: request solicitations, dispatches or rogatory letters. Also the inquiries investigations hardly leads to a repetitive work in its tasks, inquiries are very

---

1 Prosecutions - In Portuguese common law an prosecution (“procuradoria”) accuse an arguido of a crime in court of law with evidences resulting from inquiry investigations
complex, besides the existence of rules, laws and procedures. Then the substance and the nature of
tasks from a specific inquiry is always different, hence making tasks hard to be repetitive. according
with the task design aspect it falls in the fragmented quadrant of task aspect design, which shows high
divisibility and low repetitiveness of tasks, see subsection 2.2.6.

This organization also tries to maximize its efficiency and effectiveness regarding inquiries tasks.
DIAP coordination doesn’t directly coordinate internal entities from a section. A major advantage of this
structure is that each section has autonomy to focus on its own work (inquiries investigations). According
with the organizational complexity design aspect it falls in the Flat quadrant, see subsection 2.2.4

In addition DIAP treats very complex inquiries and has complex administrative procedures, which
lead to a natural tendency to have a high number of people with high professionalization, all prosecutors
need to have a superior diploma in law and many bailiffs have a high degree in administration. In fact my
analysis suggests that the people design aspect falls in the office quadrant since it’s both high in number
of people and professionalization, see subsection 2.2.7.

Any inquiry investigation complies with general procedures which are obligated and are according
with the Portuguese law, each inquiry investigation tasks are always delegated to a team of prosecu-
tors experienced with the nature of the crime investigated by the inquiry. However when dealing with
investigation tasks, prosecutors are free to try different methods or approaches if and only if they are
in line with the general procedures. This method of delegating and working tends towards optimizing
the effectiveness of an inquiry investigation. Exists here an uncertain avoidance due to the obligation of
follow general procedures and a natural tendency to delegate investigation tasks due to the hierarchal
and divisional configuration of DIAP. As follows my analysis suggest that the leadership style design aspect
falls in Leader quadrant, see subsection 2.2.8.

The communication between prosecutors is mainly ad-hoc inside groups and teams, however exists
a rudimentary application named SGIs to support inquiry investigation progress, basically a CRUDs
system. My analysis suggest that the structures for managing knowledge exchange design aspect falls in
the AD-HOC quadrant, see subsection 2.2.5.

Furthermore DIAP organizational climate has low work tension or stress between employees, they
work as a group, exists confidence between them and also exists general procedures to help them in an
inquiry investigation. Also DIAP sections follow general procedures in an inquiry investigation, however
the prosecutors try different methods or approaches during an investigation have to always be in agreement
with the general procedures. The DIAP is an organization with low readiness to change (the degree to
which the people in the organization are likely to shift direction) because in the end they have to be
in agreement with the general procedures. Hence my analysis suggests the organizational climate design
aspect falls in the group quadrant, see subsection 2.2.9.

As I explained in the above paragraphs the DIAP has general procedures to deal with each step of an
inquiry investigation, although there is a tendency to decentralization of coordination. This phenomenon
occurs in teams responsible for an inquiry investigation, management of tasks are kept in the team
without a constant control by the coordination. However DIAP tends to have a high formalization since
it has formal procedures that must me followed and these procedures are deeply embedded in the hearts
and minds of employees no matter where they reside in the organization. Thus my analysis suggests the
coordination and control design aspect falls in the clan quadrant, see subsection 2.2.10.
In addition there is a high volume of information that as to be treated for each inquiry and most of it of tacit nature (not readily articulated as a set of facts or rules). This information is captured by relationships or links between people and data, this people can also be external to DIAP like external entities which gives a high flow of information. However like we have seen in the DIAP organizational architecture analyses, its information system isn’t efficient. It doesn’t integrate many of business processes activities such as communication or exchange of documents between sections. Moreover isn’t currently integrated with OPC or court law information systems. Diverse factors contribute to this unsuccessful information system, such as: adverse to change, complexity, politics, bureaucracy or budget. Thus I conclude the information systems quadrant falls in relationship-driven quadrant, see subsection 2.2.11. Finally table 4.1 summarizes the fits of design aspects with the DIAP organization.

<table>
<thead>
<tr>
<th>Design aspect</th>
<th>Quadrant</th>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategy</td>
<td>analyser without innovation</td>
<td>A</td>
</tr>
<tr>
<td>Knowledge exchange</td>
<td>AD-HOC</td>
<td>A</td>
</tr>
<tr>
<td>Climate</td>
<td>Group</td>
<td>A</td>
</tr>
<tr>
<td>Configuration</td>
<td>Divisional</td>
<td>C</td>
</tr>
<tr>
<td>Organizational</td>
<td>Flat</td>
<td>C</td>
</tr>
<tr>
<td>complexity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Task design</td>
<td>Fragmented</td>
<td>C</td>
</tr>
<tr>
<td>Leadership style</td>
<td>Leader</td>
<td>C</td>
</tr>
<tr>
<td>People</td>
<td>Office</td>
<td>D</td>
</tr>
<tr>
<td>Coordination and</td>
<td>Clan</td>
<td>D</td>
</tr>
<tr>
<td>control</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Information Systems</td>
<td>Relationship-driven</td>
<td>D</td>
</tr>
<tr>
<td>Environment</td>
<td>Turbulent</td>
<td>D</td>
</tr>
</tbody>
</table>

Table 4.1, DIAP and fit with aspects of organizational design, order by quadrant.
The DIAP architecture and design analysis problems and requirements

In this chapter I present the DIAP architecture and design analysis problems and requirements. After the analysis AS-IS it is important to discuss which problems DIAP has and what its requirements are in order to accomplish a set of characteristics which are important to improve organizational efficiency, effectiveness and a development of a new information system.

5.1 The DIAP architecture problems and requirements

The present DIAP configuration shows restrictiveness in its structure and rigidity in its hierarchy which leads to a difficult integration of organizational self-awareness and culture [Magalhães & Tribolet n.d.].

The analysis made in chapter 4 shows that the DIAP suffers from a number of problems:

- Structure misalignment with the business processes;
- Inefficiency in external/internal communication and resources waste;
- Lack of improvement of the business processes in terms of efficiency and effectiveness;
- Lack of a true coordination and control system;
- Lack of a real infrastructure system;

In fact the DIAP presents a structure that doesn’t match its business processes, the work that is done in semi-specialized sections is equally done in the generic sections, there isn’t a need to have these different sections. Communication both internal and between the DIAP and other external entities is also inefficient and leads to a massive amount of human and economic resource efforts. In addition, it’s business processes could be improved in terms of efficiency and effectiveness, for example the use of technologies or applications to substitute many manual processes and activities, such as, the exchange of documents between prosecutors and bailiffs. Furthermore, it’s service architecture analysis shows inefficiency in terms of coordination and control systems, which goes inline with the lack of an infrastructure system to attend to all the organization needs.

As a rescue, the actual DIAP structure is inefficient, thus creating more bureaucracy. For example in the case of semi-specialized sections they process specifically by crime and generic inquiries which can result in a high demand of work if both specific and generic inquiries are complex and aren’t distributed in the proper manner between the semi-specialized and generic sections.

Moreover the communication both internal and external is mostly done by the use of paper and through excel. Thus many documents exchanged don’t have a template which doesn’t help the exchange of information between sections, and the external communication is made via paper and excel. Actually the communication is inefficient, ineffective, costly and insecure since employees or paid services (like the post office) need to transport the information across the various sections or external entities. Furthermore, in the case of an inquiry which is an aggregation of various documents, see subsection 4.1.4 such as: reports, dispatches, rogatory letters and complaints cause problems in terms of its management. In fact
these problems are related with the exchange of this information between sections, external entities and prosecutors, where it goes from hand-to-hand and is subjected to many people which could alter anything in the inquiry. In addition the historic of each document (who change, the information?, where was it change?, when was it changed?, why was it changed?) is difficult to know since there isn’t an information management track.

On the one hand there is an inefficiency in terms of coordination and control. There are many roles and actors in each service, however there isn’t a proper access control system that differentiates the access by roles and their respective actors. For example the SGI system, as explained in the above chapters, tracks the inquiry status such as: inquiry in process? Inquiry archived? In what section is it? Who is responsible for it? Thus during an inquiry investigation, if any team member (of the inquiry investigation) changes something in the inquiry, the SGI system only registers the change in the name of the inquiry responsible. So if person A is responsible of an inquiry investigation and person B (a team member) modifies the inquiry only person A be registered in the SGI system as an editor, this is an inadequate access control which doesn’t properly shows who changed the inquiry.

On the other hand the infrastructure architecture is also inadequate. The SGI and Microsoft Access database systems are running in a local computer, which means that is difficult to have more than one person inserting/updating data at the same time. Also in the case of a catastrophe there isn’t a backup or redundant system to recover the data. Finally the access control of who is creating/modifying data is also inadequate in the Microsoft Access database, since it doesn’t keep who has changed the information.

This analysis shows many fragile and urgent problems that must be solved in the DIAP, in fact four issues should be consider to understand the complexity of the problems.

- Firstly communication - using paper as the main support for the communication is slow, expensive and unsafe;
- Secondly the numbers of services related with a process - the more services a process has the more complex a process can be in terms of access to the information;
- Thirdly the number of roles that can access a service - this reveals how many access levels there must be to differentiate each role in the access to that service;
- Fourthly the number of actors related with more than one role - helps to understand if a specific actor is overloaded with responsibility and if is effective doing different things and not specialized only in a few;

Most of this complexity is shown in figure 4.4 and 4.10 of chapter 4. Possible solutions for these problems are presented in chapter 6.

5.2 The DIAP design aspects problems and requirements

The DIAP organizational design analysis presented in chapter 4.2 shows how the DIAP fits in each quadrant of the various organizational design aspects. In fact table 4.1 represents the building blocks of the organization, each building block is mapped onto a series of two-dimensional graphs and are interlocking thus, making a specific quadrant in any one graph correspond to the same quadrant in all the other graphs. In this way, is easy to visualize the relationships among the organizational design components and identify where there are misfits in the organization design.
In fact from table [4.1] it is relatively simple to understand that organization design aspects don’t all fit in the same quadrant which creates misfits. Misfits are misalignments within the organizational design components that may lead to deterioration in the organization efficiency and effectiveness. This is important because an organization has its own specificity and could be doing well in some quadrants that typically cause problems in terms of efficiency and effectiveness to other organizations.

Therefore, the first step to improve the DIAP organization design is by analyzing the misfits, since they are the starting point for the implementation of change. The idea here is to push the DIAP organization in the various design aspects towards quadrant D, which is considered the highly efficient and effective quadrant of an organization. However this has to consider the organization goals and has to analyse aspect-by-aspect. The last step are the conclusions that can be retrieved from this analyses.

From table [4.1] we have three design aspects in quadrant A, four in quadrant C and four in quadrant D. Firstly we have to analyse why some design aspects in quadrants A and C and if them make sense to try to change the DIAP design in each of these quadrants to bring it to or near to quadrant D. Secondly analyse why some design aspects of the organization are in quadrant D and if the design can be improved.

Below is the analysis of the design aspects which are not in quadrant D:

- Strategy
- Managing knowledge exchange
- Climate
- Task design
- Leadership style
- Configuration
- Organizational complexity

The strategy in the case of the DIAP must be according to with the Portuguese law. In fact its strategy fits well in the quadrant of the analyser without innovation, see section [4.2], the objective is not to explore new opportunities or innovate solutions but rather focus on the efficiency of the resources and following the Portuguese law; a perfect example were there isn’t a need to change design aspect quadrant. Therefore, the DIAP must carefully study a new strategy before implementing and needs to have mechanisms to simulate if the new strategy is considered a path. Such mechanisms can be the management of knowledge that could help to understand similar past strategies and implement a new strategy in an isolated department and evaluate its performance. On the other hand new strategies to be applied in the DIAP must also be adapted without disturbing the ongoing internal procedures and inquiry investigations.

The analysis of structures for managing knowledge exchange design aspect in the DIAP suggests that this organization is in the Ad-hoc quadrant (see subsection [4.2]). This reflects how this organization has low extent to which it relies on information technology-based systems (IT-infused). It also has problems transmitting and retaining knowledge from the prosecutors and external entities such as the OPC. Therefore I suggest that the DIAP needs to be in the network quadrant, which is contrary to the current situation. This organization has to be capable of linking communications between sections and have a standard channel of communication with external entities such as the OPC. Also capable of knowledge sharing management so that prosecutors can found similar inquiry investigations that could help them in the current inquiry investigation. In addition rely more on their business process activities in the IT
systems, with the insight of improve the efficiency and effectiveness of the inquiry investigations and business processes.

The analysis of climate aspect design suggests this organization is in the group quadrant (see subsection 4.2). In fact this is not the quadrant where this organization must be, because this demonstrates that the DIAP has low readiness to change. Although the people in the organization try new methods to resolve tasks in an inquiry investigation, they can’t shift direction or adjust their major strategy to meet new and anticipated challenges because it always has to follow general procedures, imposed by the Portuguese law, when dealing with an investigation inquiry. I suggest that the DIAP needs to approach the developmental quadrant since this represents a change in the readiness to change, although this represents a need to change these general procedures to allow prosecutors to try and adjust their strategy without being confined to procedures dictated by the coordination. This could thus help in the creation of new strategies that improve the effectiveness and efficiency of inquiry investigations and at some point improve the organization business processes. Also organizations in the developmental quadrant have to focus on external information like the DIAP which exchanges documents with the OPC investigation reports, rogatory letters and solicitations. It is however important not to forget about the knowledge management so that can be shared between prosecutors and sections.

Moreover, the analysis of the task design aspect suggests that this organization is in the fragmented quadrant (see section 4.2). In fact this quadrant could be correct for the DIAP, the substance and the nature of its tasks from a specific inquiry investigation is always different, thus making tasks hard to be repetitive. In addition they could typically be divisible into sub-tasks which are normally attributed in a section to a team of prosecutors and these teams can also take creative approaches (under the scope of general procedures made by the organization) to complete their tasks. However, I would suggest that inquiry investigation tasks could be beneficial if they were shared across DIAP sections to accelerate the investigation helping the efficiency and effectiveness of an inquiry investigation.

In addition the analysis of the leadership style design aspect suggests that this organization is in the leader quadrant (see subsection 4.2). I tend to agree that this is the correct quadrant, because organizations in the leader quadrant have a high preference for delegation, low uncertainty avoidance and a focus on effectiveness which is in agreement with the DIAP. However, the DIAP is vulnerable to weak following behaviour in the process of implementation, such as: implementing new strategies in an adequate way and resistant to change. In fact the preference for delegation is patent in it’s hierarchy and the inquiry investigations tend for its nature to be a risk when following some action courses, making the uncertainty avoidance low.

On the one hand the analysis of the configuration design aspect suggests that this organization is in the divisional quadrant (see section 4.2). I am renitent that this is the best quadrant for this organization, as it as a fractional structure where each fraction (section) is independent from the others. For example there isn’t a share of inquiry investigations which doesn’t promote efficiency and even effectiveness because there isn’t a real share of information between the sections. It also doesn’t handle the interdivisional dependencies well which only occurs between the central sections and the rest of the section and not between specialized, semi-specialized or generic sections. Due to this I suggest that the DIAP needs to be in the matrix quadrant (see subsection 2.2.4) which aims to achieve the twin goals of efficiency and effectiveness and promotes more interoperability between sections. The matrix type can be very flexible, dealing with new information and adjusting to the new situations quickly, use limited resources
5.2 The DIAP design aspects problems and requirements

to meet the organization priorities, which is exactly what the DIAP is trying to do. The challenge is that the DIAP with this new configuration could start making parallel investigations in the same inquiry of different crimes with different criminal types. For example if an inquiry investigation is about drug trafficking and IT crimes, the specialized section of drug trafficking crimes and the specialized section of IT crimes could work together, sharing information so as to make the investigation more efficient and effective.

On the other hand the analysis of organizational complexity design aspect suggest that this organization is in the flat quadrant (see section 4.2). I wouldn’t suggest this quadrant for the DIAP. This organization has autonomous sections with segmented work and the coordination bears the burden of coordinating among these subunits, where many problems can occur such as: sections get out of synch or/and lack coordination which leads to inefficiencies for the organization as a whole. I would suggest DIAP to achieve the symmetric quadrant to solve it’s problems. The organizations in this quadrant promote the work broken down into many task specialties as well as many vertical reports across sections and the exchange of knowledge (experience, methods...) between sections which could help accelerat an inquiry investigation.

The analysis of the design aspects which are quadrant D are as follows:

- people
- environment
- coordination and control
- information system

The analysis of people design aspect suggests that this organization is in the office quadrant (see subsection 4.2). I tend to agree that this is the quadrant where the DIAP should be. The inquiry investigations demand highly professional people who to know and apply the Portuguese law, as well deal with complex inquiry investigations. Notwithstanding, DIAP needs to improve communication between people and the organizational structures. It also needs to improve its business processes to achieve and maintain a high level work routine such as of filling in forms, if a form is standard through the whole organization it will make the process of communication flow much more efficiently from one section to another.

In addition the analysis of environment design aspect suggest that this organization is in turbulent quadrant. I must agree that this is the correct quadrant for the DIAP. Since the inquiry investigations are by norm complex and always have unpredictable factors which could add more complexity to the investigation. However due to the nature of a turbulent environment and the DIAP having a limit time to complete its investigation inquiries, it has to choose quickly among alternative courses of action. So its business processes have to be efficient and effective enough to respond in time when alternative courses need to be chosen. As an example the DIAP faces inquiries with many entities and interdependent factors which are hard do predict so applying the best procedures or adjustments for each situation must be made together and made quickly. Then the turbulence of the DIAP environment make me understand that the efficiency and effectiveness of the inquiry investigations are directly related to the efficiency and effectiveness of the business processes.

Moreover the analysis of coordination and control design aspect suggest , that this organization is in clan quadrant (see subsection 4.2). Once again I tend to agree that this is the correct quadrant for the DIAP. The DIAP is somewhat decentralize in terms of work, such as delegation of tasks and some
liberty in methods used for this. However, its formalization is a natural part of the organization since it has to respect and apply the Portuguese law without any ambiguity. This leads to a high formalization of all the procedures and document structures so that they reflect the Portuguese law without doubts or ambiguities. So the high formalization can be a problem when the organization is trying to improve its processes in terms of efficiency and effectiveness.

Finally the analysis of the information system aspect suggest that this organization is in the relationship-driven quadrant (see subsection 4.2). I also do tend to agree that this is the correct quadrant for the DIAP. The DIAP deals with a high amount of information specially in the inquiry investigations and most of this information is of tacit nature. Information of tacit nature is characterized by causal ambiguity and difficulty of codification which often occurs in the course of an inquiry investigation. In fact the DIAP needs to optimise the management of information with the insight of being more efficient in processing tacit information.

The DIAP table is presented in figure 5.1 and fits with the organizational design aspects. However in this table the last column to the right represents the quadrants suggested for the DIAP architecture design. In this analysis it is patent that the DIAP needs to improve some architecture design aspects to solve some problems in order to optimise efficiency and effectiveness of the organization.

<table>
<thead>
<tr>
<th>Design aspect</th>
<th>Quadrant: AS-IS</th>
<th>Position</th>
<th>Quadrant: TO-BE</th>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategy</td>
<td>analyser without innovation</td>
<td>A</td>
<td>analyser without innovation</td>
<td>A</td>
</tr>
<tr>
<td>Task design</td>
<td>Fragmented</td>
<td>C</td>
<td>Fragmented</td>
<td>C</td>
</tr>
<tr>
<td>Leadership style</td>
<td>Leader</td>
<td>C</td>
<td>Leader</td>
<td>C</td>
</tr>
<tr>
<td>Climate</td>
<td>Group</td>
<td>A</td>
<td>Developmental</td>
<td>C</td>
</tr>
<tr>
<td>People</td>
<td>Office</td>
<td>D</td>
<td>Office</td>
<td>D</td>
</tr>
<tr>
<td>Environment</td>
<td>Turbulent</td>
<td>D</td>
<td>Turbulent</td>
<td>D</td>
</tr>
<tr>
<td>Configuration</td>
<td>Divisional</td>
<td>C</td>
<td>Matrix</td>
<td>D</td>
</tr>
<tr>
<td>Organizational complexity</td>
<td>Flat</td>
<td>C</td>
<td>Symmetric</td>
<td>D</td>
</tr>
<tr>
<td>Coordination and control</td>
<td>Clan</td>
<td>D</td>
<td>Clan</td>
<td>D</td>
</tr>
<tr>
<td>Knowledge exchange</td>
<td>AD-HOC</td>
<td>A</td>
<td>Network</td>
<td>D</td>
</tr>
<tr>
<td>Information Systems</td>
<td>Relationship-driven</td>
<td>D</td>
<td>Relationship-driven</td>
<td>D</td>
</tr>
</tbody>
</table>

Table 5.1. DIAP and it’s fits in the organizational design aspects: Revised and order by quadrant.
The DIAP Organizational Design and Architecture Integration

The analysis of an organization in a perspective of organizational design and architecture shows an important set of characteristics for the DIAP architecture and possible development of an information system. Many of these characteristics could be neglected if the analysis of organizational design isn’t made. Examples of design aspects such as: people, strategy, environment, leadership style and coordination and control, impose the identification of characteristics that could be neglected or omitted in an analysis of an organizational architecture without the design aspects.

I suggest a solution for the architecture of the DIAP here based on the analysis made in chapter 4. I found several problems in the DIAP in terms of architecture and design such as problems in organizational configuration, organizational complexity, technology architecture or structures for knowledge exchange.

Therefore I proposed that a new architecture for the DIAP must support and adapt the organization strategy, for this matter it is important to understand two aspects: its environment which is turbulent and deals with unpredictable factors, such as evidences of crimes, and complex inquiry investigations which could lead to many changes in the strategy of the organization and the other factor is organization configuration which is an aggregation of sections with a rigid structure. A new architecture must have the capacity to support a flexible configuration enough to be adapted to any strategy which should extend to local changes, for example, changing a section strategy or configuration without disturbing the rest of the organization. As a solution I put forward that the configuration must be restructured to match the strategy and business processes within the organization. Since only specialized sections are specialized and the generic and semi-specialized sections in practice can handle any inquiry, the organizational configuration could be divided into generic sections, specialized sections and central sections. Therefore there is no need for semi-specialized sections, thus the generic sections would handle any generic and less complex inquiry and the specialized sections would handle complex inquiries, see figure 6.1. The specialized sections could also be divided by specialisation and the generic sections would be divided to help management and division of work, however, all generic sections and specialized sections would need to exchange information and maintain a knowledge database.

Fig. 6.1. A TO-BE DIAP configuration diagram
On the one hand I suggest an architecture which could handle multi-tasks and exchange of information support. It has to permit more than one person to modify information in the system, such as, to support inquiries and documents management and other bureaucratic and external documents. According with my analysis, in section 4.1 many of these documents are in paper support which makes many of the business processes activities inefficient and time consuming since there is a waste of resources and a waste of time in the exchange of documents. The DIAP also has autonomous sections with segmented work and the coordination needs to coordinate among these sections which can get out of synch. So using an application to exchange information and communication, such as shown in figure 6.2 could help to improve the organizational complexity.

On the other hand, an architecture should support the communications with external entities (typically Criminal Police Organ (OPC)) which are part of the inquiry life cycle. Thus the reality of the DIAP is that communication is made by exchanging documents or by direct talking between people without relying on any technology-based system. Once again this brings diverse problems such as: security, waste of resources and time consumption which could be resolved by an application where all the communications were made in a digital way such as by email, wikis or intranet webpages. This could also bring more efficiency and effectiveness to many activities such as the exchange of inquiries, solicitations, rogatory letters, reports, coordination documents and inquiry documents, thus people could know when the information would be retrieved, who is responsible for that specific information and see an historic about the accesses and modifications of each information. As an example figure 6.3 describes an application to manage external communications could be used by the DIAP and the external entities to exchange information such as: documents, reports and solicitations. This platform would have a standardization between documents and every modification in any document could be immediately been seen by any of the external entities responsible/related to that document.

Furthermore, important characteristics that cannot be neglected are the security, control and coordination of the organization. An example of security and control problems is the SGI system which tracks
inquiries and related documents. Thus this application only works in a local computer with a rudimentary security (a simple password system) where there is a high risk of anyone unduly modifying information, also if something happens to the computer all the information could be lost which could delay many inquiry investigations. Therefore, an architecture should support access monitorization to mitigate the risk of inadequate access to important information. I would advise applying RBAC [Sandhu et al., 1996] policy, since this policy can give the degree of detail to access an application by role, which helps tracking the relationships between roles and applications.

Another characteristic is that the Information System (IS) should support its access levels according to the roles of an actor. As I referred in section 4.1 the DIAP has actors with many roles in many services, for example the central section actor has two roles, the inquiry documents management which is related with the inquiry documents registry/update service and inquiries distribution which is related with the inquiry registry/update service. Thus the access to the information should be done according to the role-based access control because the DIAP has many different roles with many responsibilities, it also simplifies the management of permissions and users can be easily reassigned from one role to another [Sandhu et al., 1996].

Although a new architecture and information system could improve the efficiency and effectiveness by improving the business processes, activities and communications of the DIAP, the high formalization of this organization in terms of procedures detach the organizational beings (Humans) from the organizational self-awareness (organizational business processes). Because the organizational beings are seen as merely executers of the actions of the business processes following procedures, instead of the inclusion of the organizational culture and knowledge in the organizational self-awareness. The DIAP doesn’t have structures for the exchange of knowledge, the knowledge is exchanged between people via chat or in the working teams, however, without relying on information technology-based systems which could help in the preservation of knowledge. The DIAP architecture must contemplate structures for the knowledge exchange, inline with [Magalhães & Tribolet, n.d.], I propose a top-down action where the rational knowledge of the organizational architecture in conjunction with the interpretation of the organizational values permits a better implementation of strategies, efficiency and effectiveness in the organization. Thus this
could be accomplished in the DIAP if the information system supports each step of its workflow practices of knowledge management as seen in figure 6.4. In this case each activity knowledge is created and modified from the experiences that each prosecutor/bailiff has when dealing with the activity in question, any prosecutor or bailiff could use also the knowledge stored to learn from past experiences and do their work faster which improves in efficiency and effectiveness in that particular activity. Furthermore with the increase of experience and knowledge in each activity, the process starts to adapt this new knowledge in its procedures and execution, thus resulting in a better alignment between the organizational self-awareness and culture.

In fact a new architecture and information system for the DIAP would improve the overall efficiency and effectiveness of its business processes, the exchange of information, the communication within the organization and with external entities. Thus, the objective here is that this set of characteristic described above could help in an improvement of the DIAP architecture and a possible development of new information system. The interactions between carbon processes (humans) with the silicon processors (the machines) would also benefit.
Conclusion

In this dissertation I have made an organizational design and architecture analysis to a real organization ("Departamento de Investigação e Acção Penal" of Lisbon [DIAP]). This analysis is complex requiring a good understanding of the concepts and the organization been analyzed. In fact the proposal and objectives of my dissertation were achieved, I objectively analyse and have made my conclusions about the DIAP, although organizational design aspect analysis conclusions can differ from the person who is analyzing the organization.

![Diagram](image)

**Fig. 7.1.** Organization misalignment problem and solutions

In addition I proposed a solution for the DIAP with characteristic which can improve its architecture design. I could accomplish this solution by understanding how the DIAP architecture is and how it could be improved. In fact to improve the DIAP architecture was necessary to understand its architecture and design. Firstly the architecture help me to understand problems in the structure, business processes and infrastructures. Secondly the organizational design help me to understand the DIAP behaviours and strategy. Thirdly a DIAP architecture solution combining an restructured architecture (improvements on its configuration, business processes, infrastructures) with an organizational design (strategy and
behaviours) contribute to an improved architecture which can respond to the misalignment between the organizational self-awareness and culture.

Nevertheless the figure 7.1 shows what the improvements of the solution presented in chapter 6 could produce. In fact an organizational design and architecture analysis can give a better perspective of how the organization self-awareness and culture is attached to the architecture. Therefore it is possible to optimise an architecture to better integrate the organization self-awareness and culture, so that people, relationships and values of the organization are aligned with the business processes, tasks and strategies of the organization.

In fact the DIAP needs a new architecture and information system to solve many problems with efficiency and effectiveness in inquiry investigations. However we cannot forget the fact that this is an public organization which lacks of resources and budget to make a whole re-structure.
Future Work

It would be very satisfying to see this analysis and solution implemented in the DIAP. I think the solution would have to be more detailed in terms of architecture specification using for example UML to describe all the architectures and Archimate to specify all the business relations, using as a support the characteristics and recommendations from the solution presented in chapter 6. However it is important to understand that the DIAP is a very complex organization and a detailed analysis and implementation could take much time.
Organizational Design and Architecture - support tables

<table>
<thead>
<tr>
<th>Typical stakeholders</th>
<th>Purpose</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architect, software developer, business process designer</td>
<td>Navigate, design, support design decisions, compare alternatives</td>
<td>UML diagram, BPMN diagram, flowchart, ER diagram</td>
</tr>
<tr>
<td>Manager, CIO, CEO</td>
<td>Decision making</td>
<td>Cross-reference table, landscape map, list, report</td>
</tr>
<tr>
<td>Employee, customer, others</td>
<td>Explain, convince, obtain commitment</td>
<td>Animation, cartoon, process illustration</td>
</tr>
</tbody>
</table>

Table A.1. Viewpoint purpose [Lankhorst, 2005]

<table>
<thead>
<tr>
<th>Organizational design space quadrants</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information systems</td>
<td>Event-driven</td>
<td>Data-driven</td>
<td>People-driven</td>
<td>Relationship-driven</td>
</tr>
<tr>
<td>Coordination and control</td>
<td>Family</td>
<td>Machine</td>
<td>Market</td>
<td>Clan/Mosaic</td>
</tr>
<tr>
<td>Climate</td>
<td>Group</td>
<td>Internal process</td>
<td>Developmental</td>
<td>Rational goal</td>
</tr>
<tr>
<td>Leadership</td>
<td>Maestro</td>
<td>Manager</td>
<td>Leader</td>
<td>Producer</td>
</tr>
<tr>
<td>People</td>
<td>Shop</td>
<td>Factory</td>
<td>Laboratory</td>
<td>Office</td>
</tr>
<tr>
<td>Tasks design</td>
<td>Orderly</td>
<td>Complicated</td>
<td>Fragmented</td>
<td>Knotty</td>
</tr>
<tr>
<td>Knowledge exchange</td>
<td>Ad hoc communications</td>
<td>Informed</td>
<td>Cellular</td>
<td>Network</td>
</tr>
<tr>
<td>Organizational complexity</td>
<td>Blob</td>
<td>Tall</td>
<td>Flat</td>
<td>Symmetric</td>
</tr>
<tr>
<td>Structure</td>
<td>Simple</td>
<td>Functional</td>
<td>Divisional</td>
<td>Matrix</td>
</tr>
<tr>
<td>Environment</td>
<td>Calm</td>
<td>Varied</td>
<td>Locally Stormy</td>
<td>Turbulent</td>
</tr>
<tr>
<td>Strategy types</td>
<td>Reactor</td>
<td>Defender</td>
<td>Prospector</td>
<td>analyser with and without innovation</td>
</tr>
<tr>
<td>Organizational goals</td>
<td>Neither</td>
<td>Efficiency</td>
<td>Effectiveness</td>
<td>Efficiency and effectiveness</td>
</tr>
</tbody>
</table>

Table A.2. Fits between all concepts studied in the section 2.2, based on [Burton et al., 2006]
Table A.3. Viewpoint abstraction levels

<table>
<thead>
<tr>
<th>Details</th>
<th>Purpose</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Software engineer, process owner</td>
<td>Design manage</td>
<td>UML class diagram, Testbed process diagram</td>
</tr>
<tr>
<td>Coherence</td>
<td>Operational managers</td>
<td>Analyse dependencies, Impact of change</td>
</tr>
<tr>
<td>Overview</td>
<td>Enterprise architect, CIO, CEO</td>
<td>Change management</td>
</tr>
</tbody>
</table>

### B

**Basic set of Design Viewpoints**

These are the basic viewpoints which [Lankhorst, 2005] selected as the most useful, see sub-subsection 2.3.2. The follow viewpoints diagrams are examples applied to a fictional organization - ArchiSurance.

The organization viewpoint, figure [B.1] shows the structure of an internal organization, e.g. departments or other organizational entity. Normally this view us typically use to identify authority, competencies and responsibilities within an organization [Lankhorst 2005].

![ArchiSurance organization structure](Lankhorst 2005)

The actor Cooperation viewpoint, figure [B.2] focuses on the relations between actors and their environment. A important use of this viewpoint is in showing how a number of cooperating (business or application) actors together realise a business process, by showing the flows between them. This viewpoint show the interactions involving the actors, the insurer, the intermediary, and the customer’s bank in the insurance business and this main roles cooperate in different settings [Lankhorst 2005].

![ArchiSurance organization structure](Lankhorst 2005)
The main roles involved in the insurance business are the customer, the insurer, the intermediary, and the customer’s bank. These cooperate in different settings. For example, closing an insurance contract involves the customer, insurer, and intermediary, whereas premium collection involves the insurer, the customer, and the customer’s bank. The main collaborations of ArchiSurance, which fulfils the role of the insurer, are shown in Fig. 7.11.

Fig. 7.11. Collaborations of ArchiSurance and its partners [Lankhorst, 2005]

The product viewpoint, figure B.3, describes the value which this product offers to the customers or other external parties involved and shows the composition of products in terms of the constituting business services and other agreements [Lankhorst, 2005].

Fig. B.3. The travel insurance product [Lankhorst, 2005]

The business process viewpoint, figure B.4, is used to show the high-level structure and composition of one or more business processes. This viewpoint contains directly related concepts, which can be regarded as sub-viewpoint of the business process viewpoint, such as: the services a business process offers to the outside world, the assignment of business processes to roles, the information used by the business process [Lankhorst, 2005].

The business function viewpoint, figure B.5, shows the main business functions of an organization and their relations in terms of the flows of information, value or goods between them. Normally they are used to represent what is most stable about an organization in terms of primary activities it performs, regardless of organizational changes or technological developments [Lankhorst, 2005].
Fig. B.4. The Handle Claim Business process and its use of information \cite{Lankhorst2005}

The information structure viewpoint, figure B.6, is almost identical to the traditional information models created in the development of almost any information system. Illustrates the structure of the information used in the organization or in a specific business process in terms of data types or class structures \cite{Lankhorst2005}

Fig. B.5. Business functions and organization structure \cite{Lankhorst2005}

Fig. B.6. Information model of ArchiSurance \cite{Lankhorst2005}
The application structure viewpoint, figure B.7, shows the structure of one or more applications or components. This viewpoint is useful in designing the main structure of applications and to create a first-step work breakdown structure for building a system. [Lankhorst, 2005]

**Fig. B.7.** Main structure of the Home and Away Policy administration [Lankhorst, 2005]
DIAP business process diagrams

Fig. C.1. Investigation competence process [DIAP-Lisboa, 2008]
Inquiry and inquiry documents entry

Cidadão Atend. pr...

Outras ent...

OPC’S

Magistrado

Secções

Sec. Arq.

Registo de Inq.

Pre-Analysis of documents

Registry and distribution of inquiry

Physical archive

Preparation and presentation of the inquire

Inquire update and/or presentation

Archive and notifications process

Realization of "Diligências"

Inquiry deliver

Realization of "Diligências"

Pronounce dispatch

Realization of "Diligências"/external inf.?

Archive?

Yes

No

Send inquiry for redistribution?

Prognosis

Send inquiry for other units?

Send inquiry for OPCs?

Inquiry analysis

Realization of investigations

Inquiry deliver

Send inquiry for other units?

Send inquiry for other units?

Complaint presentation

Document reception

Complaint form

Reception and Registry of inquiry documents

Solicitation documents

Send answer?

End

Start

Fig. C.2. DIAP complaint presentation process [DIAP-Lisboa] 2008
Inquiry and inquiry documents entry

Cidadão Atend. ...

Outras entidades OPC'S Magistrado Secções Sec. Arq. Registo de Inq.

Preparation and presentation of the inquire

Inquiry reception

Update SGI System

Inquiry analysis

Send inquiry for redistribution?

Yes

No

Physical archive

Inquire update and/or apresentation

Inquiry deliver

Realization of "Diligências"

Yes

No

Send inquiry for other units?

Send inquiry for OPCs?

Yes

No

Send answer?

End

Notification

Send documents

Realization of "Diligências" process

Archive?

"Diligências"/external inf.?

Fig. C.3. OPC's complaint presentation process [DIAP-Lisboa, 2008]
Fig. C.4. Inquiry and related documents entry process [DIAP-Lisboa, 2008]

Fig. C.5. Report process [DIAP-Lisboa, 2008]
Fig. C.6. Inquiry redistribution request process [DIAP-Lisboa, 2008]

Fig. C.7. Definitive exit of an inquiry process [DIAP-Lisboa, 2008]
Fig. C.8. District competence request process [DIAP-Lisboa, 2008]

Fig. C.9. Inquiry archive process [DIAP-Lisboa, 2008]
Fig. C.10. Solicitation process [DIAP-Lisboa, 2008]

Fig. C.11. Rogatory letter process [DIAP-Lisboa, 2008]
Fig. C.12. Hierarchy flux and control mechanism of inquiries [DIAP-Lisboa, 2008]
Archimate and BPMN Graphical Notation

Fig. D.1. Archimate and BPMN Graphical Notation
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