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The Smart methodology for the life cycle of services

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Preface

Nowadays, services are more and more relevant in our life and in countries all over the world. The following Figure 0.1 shows the evolution of the labor force in the U.S. from 2.000.000 years ago to 2050, for the hunt, agriculture, manifacture, and services sectors, where the service sector is distinguished into informative services, and other types of services. This impressive figure shows that in modern economies services and information are the most diffuse product that is source of labour, used in business processes and sold in the market.

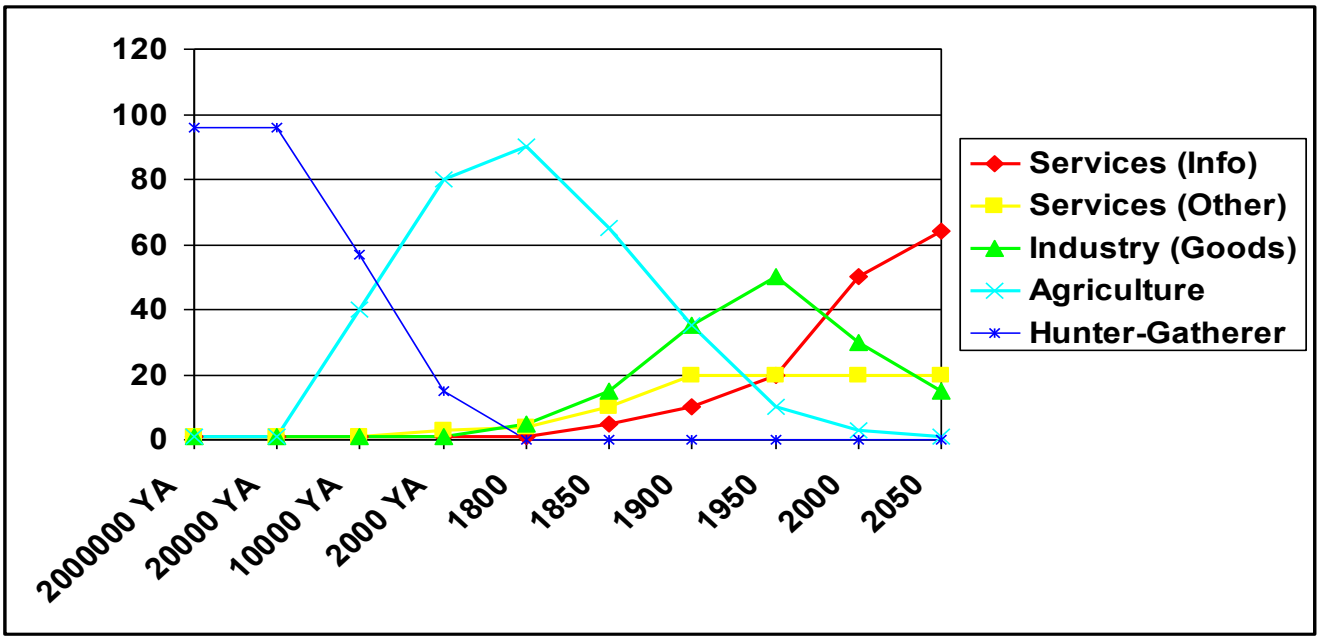


Figure 0.1: Estimated world (pre-1800) and then U.S. Labor Percentages by Sector - Estimations based on Porat, M. (1977) Info Economy: Definitions and Measurement

The book describes the Smart methodology for the service life cycle, produced as an output of the Smart project, funded by the Italian Ministry of Research. Smart has been extensively experimented in three relevant case studies based on administrative services of interest for Italian municipalities.

As other approaches to service design, Smart sees a service as an activity or series of activity, of more or less intangible nature, that they have place in an exchange between a supplier and a customer, where the object of the transaction is an intangible good so that both the supplier and the customer co-create and obtain value from the transaction. Providers of the service can be public administrations or private providers. Smart observes with specific attention the concept of value, that has different meanings and goals for the three above actors. Final users look for value in use, aiming at maximizing the relationship between benefits they obtain and sacrifices they make,

private providers rely on value in exchange, counting on revenue maximization against production and distribution costs, while public administrations, besides the administrative procedure they have to manage by law, aim for (or should aim for) other types of value such as social/public value.

The methodology proceeds initially with an activity of requirements collection, whose output is a structured tree of user goals. Such goals tree, together with rules and laws specifications for the service, lead to a service model, made of functional and non functional properties, qualities and data entities the services makes use. At this point, an assessment of quality and value of the service as-is is performed, that allows to fix the target improvement to be achieved for the service to-be. We are now in the production phase, that leads to model the service process in the BPMN language, initially as a public process and subsequently as a private process, in which services associated to the activities are implemented as web services or as new software components. The implementation end with a last step, where the an agile software production activity is performed.

The text aims to be self-explicative also for beginners. The different phases and steps of the methodology are applied using as case studies a. local police services, b. change of home address, and c. authorization to open a retail store, especially this last one.

The book is organized in six chapters and three appendixes. Chapter 1 is an introduction to all relevant adopted in the methodology. After an introduction to project Smart, we define the concepts of service, of service system and of service process, together with several classifications of services relevant for Smart. Then we introduce a model for service description, and the various types of service value that are of interest in Smart. We have at this point all the material needed to describe the Smart methodology, that is initially introduced in a simplified shape through a case study based on services for elderly people. Subsequently, the methodology is defined in a systematic way, in terms of phases and steps, showing its different versions, depending on the knowledge gathered on the service system and the effort available. For each phase and step we provide a description in terms of activities, inputs to the step and outputs produced by the step.

Chapters 2,3,4,5 examine in depth the four phases of the methodology, a. service planning, b. assessment of service as-is, c. design of service to-be, d. development of service to-be. For each phase and step in the phase a detailed description of the step is provided, that is illustrated by means of a fil rouge example, based on the “authorization to open a retail store/cafeteria. Other services are sometimes considered for examples.

Chapter 6 describes a management activity, that crosses the entire life cycle of the methodology, where the concept of portfolio of services is introduced, as an adaptation to services of the concept of asset portfolio, developed in the recent past for goods production.

Appendix 1 provides the list of non functional properties adopted in the Smart service model. Appendix 2 is a short introduction to the Business Process Modeling Notation (BPMN) language for process specification. Appendix 3 is an example of questionnaire that may be used to assess the value in use perceived for a service by a group of users.

We are indebted to John Forrester, Ancitel, for his contribution to a first draft version of sections 1.1, 1.2, and 1.4 of the Introductory chapter.

Summary

Chapter 1: The Smart Methodology

1.1. Introduction to the Smart Methodology

The goal of the book is to provide a description of the Smart methodology conceived for the life cycle of the service design, production and management process. The meaning of the acronym Smart is "Services and Metaservices for smART e-government"; the methodology addresses the service life cycle from the three different, but strongly related, points of view of a. public administration, b. final users, and c. private providers.

The concept of *service*, central in Smart, covers a very wide spectrum of issues in modern relationships between Public Administrations, private providers and final users; we just mention the fact that services contribute in developed countries to about 70-80% of the Gross Domestic Product, considering also services provided by Public Administration.

A second concept that is central in Smart, that characterizes Smart among many other methodologies for the service life cycle, is the concept of *service value*, seen, again, from the three points of view of Public administration, of the final users, and of private providers. We anticipate that, as to the relationships between public administration and final users, Smart considers the social and public value of services; as to the relationship between private providers and final users, Smart considers the value in use and the value in exchange. Therefore, before addressing the issue of the Smart methodology, we have to focus on the concept of service and its many facets.

This introductory chapter provides an overview of the main concept considered in Smart. Section 1 shortly recalls the aim of the project that has produced the methodology. This section can be skipped for the reader that is not interested in the historical development of the project. Then in Section 2 we discuss the concept of service and the different types of services that are invoked, provided and delivered in real life. In Section 3 we deal with the concept of service value. Section 4 describes the model adopted for services and processes that have to be executed for their provision. At this point in Section 5 we will be able to introduce the life cycle of Smart that will be exemplified with a simple real life example.

1.2. The concept of service

1.2.1. Introduction to services

Let's start our discussion from the concept of service, which has given rise to many definitions. We interact everyday with people and businesses to satisfy our needs, making use of various types of economic transactions, in which, given a payment, we can get a good which becomes ours, or rather we make use of an asset that is not our, to achieve a goal. In the second case we are talking of the use of a service. For example, when we buy a railway ticket to go from Milano to Roma, in Italy, we are using an asset not ours, the train, to satisfy our need to transfer from one place to another place. Once having arrived in Roma, our need is satisfied and nothing remains to us for use, in terms of the possession of the asset (the train) that provided the service.

A *service* consists of an activity or series of activities, of a more or less intangible nature, which take place in an exchange between a provider and a client, where the object of the transaction is an intangible asset. The exchange lasts in time and the provider and the client are co-producers of value.

Returning to the example of a train, assume that, if once we are on the train we do have the possibility of reserving a taxi at the station of arrival, or else we can change the reservation of the next train in a connection, if our train for some reason is late. The service provided doesn't disappear on arriving, but, as the definition affirms, is prolonged in time.

Services are produced and delivered (see Figure 1.2.1) in a system of services. A *system of services* (or service system or service ecosystem) is the set of norms, of social components, of organizations, processes, human resources, materials, and technologies that in society co-occur in the production and use of services. A system of services is characterised by three types of final users of services: citizens, businesses and the environment around us. Citizens, businesses and the environment in return cannot be considered a unitary whole.

The concept of type or user segment is defined in the marketing literature. A user segment of a service is a group of physical or juridical persons that have similar behaviour with reference to their propensity to invoke/buy the service. An example of a user segment are ecologically minded citizens who prefer when moving around to use of public transport as opposed to use exclusively private means of transport. Another example of a user segment is the set of citizens that need to change their home address.

Various types of service producers and suppliers provide services; these latter ones are also called *service providers*. The concept of service provider coincides with that of service supplier, but the concept of provider can also be applied to the activity of production. In order to produce and supply services, providers must perform a series of activities, noted in the following as service processes. A *service process* is a set of activities whose execution, according to a given flow of control, produces in output a service delivered to a user that needs it. If, for example, we want to reserve and benefit from a train travel, the reservation and acquisition of a ticket is the first phase of the corresponding process, which occurs going to a travel agency, or, more and more often, through the Internet. The second phase is time of the trip, in which resources such the train which transports us, the rolling stock, the personal on-broad, the personnel in the stations are involved. The preceding were examples of resources used to execute service processes, among them resources related to information communication technologies are of specific interest for us.

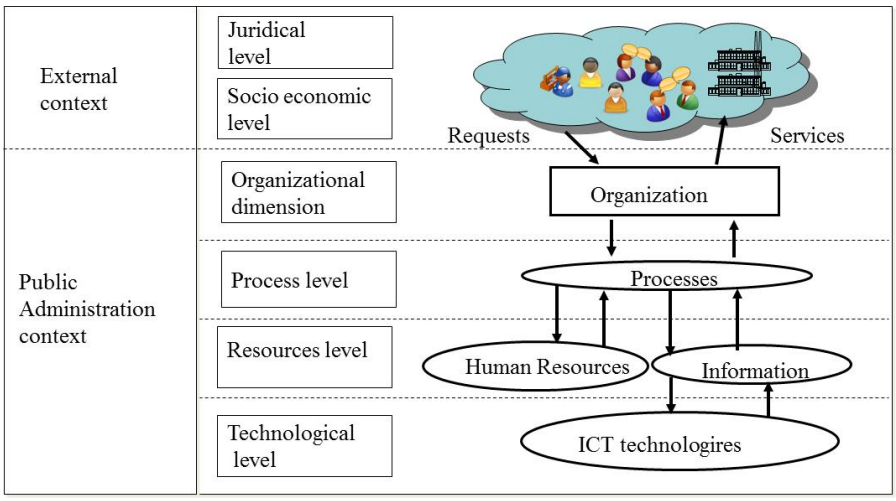


Figure 1.2.1: The service system

The role of Public Administration and private providers in service systems

Public Administration is all over the world a supplier of a vast array of services, as are the telecommunication service providers whose services we use every day through various types of mobile terminals. The differences between PA and private providers are multiple.

Most importantly, the delivery of services is a legal obligation for the Public Administration. For example, in Italy, on the basis of a law enacted in 1950, municipalities are responsible for the resident population registries. Therefore, if a citizen needs a residency certificate, he must go to the municipality, which is responsible for the validity and correctness of the information that the certificate contains. Private providers supply services on economic convenience. While in Italy and other e.g. European countries public transportation services are widely diffused, corresponding to a universal service that connects any two points of a city or an area of cities, in the United States, characterised by a much broader market economy and by lower public intervention, there are many cities where the transport services are managed exclusively or almost exclusively by private parties.

According to the context, prices of services are generally regulated in the Public Administration (PA) by laws, decrees or directives that keep in the society a form of social equity. Sometimes PA supplies services freely, while in fact financing them through taxes. Private providers supply services on payment, and revenues are the reason for their activity as a business. Finally, Public Administration in planning the production and supply of services is inspired by criteria that take account the needs of communities, and is therefore inspired by a social vision, while private parties are inspired by the market.

The production and supply of services takes place through information systems, called service oriented information systems. Their structure is shown in Figure 1.2.2 where the layers of Figure 1.2.1 are highlighted together with the relations of request and supply existing between them.

1.2.2. Types of Services

The concept of service includes of a vast amount of phenomena. As a consequence, it is necessary here to determine the perimeter of observation of the concept of service in eGovernment, the domain that is mostly considered in Smart. In this section we propose different classifications of services.

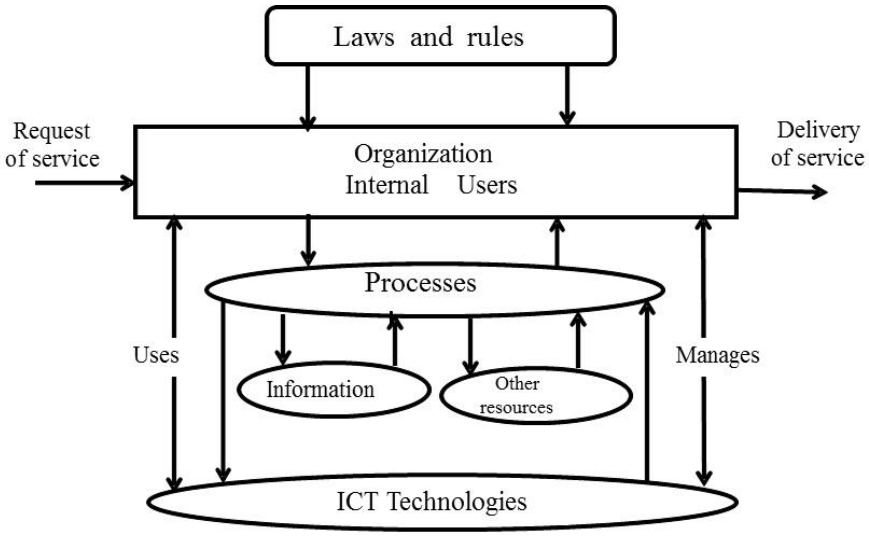


Figure 1.2.2: Structure of an Information System

1. *Classification according to the nature of the service provider*. In this case, we have:
a. *administrative services* (or *enabling services*), whose supply does not have a discretional nature on the part of the PA, because they derive from procedures defined by law;
b. services that we call *market-oriented* or *facilitative*, that the Public Administration may decide or not to provide, according to the presence of an procedural obligation, and that are more often supplied by private providers of the service market.

In eGovernment, administrative services supplied by PA are of primary interest, but it is also relevant to turn attention to services market-oriented, that are part of the expectations and needs of the users, and could be supplied by public or private parties.

2. *Classification according to the final nature of the service produced*. In this case, we have:

a. services that respond to the needs of users modifying their state (for example the granting of a license to a commercial enterprise modifies the state of the enterprise, enabling it to possibly increase its revenues); these will be called services that modify the state of the user or *world changing services* or simply *services*;
b. services whose aim is to provide information and/or knowledge that the user does not possess and that are useful for an operating activity of business, that is, a decision making process. These will be called *informative services*, or simply *information*.

An example of the first category is the provision of a commercial license that allows a business to sell its own merchandize. This service changes the state of the business because it enables a new commercial activity. An example of informative services is the information made available on opening hours of a laboratory, which does not change the state of the subject that sought the information, but gives it the possibility of undertaking an action or to make a decision to go there.

3. *Classification according to the consumer*. In this case, we can distinguish among:

a. *external* services, when the service is focused outside of the PA, towards the community of users and businesses;
b. *internal* services, when the service is dedicated to internal users in the provider organization, being PA or a private service provider.

The interest in eGovernment projects regards above all external services, which are supplied to final users. However, since, as we will see, in the context of value aspects tied to production costs and service supply are relevant, it is interesting to conceive internal services that positively influence external service production.

4. *Classification according to the phase of the service design and production life cycle*. In this case, we distinguish among:

a. *abstract* services, when services are considered at a conceptual level, independently form their concrete realization in a context;
b. *concrete* services, when services are considered in a specific technological production and management context; one concrete services correspond to a unique abstract service, while one abstract service corresponds to several concrete services.

As in other production cycles, for example software applications or data bases, service production takes place beginning from an abstract service and gradually refining its specification in terms of more and more concrete services. This is the motivation of the classification that has as further advantage, as we will see in a specific chapter, the possibility of reuse in the service life cycle.

1.2.3. The "continuum" between services and goods

Besides services, we know that other types of objects involved in economic transactions are goods and information; we have seen that information can be seen as a specific type of service, thus, there is no clear distinction between services and information, in the sense that both types of concepts belong to a more general concept of service. Likewise, between goods and services it is not possible to distinguish a precise line.

An interesting investigation on the continuum between goods and services, done using empirical methods, is described in [1]. It started out noting that marketing research has long ago recognised a distinction between services and goods and the implications of such differences in marketing strategies. The goal of the study was to test principles of the marketing of services in order to:

- furnish an empirical demonstration of some of the basic proprieties reported in the literature;
- develop a foundation based on empirical data from some generic inferences;
- encourage the study and critical comparison of some assumptions.

A selection of 46 goods and services (in the following objects) has been evaluated in [1]. By various samples of respondents on the various characteristics considered relevant, referring to the phases of:

- *search*, characteristics recognizable before the acquisition (colour, price, etc.). More typical of goods.
- *experience*, characteristics recognizable only with acquisition and use (taste, endurance etc.).
- *credence*, characteristics that are difficult to evaluate even after acquisition (effective legal advice), more typical of services.

Evaluations are done starting from:

- a first intuitive criterion of "good-ness" or "service-ness", that is how the object is near to one or the other basic concepts on the basis of user perceptions of it;
- a second criterion of selection, referring to the prevailing criterion among search/experience/credence adopted in the choice and in the acquisition of the object by the respondent.

Aside from these criteria, other criteria refer to a set of proprieties that the traditional literature on services associates to those of heterogeneity and tangibility. The term *heterogeneity* refers to the fact that services are characterised by a perception of great diversification, decidedly more significant with respect to the idea of greater standardization offered by goods. The term *intangibility* refers to the fact that the service cannot be touched or seen, so making it difficult to inform clients before about what they will obtain.

Displayed in Figure 1.2.3 are the results of the survey regarding the first and second of the proposed criteria.

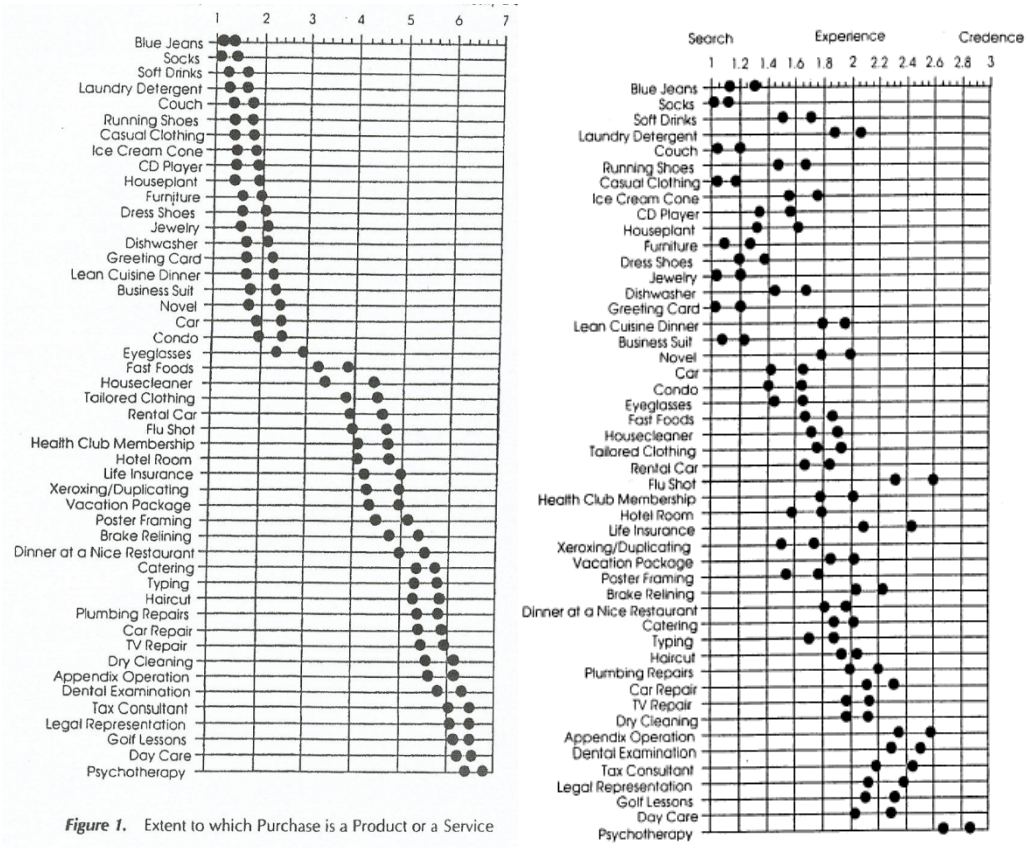


Figure 1. Extent to which Purchase is a Product or a Service

Figure 1.2.3: Results of the Survey

The conclusion to draw from the work of Jacobucci is that the difference between goods and services is more subtle than one could imagine, and this issue has to be taken into consideration in the service design and production life cycle.

1.3 The service model in Smart

In previous sections, we have introduced the concept of service, and provided several classifications for it. In this section, we examine in depth the concept of service from another point of view, namely we introduce a model suitable for describing relevant properties of a service or a group of services.

1.3.1 A motivating example

We start our discussion considering the case we need to travel in India, and our immediate goal is to get a visa for India; we contact two agencies, that, when requested for the conditions they apply to provide the visa, reply as shown in Figure 1.3.1.

Service goal	**Agency 1**	**Agency 2**
Need a visa to go to India	If you come to our agency we will provide you the visa to India in 7 days, the price is 30 euros, and the penalty for one day delay is 2 euros	If you come to our agency we will provide you the visa to India. We will do our best effort to provide you the visa in two weeks, the price is 20 euros.

Figure 1.3.1: Informal description of the "get a visa" service

Looking at the two specifications, our aim now is to provide them a structure, distinguishing the different parts that have different roles. We may identify the types of properties shown in Figure 1.3.2, corresponding to:

1. *functional property*, expressing "what" we get from the service;
2. *quality of service*, referring to characteristics (e.g., time of delivery) that specify perceived advantages or utilities associated to the service;
3. *non-functional properties*, expressing "how" the service is delivered to us.

Type of property	**Agency 1**	**Agency 2**
Functional property	- visa to India	- visa to India
Quality of service	- very fast (in 7 days),	- we will do our best effort to provide you the visa in two weeks.
Non functional properties	-the price is 30 euros, -the penalty for each one day delay is 2 euros.	- the price is 20 euros

Figure 1.3.2: Structured description of the "get a visa" service

Looking to the service description of Fig. 1.3.2, let us try to distinguish issues that can be considered at an abstract level, and are independent from the specific service implementation, and issues that we perceive are at a more concrete level, resulting in the two specifications shown in Figure 1.3.3 and Figure 1.3.4.

Type of property	**Agency 1**	**Agency 2**
Functional property	- Visa to India	- Visa to India
Quality of service	1. Service delivery time	1. Service delivery time
Non functional properties	1. Pricing 2. Penalty	1. Pricing

Figure 1.3.3: Abstract service

Type of property	Agency 1	Agency 2
Functional property	- Visa to India	- Visa to India
Quality of service	1. Service delivery time: 7 days	1. Service delivery time: best effort
Non functional properties	1. Pricing: 30 euros 2. Penalty: 2 euros for each one day of delay	1. Pricing: 20 euros

Figure 1.3.4: Concrete "get a visa" service

The two specifications of Figure 1.3.3 and Figure 1.3.4 correspond intuitively to the classification in term of abstract/concrete services we have introduced in Section 1.2. Furthermore, the above motivating example shows that services are characterized by an internal structure in terms of different types of properties that will be defined more precisely for abstract services in the next section.

1.3.2 A model for service description

An abstract service s can be described in terms of the following properties: (i) a name; (ii) a set of functional properties; (iii) a set of qualities of service, (iv) a set of non-functional properties; (v) a service data schema.

In the following we specify functional properties, non functional properties and the service data schema, while qualities of service will be discussed in Section 2.3 of Chapter 2.

Definition (functional properties): *functional properties* FP(s)={fp_1,…fp_n} of a service *s* describe *what the service does* for the customer. Each fp_i in FP(s) enables a change of state of the real world, coherently with the goals expressed by the customer.

An example of functional property description for the abstract "Hotel Reservation" service in Figure 1.3.5 is "reserve a room in a hotel".

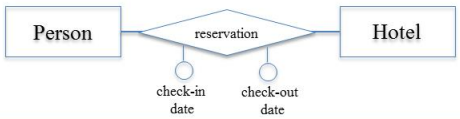
Service name	Hotel Reservation
Functional property	Reserve a room in a hotel
Non-functional properties	1. Price 2. Payment method
Service data schema	

Figure 1.3.5: Service model for the abstract «hotel reservation» service

Definition 5 (non-functional properties): *non-functional properties* NFP(s)={nfp_1,…nfp_n} of a service *s* define *how* the service performs the functional properties. Non-functional properties of services have been investigated by several authors, such as [2] and [3]. In the Smart project, we extend these contributions with a new classification that includes additional non-functional

properties emerged from the analysis of real services. The new classification is described in Appendix 1, where 98 NFPs are divided in 17 sections representing clusters of properties with inter-dependencies. Following our example on the "Hotel Reservation" service, examples of NFPs in Figure 1.3.5 are *price* and *payment method*. Let's note that, since we are considering an abstract service, the NFPs do not assume specific values.

Definition 6 (service data schema): A *service data schema* describes the types of data representing the state of real world when the service is executed. Abstract services can be seen as changes of states of the real world at a high level of abstraction, so we describe types of data involved in such changes as data conceptual schemas, adopting the Entity Relationship model [4]. An example of service data schema for the "Hotel Reservation" service is reported in Figure 1.3.5.

1.3.3. A model for the description of a set of services and of their semantic relationships

In previous section we have introduced a model allowing us to describe a single service. In our life events, to achieve our goals, we need to invoke a high number of services, referring to a corresponding high number of functional properties. Consider the event corresponding to a change of home address (see Figure 1.3.6). When we change our home address, we have to choose a new doctor, a new electricity and water supplier, we have to change our address in the driver's license, etc.

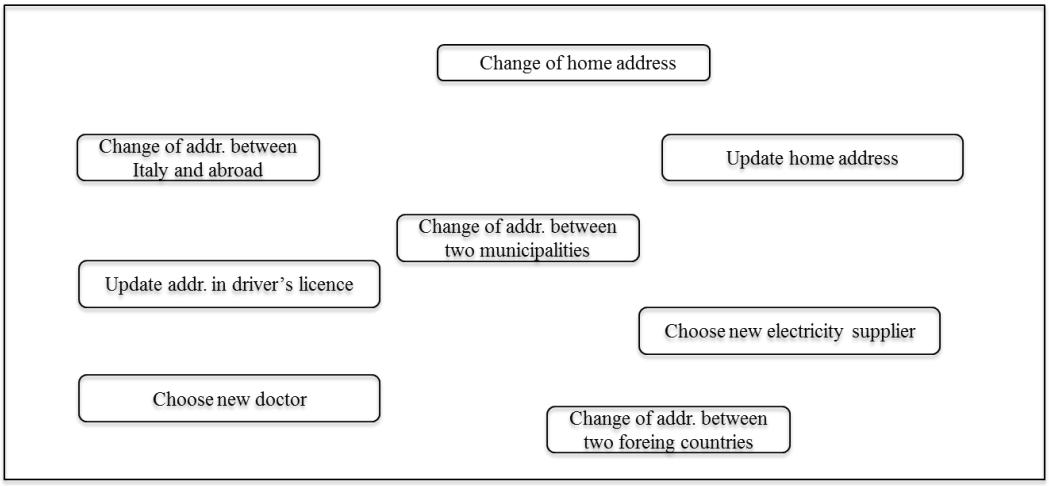


Figure 1.3.6: Set of services related to the «change of home address»

Further, the administrative procedure is different in the case we move from a municipality to another municipality, or else we change our address due to leaving our country to go to live abroad. We perceive that services represented in Figure 1.3.6 are conceptually related, but so far we lack semantic properties to express such relationships. The goal of this section is to define more precisely such semantic properties. We focus in the following on two basic conceptual relationships adopted in conceptual database models [4] [5]: the *part-of* and the *is-a* relationships.

Definition (***part-of relationship***): A *part-of* relationship holds between a service s_i (*the part*) and a service s_j (*the whole*) when the specification of s_j has as component part the specification of s_i.

Looking at Figure 1.3.7, we see that services *update home address*, *update address in driver's license*, *choose new doctor*, and *choose new electricity supplier* are all in part-of relationship with service "change of home address". We say that "change of home address" is a *composite* service, and the four services in part-of with it are *elementary* services, meaning we are not interested to further represent it in terms of more atomic components being in part-of relationships with them, such as, e.g. for the "update home address" service, the acquisition of the ID of the citizen, the access to the home address data base, and the print of the certificate. Basically, a service s_j is an *elementary service* if and only if it does not exist a service s_i with a part-of relationship with s_j. Vice versa, s_j is a *composite service*. To be noticed that part-of relationships can hold between composite services generating multi-level hierarchies, e.g., s_i *part-of* s_j, and s_j *part-of* s_z.

The part-of construct, while being effective in relating elementary and composite services, does not help us in expressing the semantic relationship existing between the different types of services related to the "change of home address" in the different contexts where they apply. We need for this purpose a new construct.

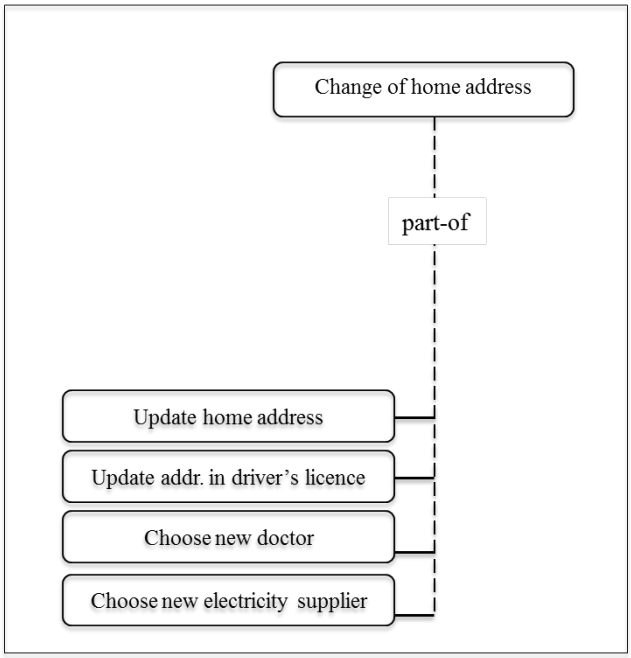


Figure 1.3.7: A composite service with elementary part-of services

Definition (***is-a relationship***): An *is-a relationship* holds between a service s_i (*child service*) and a service s_j (*parent service*) when s_i is a specialization (specific case) of s_j. According to the inheritance property of is-a relationships, s_i inherits all the (functional and non-functional) properties of s_j. Moreover, s_i inherits all the part-of relationships between s_j and its components, and all is-a relationships of s_j. s_i may have additional properties not owned by s_j.

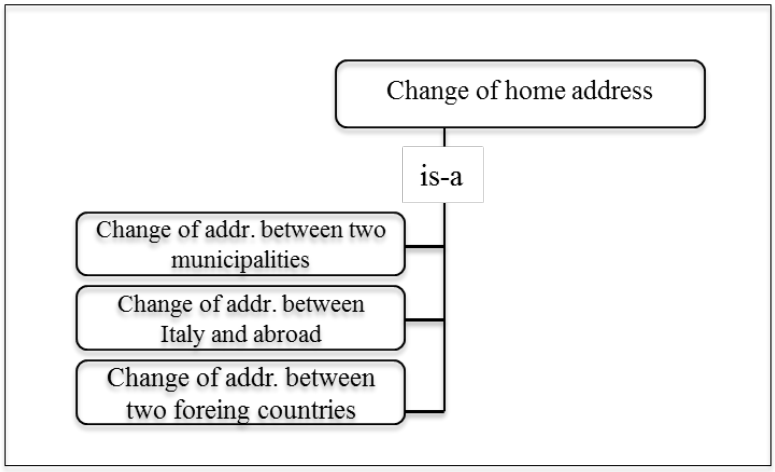


Figure 1.3.8: Services related by is-as

In our case (see Figure 1.3.8) we have that the three services *change of address between two municipalities*, *change of address between Italy and abroad*, and *change of address between two foreign countries* can be considered as specific cases of the generic "change of home address" service. Common characteristics to all the four services are the need of updating two data bases, while the specific databases will change according to the places involved in the change of address. Furthermore, when moving from Italy abroad, we can imagine that further specific administrative procedures will be activated, e.g. for issues related to citizenship.

We need now to represent all together the part-of and is-a relationships. This can be done putting together the two representations of Figures 1.3.7 and 1.3.8, giving rise to the integrated representation of Figure 1.3.9. Here, and in the following, is-a and part-of relationships are depicted with solid and dashed lines respectively.

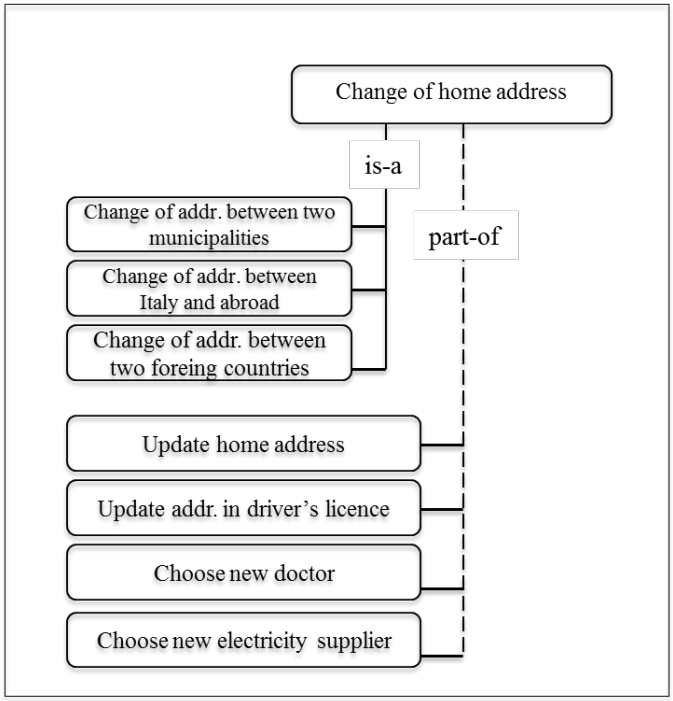


Figure 1.3.9: Composite service with is-a and part-of

Finally, in Figure 1.3.10 we show a metaschema of all the concepts introduced in this section, represented by means of the Entity Relationship model.

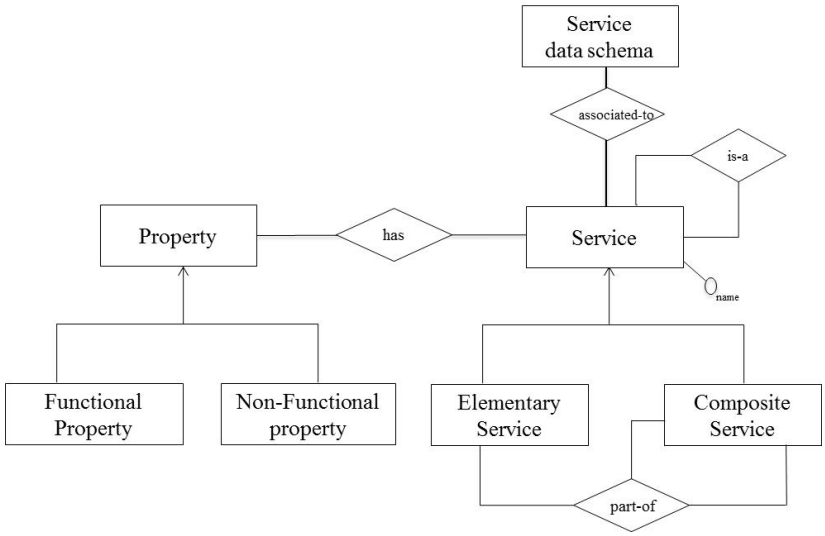


Figure 1.3.10 : Metaschema of the service model

1.3.4. A model for the description of service processes

As we said in previous sections, services are produced by processes, so in this section we focus on models for process classification and modeling.

The adopted classification of processes refers to the terminology used in the Business Process modeling (BPM) Group basic documents:

- a *public process*, is a process that defines the interactions among participants (in the process) and activities that are visible to the public for each participant. Being a high level representation of the process, a public process is also called, in BPMN, an *abstract process*.
- a *private process* is a process that, besides interactions and activities defined in public processes, defines interactions and activities internal to single participants; as such, it can be seen as a refinement of an abstract process, and, although this is not BPMN terminology, can be called a *concrete process*.

As in other production life cycles, such as production of software applications or data base design, service/process design is performed in Smart at different refinement levels, initially at the level of abstract service (according to definition given above) and public process (according to the BPMN terminology). Subsequently, in the production activity, services are expressed as concrete services and processes as private processes (BPMN).

A more detailed description of BPMN appears in Appendix 3.

1.4 Value of services

1.4.1 Introduction

In order to understand the concept of value of service we can start with an example. Consider again the two "get a visa to India" services of Section 1.3, that we reproduce in Figure 1.4.1.

Type of property	**Agency 1**	**Agency 2**
Functional property	- Visa to India	- Visa to India
Quality of service	1. Service delivery time: very fast (7 days)	1. Service delivery time: best effort
Non functional properties	1. Pricing: 150 euros 2. Penalty: 10 euros for each one day of delay	1. Pricing: 20 euros

Figure 1.4.1: Two services for getting a visa

Assume that two possible users of services are:
1. a rich man, that needs to go to India as soon as possible.
2. a university student, who has a very limited budget, and plans to buy a low cost ticket for India, to leave in the next three months.

For both of them, the goal to go to India can be considered the fundamental benefit they achieve by the service. Besides that, the rich man perceives as important the fact that the first provider guarantees the visa in the next seven days, and such warranty is considered reliable due to the relatively high penalty for each extra day. The student is not interested to fast provision, due to the long period before leaving to India. Furthermore the price is perceived completely different, due to their different economic means. We can say that both of them, before deciding which service to choose, make some informal balancing between advantages they have and disadvantages they suffer to get each one of the two services, and each one of them decides on the basis of some comparison between advantages and disadvantages. A similar evaluation is made by the two providers when they fix the price and other properties of the service. In this case they have to balance a. costs they have to sustain to provide the service, and b. revenues they gain when selling the service. While costs can be determined with enough precision in advance, revenues depend on the market, a very difficult to predict phenomenon.

The two types of values introduced in the example, namely value in use and value in exchange are dealt with in Smart and will be discussed in Section 1.4.3, together with other two types of value characteristic of Public Administration, public value and social value; before, in Section 1.4.2 we will shortly discuss other types of value investigated in the literature on services. In a separate section, Section 1.7, we will discuss in more detail public value and social value, while value in use and value in exchange will be considered in several steps of the Smart methodology.

1.4.2 A first set of types of value

Many proposals for a vast set of value types are present in the literature; below we discuss five of them, in accordance with the proposal of [6], to show the great variety of meanings of the concept. They are used to refer to goods, assets, services, without a precise distinction between them.

The *functional value* is the perceived utility (of a good, an asset or a service), which comes from the functional, utilitarian, and physical performance shown. For example, a car enables us to move from one place to another, with a certain speed and time, being in a comfortable body position during the transfer.

The *social value* is the utility perceived from the association of the good, asset or service with characteristics taken as stereotype, positive or negative, referring to groups or demographic, socio-economic, or ethnic cultural groups. For example, a newspaper that weekly publishes a column dedicated to immigrants and their problems provides a social value to those subjects.

The *emotional value* is the utility perceived when associated with specific sensations or emotions or affective states, or with the dynamics associated with such sensations, emotions or affective states. For example, attending the projection of a movie or looking to a picture in a museum provides us several types of emotions.

The *epistemic value* is the utility perceived when associated with the capacity to arouse intellectual emotions, to provide novelty or satisfy a need for knowledge. For example, a library is a service frequently attended (paper books library) or accessed through the web (digital library) by students that want to extend their knowledge on a given cultural/technical issue.

The *conditional/contextual value* is the utility perceived of an asset or service in relation to a specific context or event or condition of use. For example, welfare services in the context of developing countries.

Various authors have experimented with the effective measuring of preceding types of value. [7] comes to the conclusion that the "benefits connected to novelty appeared linked to specific products (ex., high-tech products) or to particular types of consumers (ex., the comportment of explorative acquisition). One hypothesis, moreover, that the epistemic benefits could be critical to the processes of consumer experience and in the first phases of using products, but the following consumer learning could reduce their general relevance.

Other authors (ex. [8] see value as a relation between benefits and sacrifices, where the relation can be a mathematical function or else a statistical correlation. With reference to benefits, there is a convergence to express them in terms of:

1. functional properties;
2. non functional properties;
3. qualities of the service;
4. social benefits;
5. economic benefits.

Sacrifices are usually expressed in terms of:

1. the price of service;
2. the cognitive and temporal effort needed to invoke and get the service;
3. the risk perceived when the service is invoked (due to the fact that usually no previous experience has been done before with the service, see the discussion in Section 1.2.).

1.4.3 Public and social value, value in use and value in exchange

We focus now on values considered in the Smart methodology for Public Administration, final users and private providers. As for Public administration, we examine in more depth public value and social value.

Here, we start with a motivating example. In an issue of the Economist of October 2011 a section appeared on the Open Government Initiative, see Figure 1.4.2. An article whose title was "The parting of the red tape – it is just another global talking shop or a fresh approach to shaking out government secrecy?", a research was reported as follows. "Uganda is not best known as a test-bed for new ideas in governance. But research there by Jakob Svennson at the University of Stockolm and colleagues suggested that giving people health care performance data and help them to organize to submit complaints cut the death rate in under fives by a third. Publishing data on school budgets reduced the misuse of funds and increased enrollment."

Figure 1.4.2: Excerpt from the issue of Economist October 2011

Public value aims to exploit capabilities to make governments achieve valuable goods or activities and states that allow people's wellbeing, namely functioning, and to convert them into utilities. [9] lists the following types of public value:

- *Financial* – impacts on current or anticipated income, asset values, liabilities, entitlements, and other aspects of wealth or risks to any of the above.
- *Political* – impacts on personal or corporate influence on government actions or policy, role in political affairs, or influence in political parties or prospects for current or future public office.
- *Social* – impacts on family or community relationships, social mobility, status, and identity.
- *Strategic* – impacts on economic or political advantage or opportunities, goals, and resources for innovation or planning.
- *Ideological* – impacts on beliefs, moral or ethical commitments, alignment of government actions or policies or social outcomes with beliefs, or moral or ethical positions.
- *Stewardship* – impacts on the public's view of government officials as faithful stewards or guardians of the value of the government itself in terms of public trust, integrity, and legitimacy.

Among the six types of public value, we focus in this book on social value.

The *social value* of administrative services makes references to policies and principles that public administration plans and puts into effect, with the final goal to focus our action towards the

improvement of the quality of life of the administered community, both for citizens and for companies. In case of municipalities, it is often mentioned the concept of *civic value*, that can be seen as the social value with specific attention to quality of life of resident citizen and operating companies in the territory administered by the municipality.

With reference to final users and providers, we assume as reference the two value typologies representative of economic exchanges proposed by Adam Smith [10] more than two centuries ago, that correspond to the value in use and the value in exchange.

The *value in use* is the capability of the service to satisfy a requirement/need of the final user. Being closely related to an aspect subjectively related to the user, the value in use changes according to the subjective perception, state, condition of the user. The value in use can also be defined as a set of elements with corresponding associated characteristics or properties, that, in the following, we will call functional and non-functional properties. For example, a car is a collection of functional properties; the main one is the capability of carrying us from to one to another place, plus a collection of non functional properties, such as the price, the maximum speed, etc.

The *value in exchange* is the attitude that a service has to be exchanged with another good or service, usually such good is an amount of money, called price. As such, the value in exchange is of interest for the service provider that aims to achieve from the exchange an economic advantage, or revenue.

Adam Smith observes that there is in general no correlation between value in use and value in exchange. The famous example he provides concerns:

- a good that may have a high value in use, e.g. the air, has a very negligible value in exchange;
- a good that is very expensive, having in such a way a high value in exchange, e.g. a diamond, may have a scarce value in use (this is true, if we do not consider the functional and emotional value).

Value in use will be considered is several steps of the methodology, due to its relevance both in services provided by public administration and by private providers, while value in exchange, although considered in the step on business model, will have a lower relevance in the book.

1.5 Smart at a glance

In this section we show a simplified version of the Smart methodology, so that the reader can capture immediately its main characteristics at a glance. The initial assumption of Smart is that technologies should not be seen as an end, better as a mean. It is well known that in the traditional approach to software and service design, technologies are seen as the driver of the project. Once technologies have been chosen, designers identify the data and applications that are needed to allow the partial automation of processes that produce services.

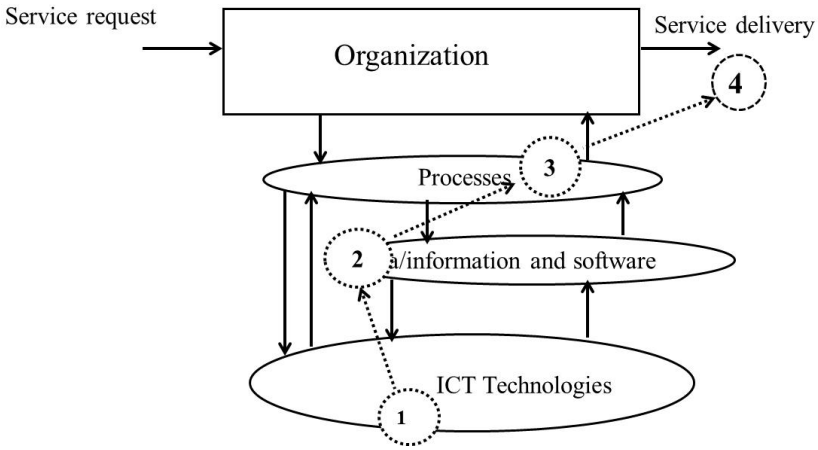


Figure 1.5.1: Technology driven approach to service design

Adopting this approach the designer, that e.g. has fallen in love with a new technology, does not know which will be the impact of such technology on the final users, since the choice of technology has been made a priori. Often happens that when at the end of the production life cycle services are finally provided at run time, due to negative feedbacks coming from the users, designers are obliged to perform maintenance of the system that improves/corrects interaction, interfaces, work flow, and other deficiencies that couldn't be foreseen a priori due to lacking communication with users.

Smart adopts a technology-enabled approach, in which the starting issue analyzed is the service, seen from the point of view of the user, of his/her needs and outcomes (see Figure 1.5.2). Once understood the nature of the service, the following activity focuses on the design of the service process. In this phase one has to analyze restrictions that can come from legislation, organizational rules, human resources involved in the service process, in such a way that every aspect is considered to produce a service process that is optimal w.r.t to the service to be produced. At this point, one can examine in depth the process to choose sensor, hardware, software, data technologies that better contribute (enable) to achieve the targets initially fixed with the users.

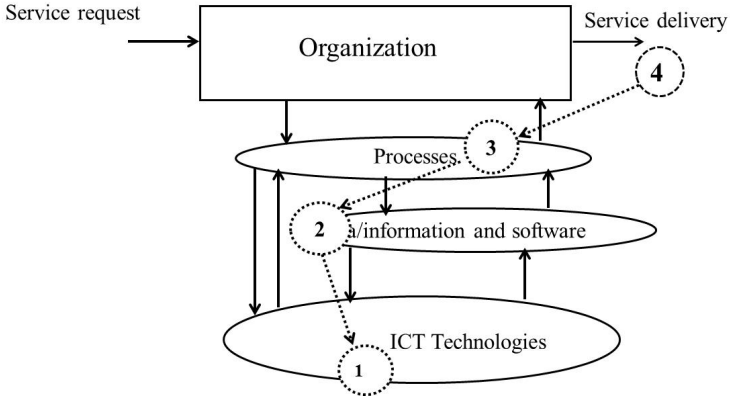


Figure 1.5.2: Technology enabled approach to information systems design

The technology enabled approach adopted in Smart results in methodological guidelines that in a nutshell are described in Figure 1.5.3. Let us consider the five steps by means of an example of development of services for elderly people. Due to progress in therapies and surgery practices, and the discovering of effective active principles resulting in more and more effective medicines, the average age of population and the expectancy of life is increased in all countries in the world. So, the management and looking after elderly people is now a critical and highly costly social issue.

Step 1 - Define planning guidelines of the initiative
Step 2 - Identify future users and fix their goals
Step 3 - Find service(s) that better enable achievement of goals
Step 4 - Define the target qualities and value of services
Step 5 - Design and produce processes and related technological architectures that enable target qualities and values

Figure 1.5.3: Smart at a glance

Step 1- Define planning guidelines of the initiative

During this step the organization responsible of the initiative (in most countries in the world programs for elderly people are boosted and supported by national or regional governments) has to define a strategy, that is short term in case funds available or limited, while it is long term if the initiative spans several years. According to common practices, we can assume that health services have followed in the past an evolution along different generations, where in the first generation elderly people were held for long periods in nursing homes, with high costs sustained by relatives or else by public welfare. Subsequently, we may assume that, due to high costs, a part of elderly people were not moved from their homes, and services were supplied at home. In this case logistic costs of staying at nursing home are decreased, but the quality of service decreases significantly, and is more complex to intercept sudden pathologies such as e.g. stroke, or else home accidents such as falls.

Generation	first	second	third	fouth
Objectives	- elderly care residence	- home assistance	- simple alarm tools: panic button	- elderly independence - bi-directional channels - community support - active aging

Figure 1.5.4: Define planning guidelines of the initiative

The simpler evolution toward a more active role of the elder is the availability of a panic button that signals the insurgence of a critical situation. The panic button although having a very high benefit cost ratio, is a yes/no information, and does not allow the resolution of the problem. Furthermore, results in a reactive service, while it is well known that in these contexts it is extremely important to provide a proactive and precautionary aid, and to favor as much as possible an active role of the elder. For this reason, we can assume that the strategy of the organization is toward services that

cover the whole life experience of the elder, so to achieve the objectives that are mentioned in Figure 1.5.4.

Step 2 – Identify future users and fix their goals

Once defined the long term plan, we have now to identify in more detail the final users of services involved in the initiative, and understand in detail their needs and goals (see Figure 1.5.5).

Type of user	**Goals (high level)**
Elderly people	Improve quality of life
Relatives	Achieve peace of mind
Health system	Provide value added services saving money

Figure 1.5.5: Identify types of users and their goals

A first group of users are, evidently, elderly people, whose general goal is improving the quality of their life. So stated, the objective is very generic. To understand in detail the specific needs we have first of all to segment the different types of elderly people, assisted to this aim by the sociological and medical literature and by domain experts. Then, for each segment, we have to interview people in the segment, and try in a few questions to elicit and identify their needs.

A second group of users are relatives of elderly people, whose main concern is from one side to be able to react to critical situations, from the other side to avoid being in a continuous state of anxiety and stress. A third, relevant, type of user is the Health system of the country that can obtain from the planned service system potential significant savings, and at the same time improved prevention and reaction capacity.

Step 3 – Find services that better enable the achievement of goals

In this step we have to move from goals of users to services (see Figure 1.5.6 and Figure 1.5.7). We have also to identify the sources of information that will feed service processes As to the source of information, we may adopt a modern approach based on the adoption of fixed and mobile sensors to be placed in the home, that from one side allow to capture from the environment and from the elder various types of static and dynamic information to be analyzed to identify anomalies, and from the other side allow bi-directional communication with the elder.

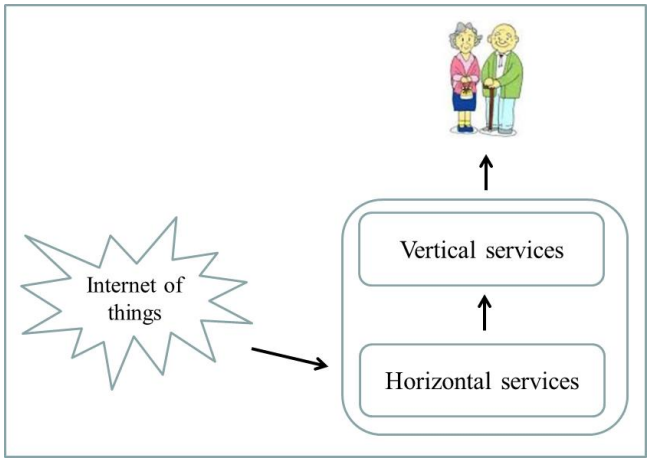


Figure 1.5.6: Sources and organization of new services

The term "Internet of things" is widely adopted to describe all kinds of information we can collect from sensors and sensor networks. As to services, they can be divided into two categories, horizontal and vertical services. Horizontal services provide specific functionalities for vertical services (see Figure 1.5.7) while vertical services are services that are directly provided to the user.

Type of service	Role	List
Horizontal	Specialized base services that provide specific functionality for vertical services	• Specialized interfaces for elderly • Virtual Community Support • Web service access
Vertical	Defined on top of the horizontal infrastructure taking into account the value perceived by users	• Living status monitoring • Agenda reminder • Time bank • Entertainment

Figure 1.5.7: New services

We have to be careful in the choice both of horizontal and of vertical services. Weak or incomplete horizontal services, such as e.g., web service access or connectivity, can hinder effective provision of vertical services. For vertical services, according to the different user segments, the perception of their utility may vary, and we can capture such perception, and related priorities, only by means of interviews and to some extent questionnaires. We may assume that the list shown in Figure 1.5.7 is the result of a ranking produced by elders, where the top priority are services related to living status.

Step 4 – Define target qualities and value of services

After the identification of services and priorities among them, we have to fix quantitative and subjective levels of quality and value to be achieved. It is not enough to say "the system has to react in real time to a critical event". It is too generic, so we have to quantify precise indicators for the different user segments (see Figure 1.5.8).

Type of user	Value	Quality
Elderly people	- Intervention in 15 minutes, decreased risk of death by 30%	- reaction to the help request in at most 5 minutes
Relatives	- the same as above + immediate alert after filtered help request	- the same as above
Health system	- Reduction of chronically ills and related costs	- 40 per cent of falls/strokes etc. immediately discovered

Figure 1.5.8: Quality and value of living status monitoring

Here, for the first time, we make use of concepts of value and quality introduced in previous sections. Value in use expresses a desired outcome, while quality represents more a desired property of the service. So, both for elderly people and for relatives, a desired quality is that the reaction of the system to the help request is provided in at most 5 minutes. As to the value, the outcome for

elderly people refers to the quality of life and risk of death, that should decrease by, say, 30%, while for relatives there is an added outcome, consisting in getting an immediate alert that filters false positive help request, in such a way that they are not diverted in their daily activities, while they are alerted when needed. The value and quality wished by the Health system are in part similar, in part different, referring from one side to the improvement of the quality of life of elderly people, that can be specialized as we have done in figure 1.5.8 for specific frequent pathologies or accidents, and from the other side on savings in the yearly budget of the health system.

Step 5 - Design and produce processes and related technological architectures that enable target qualities and values

We shortly mention at the end of the section this step, due to details and technicalities we should introduce for process modeling. As to technological architectures, e.g. the telecommunication network has to be designed with enough band to guarantee desired response time, the same for the software responsible of the management of help requests and identification of the nature of the request. Sensors should be chosen with technological parameters to measure the error under a certain threshold, so to be able to feed applications with data with a given precision.

1.6 The Smart methodology and its different versions

1.6.1 Introduction

In the previous section we have shown a simplified version of the Smart methodology, highlighting the most significant characteristics. In this section we will discover that what we have called the "Smart methodology" has different versions according to the following coordinates:

1. the wider or else more concise spectrum of life cycle information dealt with, in input to steps and activities, and output from steps and activities, resulting in Smart full (Smart-F) and Smart light (Smart-L);
2. the wider or more concise number of phases and steps, resulting in Smart Complete (Smart-C) and Smart synthetic (Smart-S);
3. the organizational subjects involved in the Smart application, resulting in Smart for Public Administrations (Smart-A) and Smart for Private providers (Smart-P).

So, we have potentially *eight* Smart methodologies, or at least *seven*, being Smart-F and Smart-FA incompatible with each other. For reasons of simplicity and compactness, in this book we will focus on FC (Full-Complete). Here, we first provide a short introduction to the phases, then for each phase we describe each step in terms of short a description and the inputs to and outputs.

The Smart-FC methodology is organized in four phases:

1. *Requirements collection*, in which the provider defines the strategic long-term activities in the production and delivery of services, and the goals of the users are collected and organized.
2. *Service as-is assessment*, namely assessment of the different components of the service system as-is and of the relationships among them, with an evaluation of the level of service quality and value in use perceived by the users.
3. *Service to-be value optimization*, in which strategies, design choices and heuristics are applied with the goal of optimizing the value of the service to-be and of the corresponding process, from the three different points of view of public administration (social and public value), final users (value in use) and private providers (value in exchange).
4. *Production of service to be*, in which services are specified and service processes are produced.

A view at a glance of Smart-FC in terms of phases, steps, and outputs of steps is shown in Figure 1.6.1. In the central part of the figure we show the four phases mentioned above, with the main outputs of phases. In the right part of the figure we see the typical management activity that spans the four phases. In the left part of the figure we show the evolution of concrete and abstract services considered in the life cycle of Smart. Initially, two situations may occur:

1 The service s that has to be designed is actually provided, so the inputs to the life cycle are (i) a concrete service as-is s, and (ii) user goal expressed in requirements and collected during the planning phase. In this case we have to model first the concrete service as-is, so to proceed to its transformation into the corresponding (unique) abstract service as-is.
2 The service is completely new, never provided before, so we start from scratch, having in input solely the user goals expressed in requirements. In this case, we directly model, from analysis of the user goals, the abstract service as-is.

In both previous cases, the abstract service as-is is considered in input to the "service to-be design phase", that produces in output a new value optimized abstract service to-be, that in the last phases is transformed into the concrete service to-be and the corresponding BPMN private process.

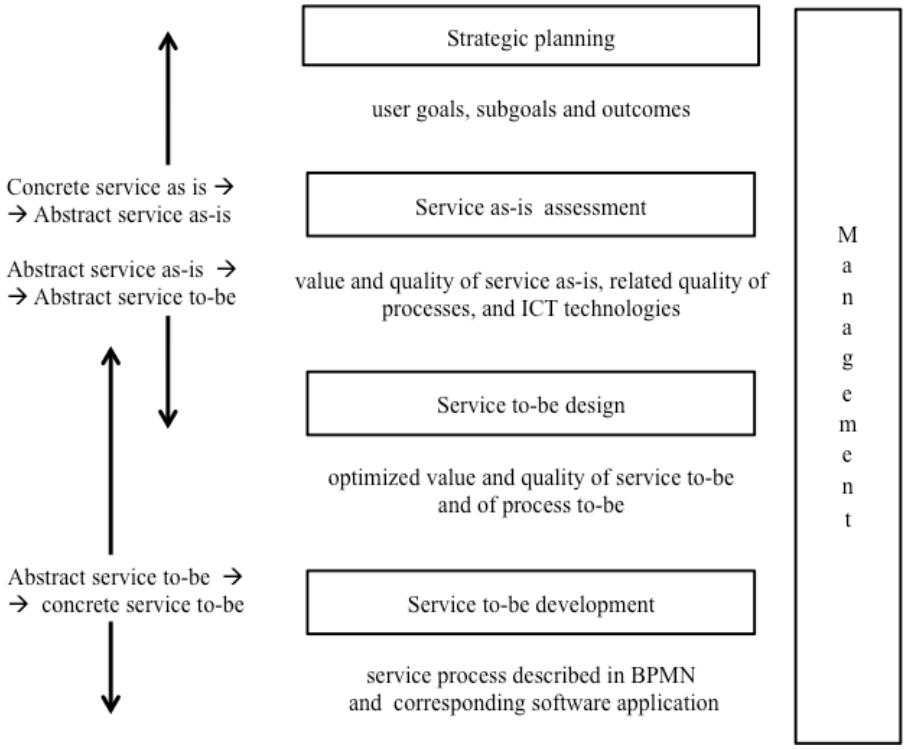


Figure 1.6.1: Smart-FC at a glance: phases, steps and main outputs of steps

We now provide the description of specific phases, whose steps are shown at a glance in Figure 1.6.2.

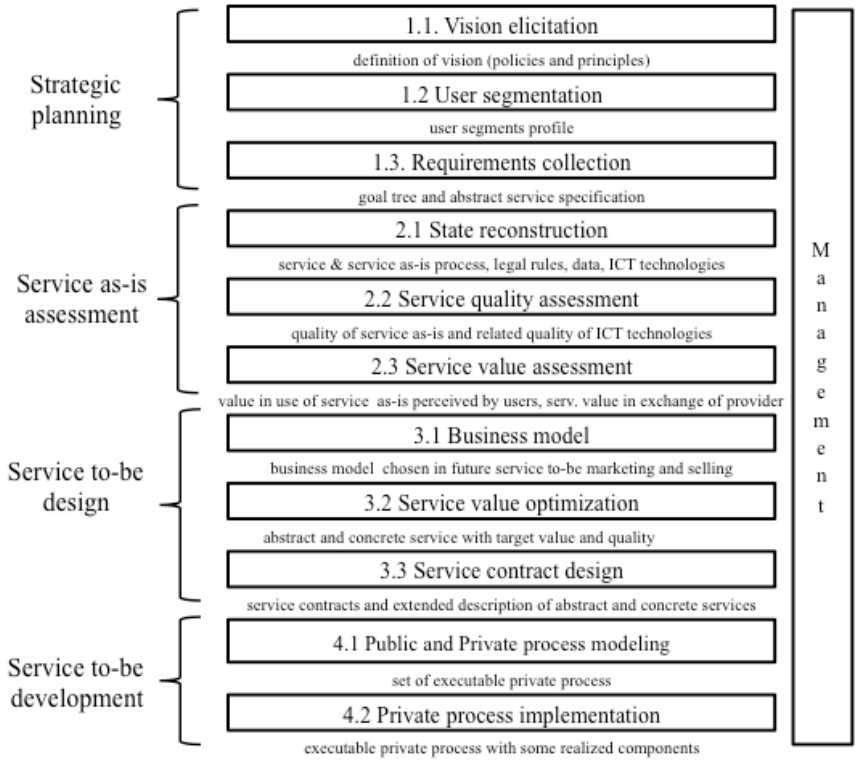


Figure 1.6.2: Detailed description of Smart steps, with synthetic description of outputs of the steps

1.6.2 Strategic planning

Strategic planning is made of three steps, whose function in the methodology is described in Figure 1.6.3.

Step	Synthetic description
1.1 Vision elicitation	Has the goal of defining general policies and objectives of the organization (public administration or private provider) offering the services
1.2 User segmentation	potential users are identified and divided into groups with homogeneous goals
1.3 Requirements collection	Involves the identification of the requirements through the analysis of user's goals

Figure 1.6.3: Steps of strategic planning

The following figures provide inputs and outputs of the strategic planning step for Smart-A and Smart-P (the input/output marked with an asterisk (*) are only for Smart-P).

INPUT	OUTPUT
1. Interviews to management	1. Average and long term eGovernment Objectives and technological drivers
2. Policies	
3. Principles	
4. Strategic and managerial documents *	

Figure 1.6.4: Input and outputs of vision elicitation

INPUT	OUTPUT
1. Primary sources (questionnaires)	1. User segments
2. Secondary sources (from providers of statistical data)	

Figure 1.6.5: Input and outputs of user segmentation

Requirements collection involves the elicitation of user goals, a critical and complex process that assumes a significant importance for the entire life cycle of service production. Figure 1.6.6 provides inputs and outputs of requirements collection step.

INPUT	OUTPUT
1. Interviews to final users and/or user representatives	1. Goal tree and mapping of goals to services
2. Market surveys	
3. Laws and rules	
4. User segments (from 1.2)	

Figure 1.6.6: Input and outputs of requirement collection

1.6.3 Service as-is assessment

Service as-is assessment is made up of three steps, whose descriptions are provided in Figure 1.6.7.

Step	Syntetic description
2.1 State reconstruction	The goal is to reconstruct the concrete service as-is in the context of actual users, provider organization, processes, ICT technologies
2.2 Quality assessment of service as is	identifies qualities of the service as-is that are of interest for users, and for the concrete service as-is measures them in the current ecosystem
2.3 Value assessment of service as-is	Measures the social and public value of the service as-is provided by Public Administration, the value in-use perceived by users, and the value in exchange gained by provider

Figure 1.6.7: Steps of the assessment of service as-is phase

Inputs and outputs of state reconstruction are shown in Figure 1.6.8 for both public administration and private providers.

INPUT	OUTPUT
1. Interviews to the three organizational levels: top management, middle management, control management	1. Enrich specification of service process, laws, organizations and relationship among them 2. Concrete service specification 3. Software, hw & network infrastructures models 4. Data schemas
2. Organizational documents on services, processes, ICT software applications , data and HW/network infrastructures	
3. Abstract service specification (from 1.3)	

Figure 1.6.8: Input and outputs of State reconstruction

Inputs and outputs of quality assessment of the service as-is are shown in Figure 1.6.9.

INPUT	OUTPUT
1. Smart quality registry	1. Abstract and concrete services with dimensions and metrics 2. Software, hw & network infrastructures models with dimensions, metrics and quality values 3. Data schemas with dimensions, metrics and quality values
2. Abstract service specification (from 2.1)	
4. Software, hw & network infrastructures models	
5. Data schemas	

Figure 1.6.9: Input and outputs of service quality assessment

Inputs and outputs of service value assessment are shown in Figure 1.6.10.

INPUT	OUTPUT
1. Abstract services with quality dimensions and metrics (from 2.2)	1. Value of abstract and concrete services as-is
3. User segments (fromm 1.2)	
4. Goal tree (from 1.3)	

Figure 1.6.10: Input and outputs of value assessment

1.6.4 Service to-be design

Service to-be design is made up of three steps, whose descriptions are provided in Figure 1.6.11.

Step	Syntetic description
3.1 Business model	Defines the optimal market strategy, identifying alliances and competitors, economic trends, most interesting market sectors, financial and risk aspects
3.2 Service value optimization	The goal is to conceive new functional and non functional properties that enrich the service is user value in use perception. Here, as in step 2.3, value is influenced by the different points of view of Public Administration, users and providers
3.3 Service contract design	Defines one or more contracts to be associated with each service identified in previous phases of the methodology

Figure 1.6.11: Steps of service to-be evaluation

Inputs and outputs of business model are shown in Figure 1.6.12.

INPUT	OUTPUT
1. Customer relationship management	1. Business Model that identifies: • Key Partners • Key activities • Value offered • New relationships with customers • Key resources • Delivery channels • Cost structure • Expected social and economic side effects • Expected revenues*
2. Revenues, resources, costs	
3. Partnerships	
4. Medium and long term organizational objectives (from 1.1)	
5. User segments (from 1.2)	
6. Goal tree (from P1.3)	
7. Value of abstract and concrete services (from 2.3)	
8. Data, Software, hw & network infrastructures with dimensions, metrics and quality values (from 2.2)	

Figure 1.6.12: Business model inputs and outputs

INPUT	OUTPUT
1. Abstract and concrete services with dimensions and metrics (from 2.2)	1. New abstract service with target value and quality 2. Target value and quality for concrete services
2. Value of abstract and concrete services (from 2.3)	
3. Goal tree (from 1.3)	

Figure 1.6.13: Inputs and outputs of the service to be value optimization

Inputs and outputs of the service contract design are shown in Figure 1.6.14.

INPUT	OUTPUT
1. Goal tree and mapping of goals to services (from 1.3)	1. Service Contracts
2. User segments (from 1.2)	

Figure 1.6.14: Service contract design

1.6.5 Service to-be development

Service to-be design is made up of two steps, whose descriptions are provided in Figure 1.6.15.

Step	Syntetic description
4.1 Public and Private process modeling	The step consist of the definition of the public process and its transformation into a. non-executable private process and b. executable private process that satisfy the service to-be specification
4.2 Private process implementation	The goal of the step is to choose among others the executable private process to be implemented, the components to be developed and the strategy for the software development life cycle. Final implementation of the process is achieved by the Agile DAD methodology, which involves the requirements formal modelling (using UML), coding and testing.

Figure 1.6.15: Steps of service to-be design

Inputs and outputs of the public and private process modeling are shown in Figure 1.6.16.

INPUT	OUTPUT
1. New abstract service with target value and quality (from 3.2) 2. Concrete service specification (from 2.1) 3. Service conctract (from 3.3)	1. Set of executable private process

Figure 1.6.16: Steps of public and private process modeling

Inputs and outputs of the private process implementation are shown in Figure 1.6.17.

INPUT	OUTPUT
1. Set of executable private process (from 4.1)	1. Executable private process with some relized components

Figure 1.6.17: Steps of private process implementation

In some steps of the Smart methodology are involved both citizens and providers (public and private) and in Figure 1.6.18 is shown this relation.

	Citizen	Private provider	Public Administration
Strategic planning		X	X
User segmentation		X	X
Requirement collection and elicitation	X	X	X
State reconstruction of service as-is		X	X
Quality of service	X	X	X
Service value assessment	X	X	X
Business model		X	X
Service value optimization	X	X	X
Service contract design		X	X
Public and private process modeling		X	X
Private process implementation		X	X
Portfolio management		X	X

Figure 1.6.18: Actor involved in each step of methodology

1.6.6 Smart-Fast

In this section we describe Smart Fast. Applying a methodology for the service life cycle requests a significant effort that has as a counterpart in the production of better services. Due to budget restrictions, it is frequently necessary to distinguish between mandatory and optional activities.

Furthermore, the design and production of services often is done by scratch, without considering the actual provision; this means that phase 2, assessment, is frequently skipped during the life cycle. This choice has a risk, since no reference target with the actual delivery context is available, and it may happen that the new service is even worse than the actual service. Notwithstanding this argument, designers need methodological shortcomings; this is what happens in Smart-F, see next figure for a description of phases and steps. We comment now the rationale behind inclusions and exclusions of phases and steps moving from Smart to Smart-Fast.

We consider two steps of phase 1 (requirements collection) as mandatory. The planning step, both in public administrations and for providers is too often neglected, resulting in an "entropic" and irrational production of services with no coordinated governance and relationships with user needs. No plan for private providers is even a non sense. Avoiding requirements collection has similar drawbacks, and it cannot be understood how the service can be designed and produced without any idea of user needs and preferences (providers) or administrative regulations.

The minor importance of phase 2: assessment has been discussed a while ago. Anyhow, before cutting this phase the designer has to carefully evaluate the risk of having scarce or no knowledge on the actual situation. So, in case of reduced amount of resources available, one can focus in the state reconstruction step on most critical resources, such as, e.g. data used in service production, whose low quality can severely impact on service quality, in such a way that a cleaning activity becomes highly advisable.

As to phase 3, the absence of the business model step is balanced in some way by the previous presence of a planning activity, where issues on the business model are implicitly addressed. The value optimization step is the most important step in a value based methodology such as Smart, and is therefore mandatory.

Coming to the production phase, the activities of service modeling and process implementation are mandatory, in order to produce an operating environment for service delivery.

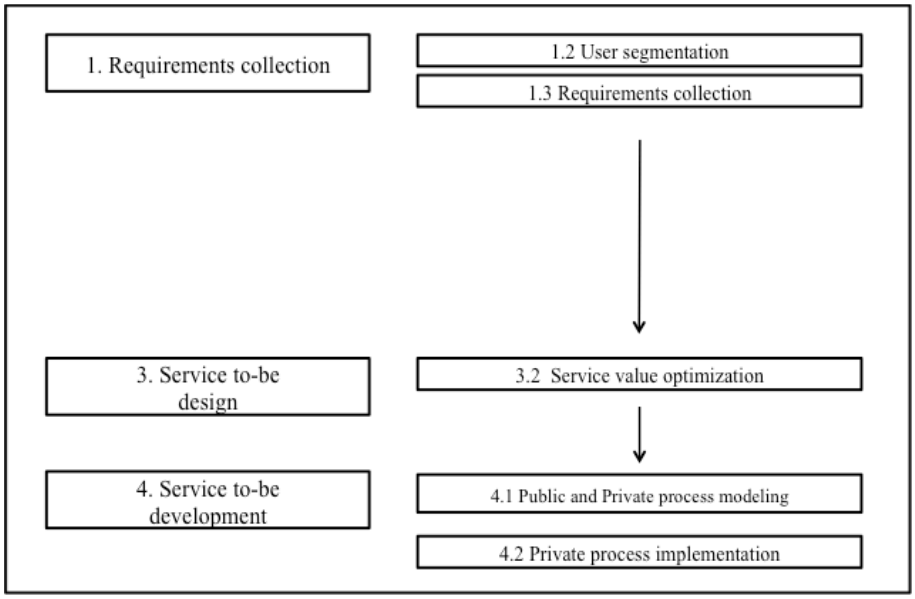


Figure 1.6.19: The methodology Smart-Fast

1. 7 Public and social value of digital government initiative

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1.7.1 Questions addressed and relevant concepts of the step

Questions addressed in the step are shown in Figure 1.7.1

- What is Public Value?
- What is Social Value?
- What are the key factors for a social value oriented service assessment?
- How to classify and publish open data under a social value perspective?

Figure 1.7.1 Questions addressed by the requirements elicitation step

A key issues for public administration is actually the understanding the value of digital services and data they provide or publish. Indeed, this understanding allows an effective orientation of assessment, benchmarking, and monitoring activities.

Most of the time, a cost-benefit or else revenue oriented perspective is neither sufficient nor appropriate for government reach effective outcomes from digital initiatives in terms of better quality of life and satisfaction for constituencies, either citizens or businesses. Thus, in order to complement revenue oriented perspectives, in what follows, first, the concept of public and social value are introduced. Then, having a focus on social value, key factors for service assessment and open data classification and publishing are proposed.

1.7.2 Introducing public and social value

Over the last two decades and basically since the publication of the Moore book [11], which points out the relevance of the concept for public management, public value has raised discussion among academics and practitioners as for its definition measurement and target [12]. The diffusion and use of Information and Communication in public sector and investments in e-Government initiatives have contributed to introduce a further relevant dimension as well as topic of discussion to the debate [13]. In general terms Public Value can be defined as the value that citizens and their representatives seek in relation to strategic outcomes and experience of public services [11], thus, it is related to the achievements of objectives set by government programs and the delivery of public services to the citizens [13], focusing on what has meaning for the constituencies, rather than what a government or public-sector decision-makers think or design as their actual needs. Among other subsequent proposals for public value measurement [14], it is worth mentioning, e.g., the early comprehensive perspective on public value measurement has been presented by Kelly, Mulgan, and Muers [15], as an attempt to measure the total benefits coming from government action. The authors identified three key components of public value:

i) *services*, that are the way for delivering public value (e.g. garbage collection),

ii) *outcomes*, deriving from services and encompassing higher order goals (e.g., garbage collection protects public health);
iii) *trust*, legitimacy and confidence in government.

Adopting a public value perspective for interpretation issues in policy making may benefit from a renewed consideration of the information asset of public administrations, particularly, considering the information objects represented by conceptual schemes of their information systems. As pointed out by Floridi [16] entities can share different observable properties depending on the level of abstraction adopted, and being information objects the highest level of ontological abstraction represented by the informational analysis, they can have an intrinsic value providing useful insights to the appropriate policy level of abstraction a decision maker has to consider and the actual capacity of a public administration or government information systems to implement the policy goals. Indeed, missions and goals can be formulated in broad or narrow and abstract or concrete terms and the scope of the organization differs significantly as a policy makers goes from the first item on a list of principles or policy goals (a high level of abstraction) to the last (a lower level of abstraction and much more focused).

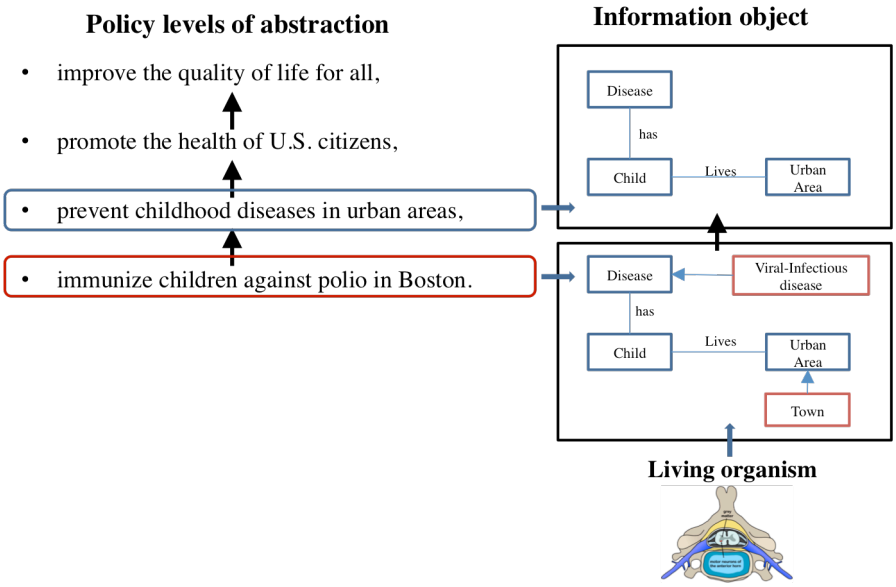

Figure 1.7.2 Public value of information objects for diverse levels of abstraction, adapted from **[17]**

Figure 1.7.2 shows an example of the different abstraction levels for policies of a government (or e-Government) strategy and how they fit the actual information objects in public administration information systems. Consider, for example, the policy goal "prevent childhood diseases in urban areas" as a specification of the higher goal "improve the quality of life for all" (left-hand side of Figure). The former is still too general to provide guidelines and requirements for appropriate and effective actions. Thus, a policy maker may further consider exploring the conceptual schemes of public administration information systems (right-hand side of Figure) to identify information objects at a less abstract and more specific level of detail. This way, he can focus on the health issues concerning the diverse town (in the case of a government action) or his own town (in the case of a municipality oriented action). Consequently analysing figures for the considered information objects (e.g., "Viral-infection disease" and "Town" in Figure 2), the policy maker can better detail the public value of his policies, by stating their goal is "immunize children against polio in Boston". It is worth noting that the path can be also the opposite. That is, a policy maker can have already decided that the policies goal is "immunize children against polio in Boston", but the public

administration information systems may not cover the information objects for an appropriate and effective implementation of the required initiative. Thus, providing the information systems a not sufficient support in terms of public value, it has to be further specified in terms of levels of abstraction and enriched with information objects referring to diverse facets of living organisms (e.g., again "Viral-infection disease") as well as the social context (e.g., again "Town" in Figure 1.7.2).

As said above public value is a complex concept, encompassing on the one hand the activity of the decision makers as valued by constituencies, on the other hand the value of the outcomes of such an activity. In this case, public value can be better defined in terms of social value. Indeed, the former imply an active action and interests by the central or local government as well as a focus on their behaviour; whereas, we consider social values as emergent from the welfare state, thus having a potential but not necessarily actualized pull perspective towards public administration action and policies [17].

Among the different methods for measuring social value [18], the *Life Satisfaction Assessment* perspective seems the one most suitable to provide appropriate results as for the effectiveness of public sectors service or data oriented digital initiatives. Indeed, its focus is on well-being and quality of life [19], where the constructs of what is known as the *capability approach* [20] [21]. The approach focuses on the ends rather than the means (such as, e.g., goods and services) and provides key indicators and dimensions [22], evaluating *human functionings* (that is, various states of human beings and doings or ac [22] activities that a person can undertake, for example, travelling) and *capabilities* (i.e., the opportunities to achieve those beings and doings, for example, the real opportunity to travel) . Thus, the above approach is suitable to identify what information should be well-thought-out to assess how well an individual's life is as account of well-being or human development [22]. For example, the current diffusion of open data initiatives seems to be suitable to provide, e.g., policy makers access to the kind of information required for interpreting the actual degree of satisfaction or well-being of a given population as well as individuals as well as eventual misalignment between government action and social welfare. In what follows, we provide an example of how open data initiatives may have public as well as social value.

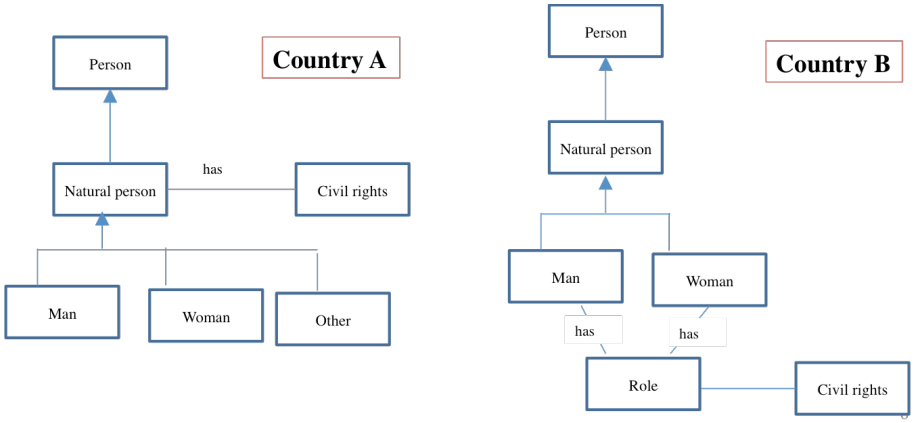

Figure1.7.3 Schema of life from open data of two different countries

In principle, open data perspectives allow to access the «schema of life» for a given country. Consider, for example the conceptual schemes in Figure 1.7.3. They provide a view on information objects for the information systems of two diverse countries, Country A and Country B, as for their legal framework.

Figure 1.7.4 Example of misalignment between legal and social level shown by linking data

In particular, the schemes show how civil rights are attributed and managed. Country A seems to have a more liberal perspective, attributing civil rights to all natural persons no matter the gender distinction, thus, in principle, not bounded by institutional roles associated with gender difference. Whereas Country B adopts the latter role-based perspective. Having a perspective close to Country A or else Country B is relevant to the prevention or permit of issues such as, e.g., marriage between people of the same sex or forms of union different from marriage (e.g., Civil Union, Civil Partnership, etc.).

Considering now Italy as a specific case of Country A, Figure shows the results of having open and linked data from, e.g., a blog (social context) and the Country Constitution (legal framework). A misalignment emerges between the social level represented by the blog, which basically claims for gender inequalities limiting the capability of self realization for women as well as the related set of achievable functionings, and the legal framework, when the Italian Constitution states at the Art.3: "*It is the duty of the Republic to remove those obstacles of economic and social nature which constrain the freedom and equality of citizens, prevent the full development of the human person and the effective participation of all workers in the political, economic and capital of the country.*" While the Constitution is coherent with the conceptual scheme of Country A in in Figure 3, the data from the social context reveal a coherence with the conceptual scheme of Country B, thus, basically a misalignment. Therefore, the linked data have a public value because they allow citizens to evaluate the action taken or not taken for this misalignment and the policy maker to identify potential alternative actions. Also, the linked data have a social value because they allow identifying the actual capability set, e.g., for women and their related functionings, providing hints on how to improve them.

1.7.3 Key factors for social value assessment of digital services

The previous Section has discussed public and social value, providing examples from policy making for health services as well as open and linked data. In what follows we introduce a framework for assessing the social value of government digital initiatives, particularly focusing on factors for services provision.

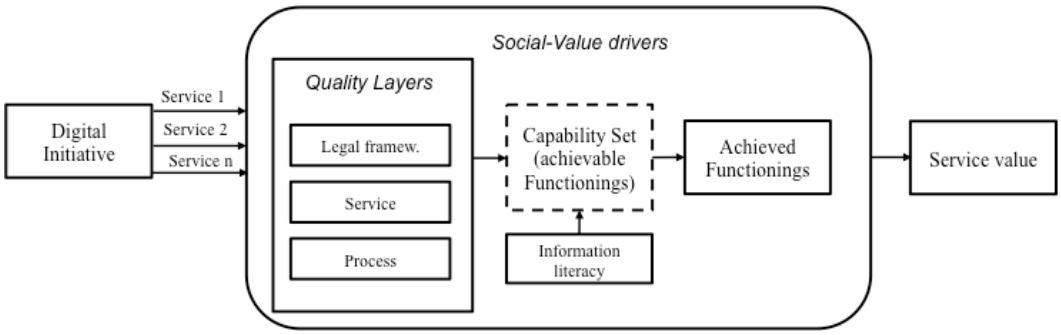

Figure 1.7.1. Framework for digital services social value assessment

As shown in Figure 1.7.5, the starting point is a plan for a given digital government initiative (implementing a policy goal, such as , e.g., the above mentioned "prevent childhood diseases in urban areas"). A set of *n* services is expected to be developed, whose appropriateness in terms of social value to constituencies (citizens and businesses) as to be evaluated and assessed with regard a set o key drivers, that are

- *quality dimensions* considered at systemic level (*efficiency*, *effectiveness*, *accessibility*, and *accountability* for legal framework, service, and processes, see for details [23]);
- the actual *capability set* and achievable *functionings*;
- *eReadiness* and *information literacy* of the population [24] .

The services are first evaluated for the above mentioned quality dimensions in order to understand the as-is impact on the diverse systemic levels considered, thus, defining appropriate to-be target values. This step is necessary to ensure the feasibility and reliability of the services to be provided. Then, the achievable functionings for each service are mapped to current capabilities and weighted by the current eReadiness and information literacy of the target population. The result is a set of functionings suitable to be achieved and capabilities to be empowered (acting on eReadiness and Information literacy dimensions) by the selected services provision, thus having a consequent social value.

1.7.4 Classify and publish open data under a social value perspective

The previous Section has discussed a framework for assessing the social value of government digital initiatives, particularly focusing on factors for services provision. In this Section, we will focus on a classificatory framework presented in [17] suitable to support the publishing of open data under a social value perspective.

Table 1.7.1 Well-being and Capabilities characteristics in the classification framework

Well-Being dimensions	**Capabilities dimensions**	**Well-Being Indicators**
Civic engagement	Control over one's Environment	Consultation on rule-making
		Voter turnout
Community	Affiliation	Volunteering borough
	Bodily Integrity	Urban information
	Control over one's Environment	Transport places and information
	Emotions	Quality of support network
	Knowledge	Demographic indexes
	Spirituality	Spirituality information
Education	Senses, Imagination and Thought	Educational attainment
		Event information

		Job information
		Places information
		Students skills in math, reading and science
		Years in education
Environment	Other Species	Air pollution
		Animal care
		Green Quantity
		Information about watercourses
		Other environmental indicators
		Water quality
Health	Bodily Health	Self-reported health
		State of health
		Useful information about health
		Life expectancy
	Life	Life expectancy
Housing	Life	Care and treatment of people
		Dwelling with basic facilities
		Housing expenditure
		Rooms per person
Income	Control over one's Environment	Financial wealth
		Heritage and tourism
		Household disposable income
		Household financial wealth
		Number of visitors
		Personal earnings
Jobs	Control over one's Environment	Employment rate
		Job information
		Job security
		Long-term unemployment rate
		Number of visitors
		Online services information
		Personal earnings
		Transport places and information
Safety	Bodily Integrity	Assault rate
		Dangerous natural event
		Homicide rate
		Other crime statistics
		Places of shelter
		Road accidents rate
Social connections	Bodily Integrity	Transport places and information
		Urban information
	Control over one's Environment	Urban information
Work-life balance	Affiliation	Employees working very long hours
		Equality of treatment
	Appreciation of beauty	Number of visitors
	Play	Number of visitors
		Time devoted to leisure and personal care

The final framework includes public value oriented characteristics such as, e.g., the number of *Like*, *Five star rating*, number of *Visits*, and social value characteristics such as the number of *Downloads*. A characteristic such as, e.g., the *Like* may be considered as related to public value, not explicitly implying an effective usage of the data set by constituencies, which should require a weight such as, e.g., the *number of downloads*, which, on the other hand, implies a kind of action

different type from the simply appreciation by the user as well as a somewhat explicit willingness "to have the data set" as a mean for obtaining a certain outcome valuable to the user.

Thus, the attribute *number of downloads* seems a more social value oriented one, and when considered together with, e.g., the *Like* one, may provide an indication on public value as well as on social value. Furthermore, the framework encompasses the set of well-being and capabilities characteristics (dimensions/indicators) shown in Table 1.7.1.

The framework allows a view on data that emphasizes the capabilities and the functionings (well-being related issues) achievable by and with a given data set, thus, providing a social value oriented alternative than the usual classification schemes, such as, e.g., the one focused on life events, complementing them, likewise.

Chapter 2: Service planning

2.1. Vision elicitation

2.1.1 Questions addressed and relevant concepts of the step

Vision elicitation is the most relevant phase of the service life cycle for achieving a clear understanding of the alignment between the political vision, the context of intervention, and the actual ICT goals, architectures and infrastructures. The main questions answered in this step are shown in Figure 2.1.1.

- Which is the e-Government vision?
- Which is the e-Government mission?
- Which are the e-Government strategy principles?
- Which are the e-Government strategy policies?
- Which are the e-Government strategy principles and policies target layers?
- Which is the current state of advancement of the initiatives required for each policy/target layer cluster

Figure 2.1.1: Questions addressed in the step

In this section we consider a case study related to the State of Singapore. Most of funds that the State of Singapore supplies in eGovernment initiatives [1]are focused on the following areas:

a. creation of space: land reclamation has been one of the main ways through which land capacity has been expanded to sustain growth. New ways for creating space tend to identify technologies enabling the overcoming of limitations of surface land.
b. optimizing the use of land: advancements in engineering and technology open the possibility for re-engineering industrial processes, as well as reconfiguring building layouts and material handling systems, to enable better optimal use of land.
c. creating highly livable residential towns. While high-rise housing offers many benefits, it should be ensured that such housing continues to be highly livable.
d. supporting ICT and platforms. As new spaces (e.g., underground or on floating structures) are created, ICT has to be leveraged in the design, monitoring, modelling and simulation of facilities to ensure cost-effectiveness, performance efficiency and comfort of the operating environments

The activities characterizing the step are shown in Figure 2.1.2. We now consider each one of them.

1. Defining the socio economic context
2. Preliminary e-Government vision elicitation, identification of policies and principles and priorities among them
3. Identify Macro and Micro-objectives and technological drivers of the e-Government vision

1 See e.g. http://www.nrf.gov.sg/

Figure 2.1.2: Activities of the step

2.1.2 Defining the socio economic context

Vision elicitation aims at finding the long term initiatives that fit the general vision of the organization, with specific reference to enabling usage of ICT technologies. Organizations we are interested in are public administrations and private providers that cooperate with public administrations in providing services to citizens and companies. In Figure 2.1.3, that reproduces Figure 1.2.1 of Chapter 1, we see all the layers involved in a service provision system.

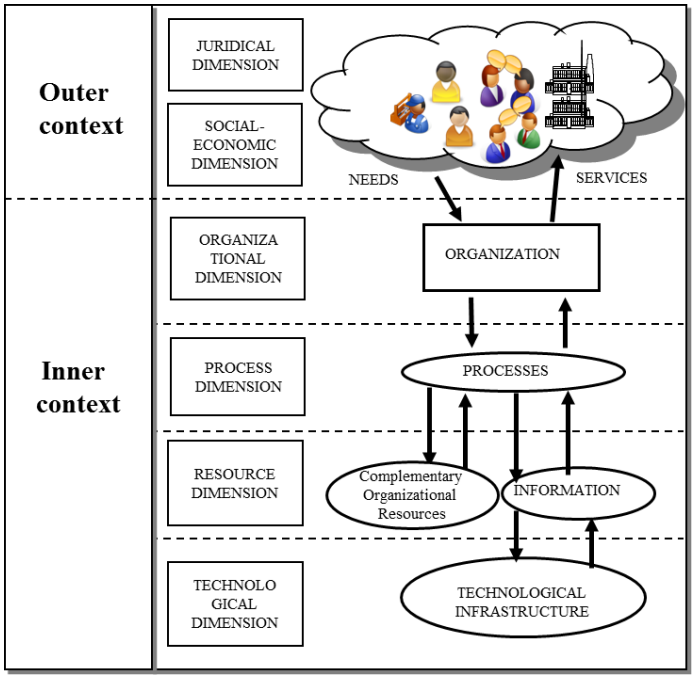

Figure 2.1.3: Layers of a service provision system

The goal of this step is to reconstruct and analyze main characteristics of the socio economic context in which the public administration considered operates. Such characteristics concern economic activities, environment, population, education, and health, all issues that are involved in the phase of planning of new services, observed in their interrelationships and in their evolution in time. Data needed to reconstruct the socio economic context can be extracted from primary or secondary statistical sources.

Singapore case study – In the case of Singapore we can obtain useful information from the Ministry of National Development and the National Research Foundation of Singapore that have launched an innovation program based on the need to sustain growth in a context of very densely populated land, resulting in the urgent need of creation of space. Another interesting source of knowledge for Singapore (as for other countries) are statistics produced by public bodies, such as the National Institutes of Statistics, or else produced by private bodies such as, e.g. the Pocket World in figures, Economist, 2014. E.g. in this last publication we discover that Singapore is ranked 23th in the world for the highest GDP per head, it is not ranked in the first 35 countries for the median age, while in 2050 is forecasted to be the 7th for median age.

2.1.3 Preliminary e-Government vision elicitation, identification of policies and principles and priorities among them

The aim of the eGovernment vision elicitation activity is to collect and organize the knowledge about the policies and the principles adopted in the country/ administrative unit where the eGovernment intervention is going to take place, in order to provide a detailed and structured perspective on the facets of the political vision and on the related goals.

In the right side of Figure 2.1.4 we show a correspondence between the layers defined in Figure 2.1.3 and all the issues considered relevant for strategic planning, and relationships between them.

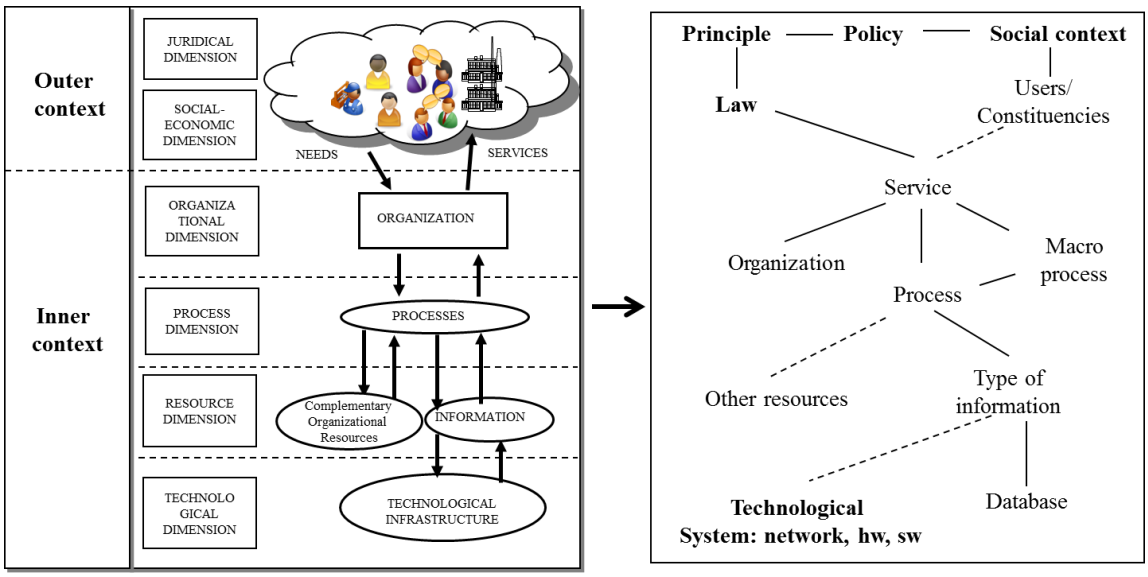

Figure 2.1.4: Issues and relationships between them considered in eGovernment strategic planning.

It is important to note that this step does not substitute strategy analyses carried out by eGovernment units or consultants, and its goal is to provide an instrument which allows:

- identifying the set of principles and rules supporting the definition of common strategies and goals in terms of macro-objectives;
- to reduce the complexity of the (often) huge documentation produced by these analyses;
- to define priorities, focusing on a limited and precise set of areas of interventions.

Under these perspectives, the eGovernment vision elicitation activity is complementary to traditional approaches of strategic advisory. The outputs of the vision elicitation are a set of descriptions of the policies and principles considered relevant in the context of the administration. We have now to explain in detail policies and principles.

In general terms, a *policy* is a set of decisions which are oriented towards a long-term purpose or to a particular problem. Such decisions by governments are often embodied in legislation and usually apply to a country as a whole rather than to one part of it'. [2] Focusing on eGovernment, a policy can be defined as a set of decisions which are oriented towards a long-term purpose or to a particular problem. Such decisions by governments are often embodied in legislation and usually apply to a country as a whole rather than to one part of it. Besides actions, policies also involve intentions. A

[2] Merriam Webster Online Dictionaryhttp://www.merriam.webster.com/dictionary

specific case of policy intention is a *principle* that can be defined as a general view about how public affair should be arranged or conducted.[3]

At the state of the art, two main policy perspectives characterize the different approaches to eGovernment, namely:

- a *market-oriented perspective*, whose goal is the efficiency of the action of the public administration evaluated in private sector terms such as cost reduction and return on investment;
- a *public oriented perspective*, where the main goal is the effectiveness in the achievements of government programs in terms public value. It is worth noting that market oriented perspectives have been influencing New Public Management programs of public sector reforms.

Market-oriented policies consider citizens as customers of the government agency, interested in achieving principles such as, *efficiency* of administrative processes and accountability of the process supporting service delivery.

Every policy considered as action is guided by principles defining the policy intentions. Some of the most important principles are, among others:

a) *efficiency* of the administrative activities that deliver services to citizens and businesses, in terms of (efficient) use of resources and achievement of the final goals;
b) *effectiveness* of the enactment of political programs in terms of public value. An important characteristic of effectiveness that has the range of principle is quality of life (see next item);
c) *quality of life* of the administered community, both for resident citizen and for operating companies in the territory administered by the administration, e.g., a municipality;
d) *transparency* of institutions, government and public administration, i.e. the right of citizens and enterprises to access all types of information and knowledge produced by institutions and administrations, not covered by secret (so called *public data*);
e) *simplification* of administrative activities, the elimination from administrative activities of all types of interactions and burdens not strictly needed by law;
f) *sustainability* of policies and projects, especially financial sustainability, i.e., feasibility of the initiatives connected to ICT projects within the available budget;
g) *accountability,* the assumption of responsibility for actions, products, decisions, and policies of the administration;
h) *security*, and privacy, i.e., the right of the citizen to have sensitive and personal information protected with respect to incorrect use;
i) *e-Inclusion*, and overcoming of digital divide, the establishment of the right of every citizen to access and benefit from eGovernment services, independently from their culture, economic condition, available access devices, or language.

Notice that the above classification cannot be considered universally accepted, since, e.g. security can be seen as a sub characteristic of quality of life, and transparency can also be seen as a specific characteristic of accountability. Furthermore, the proposed list of principles concerns the highest ones cited in literature and in eGovernment programs. The list can be enlarged on the basis of the context of intervention.

Matching between policies and principles depend on the nature of the policy (see Figure 2.1.5 showing prevalent relationships). Whereas the public oriented policies, on the one hand, share the goal of improving the efficiency of the public administration with the market oriented ones; on the

[3] Page E.C. – The origins of policy – Oxford University Press, 2008

other hand, they relate this goal to the basic principles of democracy such as impersonality, and equality of services provided by the public administration, where the effectiveness of the service is strictly related to public value and to the degree of transparency for citizens of the service provision in terms of impersonality and equality of the back-end procedures.

Principles orient policies toward the different ways of conceiving and implementing the eGovernment strategy, influencing all future activities. Indeed, public managers in the first place need to be aware if they are working on a strategy defined by market-oriented or public-oriented policies. Furthermore, they need a way to share with other actors and stakeholders the knowledge related to their strategy in a fairly structured way in terms of requirements documentation. To these ends, in the preliminary eGovernment vision elicitation activity a simple checklist where principles are outlined for the main policies discussed above has to be produced. On the basis of the policy orientation a first set of principles can be chosen in order to better detail them in terms of requirements for the strategy definition.

We focus in the following on three principles, namely efficiency, effectiveness (and the related quality of life) and accountability of public administration. Accountability is seen according to the two coordinates of transparency and traceability of administrative procedures. As described above, efficiency is relevant both for the market-oriented and the public-oriented policies; while effectiveness, even if considered explicitly in an entrepreneurial, is generally considered more strictly related to public-oriented policies.

Principle/Policy	Market-Oriented	Public-Oriented
Efficiency	X	X
Effectiveness		X
Quality of life		X
Simplification	X	X
Transparency	X	X
Sustainability	X	X
Security and Privacy	X	X
Accountability	X	X
eInclusion	X	
Impersonality		X
Fairness		X
Equality		X
Personalisation	X	
Decentralisation	X	
Delegislation	X	
Subsidiarity	X	
Wholeness	X	
Disaggregation	X	
Cooperation	X	X
Integration		X
Uniformity		X
Productivity	X	

Figure 2.1.5: The principle/policy matrix

In the Singapore case study, looking at strategic information provided by institutions involved in innovation programs, the above selected principles are given the following degree of attention:

a) *efficiency*: focus areas 1. creation of space and 2. optimization of space are especially concerned with efficiency. Among the different initiatives, we mention vertical staking of compatible industries, multi level buildings with compatible facilities to consolidate common services, and logistics improvement in moving goods and equipment.
b) *effectiveness (quality of life)*: focus area 3. Creating highly live able residential towns is fully concerned with quality of life. Attention given e.g. to noise level, ambient temperatures, the growing ageing population boost the need to design and redevelopment of new and existing residential towns.
c) *accountability*: although not absent from programs and strategies, accountability is given minor importance in innovation initiatives accountability of resources and good governance. E.g. in one strategic document it is stated that "realizing value from can be obtained among others sustaining strong performance across the different entities in our ecosystem through sound governance and accountability".

2.1.4 Identify Macro and Micro Objectives and Technological Drivers of the e-Government vision

Once defined policies and principles, and priorities among them, in this step we have to move one step ahead, and deal with requirements related to the implementation of principles, in our example efficiency, effectiveness and accountability. We introduce here four new dimensions:

a) the high *level strategic/political objectives* which satisfy the principles; the objectives can be seen as an operational refinement of principles; furthermore, they can be defined at different refinement levels, leading usually to a two level classification in terms of *macro* and *micro-objectives*;
b) the enabling technologies for the actuation of the strategy satisfying the principle; macro and micro-objectives depend respectively on the final intention and associated strategies; furthermore they can be implemented using various types of technologies, that have to be identified at this stage only at a high level of detail, such technologies will be called in the following *technological drivers*;
c) the *legal rule(s)* which facilitate the actuation of the principle; legal frameworks should in turn enable the adoption of technologies, and not slow down and overload this process;
d) the actual *socio-organizational impacts* of the application of the principles.

We will focus in the following on the first and second point.

With reference to objectives, macro-objectives are defined on the basis of the final intentions of the administration, while micro-objectives are defined on the basis of the more focused strategies improving administrative processes and improving information management and coordination by means of laws or ICT. The set of macro-objectives must be clustered on the basis of their impacts on the context of interventions in terms of laws, services, organization-processes, technology adopted. The set of micro-objectives must be defined on the basis of the macro-objectives, starting from the available documentation and asking opinions of public decision makers and managers by means of questionnaires or involving them in focus groups.

In the Singapore case study we may identify the following macro and micro objectives.

1. *macro objective*: Sustain growth
a. *micro objective*: creation of space;
b. *micro objective*: import of sand.
2. *macro objective*: creating capacity

a. *micro objective*: optimizing land;
b. *micro objective*: leveraging on ICT in the design, monitoring, modeling, and simulation of facilities.
3. *macro objective*: Improving quality of life through creating highly livable towns.

Drivers of the planning process can be identified considering macro or micro objectives, and focusing on which technologies enable them. So they can be seen as "technology oriented" objectives; in a sense, they can be seen as technological tools to establish the principles. Technological drivers that from best practices can be seen as specifically relevant for public administration belong to the following families (non exhaustive list):

Quality of data and services: services and data (especially public open data) should be provided to citizens/businesses matching user perception in terms of quality and value, and such levels of service should be improved over years. ICT technologies should be chosen on the basis of the criteria of best improvement realized on the quality of service and the quality of data used, exchanged, managed in order to produce the service.

Data/information and service integration: data/information and services should not only be of high quality, they should be also integrated. This means that from one side the different representations of citizens/businesses in different agencies should be reconciled and that citizens should be uniquely identified and linked among the different registries. From the other side, services should be provided clustering elementary services into composite ones, referring to all the different interactions associated to a unique event of life of citizen or business. E.g., to open a cafeteria, a business has to interact with more than a dozen of public and private providers; the SUAP project aims at unifying such interactions.

Openness and reuse: services, software applications produced to realize services, data and every other artifacts available in the domains of single administrations should be made available to other administrations, in order to increase reuse and reduce costs. In order to achieve this principle, systems should be open, i.e. they should use highly available, non proprietary technologies.

Interoperability of processes, data and information flows: interoperability is considered perhaps the most important driver in best practices and lessons learned. A system, a service, an information flow, etc is said to be *interoperable* when it is able to operate in conjunction with other systems, services, information flows. In cooperative information systems, interoperability is often considered the crucial factor for success.

Authentication and anonymity: users should be protected against incorrect use of their personal and sensitive data, and, at the same time, the access to services and data should be disciplined in such a way as to provide access only to authorized users.

Sensor networks: sensor networks can be defined as large-scale ad hoc networks of homogeneous or heterogeneous, compact, mobile or immobile sensor nodes that are randomly deployed in an area of interest. Recent advances in miniaturization and low-cost, low-power design have led to adoption of sensor networks in large-scale, highly distributed systems of small, wireless, low power, unattended sensors and actuators.

Big data and analytics: the Web has been in the last years an extraordinary vehicle of production, diffusion, and exchange of information, and such trend will be larger and larger in the future. From one side, such huge amount of information allows analyses that weren't possible in the past, from

the other side the complexity of technologies that are needed to manage big data and the need to homogenize data form the different sources create significant challenges.

Assistive technologies enabling accessibility and adaptability to user diversity: users, independently from their culture, physical and social condition, native language, should have access to the services, and benefit from them.

In the Singapore case study, identified technological drivers refer to:

a) building effective *sensor networks* for environmental and structural monitoring in underground and underwater conditions;
b) developing *low-cost, low-maintenance sensor systems* with small form factor for efficient large-scale deployment in new spaces;
c) accessing *crowd-source sensor information* in a non-intrusive manner while ensuring privacy;
d) management and *analysis of data* from a proliferation of sensors within adopted in different projects;
e) *transforming* unstructured *content* into a structured and analyzable format;
f) *managing and handling incompatible and incomplete datasets* with varying degrees of standardization;
g) *developing efficient, accurate and reliable models* to facilitate design, planning or solution testing of applications (e.g. underground geology analysis and predictions, understanding human behavior and interaction in the urban environment such as commuting behavior, predicting impact of disruptive events such as crises or emergencies in new spaces or intensive industrial developments etc.).

2.2 User Segmentation

2.2.1 Questions addressed in the step and main concepts

Question addressed in the step are shown in Figure 2.2.1.

- Which are user segments interested in service provision?
- How the (abstract) service changes according to user segment considered?

Figure 2.2.1: questions addressed in the user segmentation step

Starting from data about user characteristics, user segmentation has two main aims:

1) deriving a number of user segments, i.e., groups including users that are similar with respect to some considered characteristics;
2) providing an accurate description of the peculiarities of the users belonging to each derived user segment.

To achieve these aims, in the adopted approach, four main activities are performed that are:

- *Segmentation Variable Selection*: this step is devoted to the selection of variables useful to characterize users and to enable the grouping of similar users;
- *User Data Gathering*: this step is aimed at the gathering of data about user characteristics related to the segmentation variables selected in the previous step;
- *User Segment Derivation*: this step has the goal to derive a number of user segments by grouping together users that are similar with respect to the considered characteristics;
- *Segment Profile Definition*: this step has the aim to define, for each segment derived in the previous step, a profile, i.e., a synthetic description of the main characteristics of the users belonging to the same segment.

A graphical sketch of the workflow scheme of the adopted user segmentation approach is shown in Figure 2.2.2.

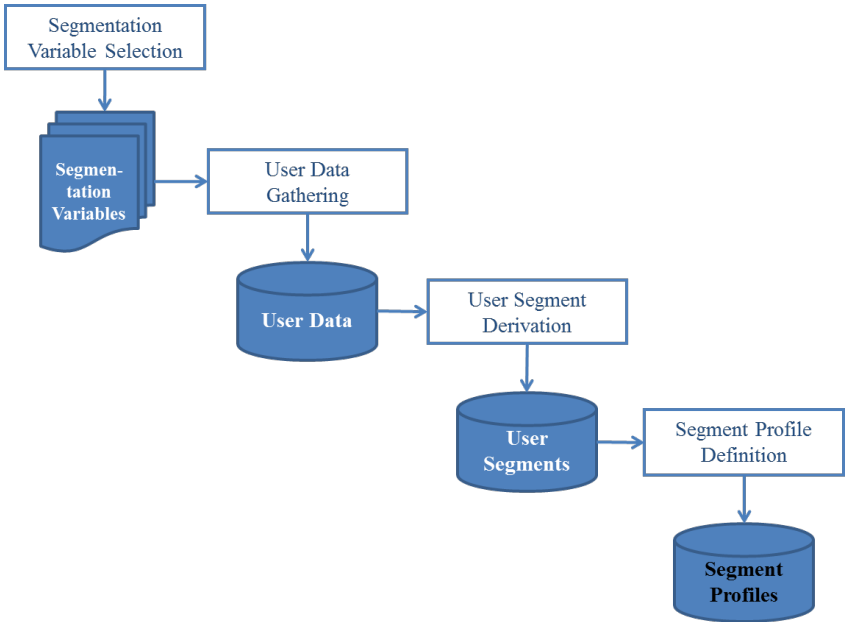

Figure 2.2.2: Activities, inputs and outputs to/from activities in the user segmentation step

In the following subsections, we provide more details for each involved step.

2.2.2. Segmentation Variable Selection

The first step of the user segmentation approach is mainly devoted to the selection of a set of features that allow us to effectively characterize and differentiate service users. Then, the main goal of this step consists in identifying a set of variables (also called segmentation variables or segmentation bases) related to user characteristics that can be conveniently employed as basis for the segmentation, i.e., variables considered in order to group together users having similar characteristics.

SMART focuses on service domains, with particular attention to services in the e-Gov domain. Broadly speaking, referring to segment users in such kinds of domain, we may rely on user characteristics that are easy to gather and commonly available. The variable selection should take into account that the gathering of their actual values may actively engage users who could be adverse to provide information about themselves or they could provide unreliable data nullifying the overall segmentation process. Moreover, it is important that user characteristics may be integrated with information deriving from other sources in order to mine a deeper knowledge about users.

Starting from these considerations, in SMART, we choose, as basis for the segmentation, variables that fall in the class of the general and observable variables. More precisely, we believe that, in the considered service domains, demographic and geographic variables can be useful to segment users since these allow us to effectively differentiate the users and, thus, to group them according to shared characteristics.

Specifically, in the SMART approach for user segmentation, we select demographic variables such as:

- *age*: the age range of the user;
- *gender*: the gender of the user;
- *marital status*: the civil status of the user;
- *family*: the number of components of the user family unit;
- *children number*: the number of sons of the user;
- *occupation*: the job carried out by the user;
- *residence city*: the place where the user resides.

In addition, whenever we deal with a domain where it is possible, we expand the demographic variables that someway have geographic significance by combining them with data of national statistics that are publicly available. For instance, the *residence city* variable can be usefully integrated with national statistic data in order to obtain a number of additional geographic variables such as the *city size*, the *chief town*, the *altimetric zone*, the *tourist vocation*, and so on. At the end of this step, the output is a set of N_{SV} segmentation variables $sv_j,\ j = 1, \ldots, N_{SV}$ that are useful to characterize users and to be used as a basis for an effective derivation of user segments.

2.2.2 User Data Gathering

User Data Gathering is essentially aimed at acquiring data about users by collecting the actual values taken by the variables selected in the previous step.

In the SMART project, to collect user data we choose to adopt an exploratory strategy that requires the explicit involvement of users who have to provide information about their main characteristics.

More precisely, in SMART, data about users are gathered by the provision of a questionnaire to a sample of users who have previously experienced the services involved in the considered domain.

Although the use of questionnaires could seem an intrusive strategy to collect user data since it needs that users directly provide their information by answering a set of questions, this choice is strictly related to the ability of such strategy to gather, in a simple manner, useful knowledge about the user characteristics. Of course, to reduce the effort of users engaged in the fulfillment of the questionnaire and to avoid their rejection to collaborate in this activity, the questionnaire has to include a restricted number of questions that are adequate to acquire the knowledge useful to efficiently segment users.

The questionnaire devised in SMART allows us to gather different kinds of data about users as follows:

- *demographic data*: the actual values related to demographic variables selected in the first step of the segmentation approach;
- *usage experience data*: the values of user perception based on their experience when they have used the considered services. Perceptions are required with respect to some aspects of services such as the time spent to request the service, the time passed to obtain the service, the cost, the service ability to satisfy user needs, the service quality, etc.;
- *geographic data*: the values for variables with geographic significance obtained by the integration of national statistics (as before explained);
- *aspect relevance data*: the relevance degrees ascribed by the users to each aspect of the considered services.

To segment users in the adopted approach, demographic and geographic data collected by questionnaires supplied to users are exploited. The other kinds of gathered data could be conveniently exploited for additional analyses. For example, such data could be useful in order to analyze the quality of the offered services or also to estimate their value in use that are further core topics addressed by the SMART project.

In SMART, the actual provision of questionnaires in order to gather user data is performed in two different ways: by requiring users to autonomously fill on-line questionnaires and by interviews (in this last case, questionnaires are filled by the interviewer). Despite less intrusive, with the first way of provision we may risk that users omit the invitation to fulfill the on-line questionnaire and consequently do not provide the requested information. Instead, the second way ensures a larger propensity by the users to collaborate in the data gathering step.

The outcome of this step is a dataset expressed in terms of a matrix $\mathbf{U}_{N_U \times N_{SV}}$ where N_U is the number of users who have accomplished the questionnaires and N_{SV} is the number of the selected segmentation variables. The *i*-th row of the dataset is a vector $\mathbf{u}_i = (u_{i1}, \ldots, u_{iN_{SV}})$ where each component u_{ij} represents, for the *i*-th user, the actual value taken by the *j*-th segmentation variable.

2.2.3 User Segment Derivation

Once user data have been gathered, the next step of *User Segment Derivation* has the aim at deriving user segments by grouping together users considered similar according to the selected segmentation variables. Among the wide variety of segmentation techniques, in the approach adopted in SMART, clustering analysis is performed in order to identify groups of similar users. In particular, we adopt a *post-hoc* descriptive approach for user segmentation based on the use of a partitional clustering technique. Precisely, starting from the dataset about user characteristics

gathered by questionnaires in the previous step, user segments are derived by the application of a K-medoids clustering algorithm, namely the *Partitioning Around Medoids* (PAM) algorithm proposed by Kaufman and Rousseuw [25]. Such algorithm is a slightly modified and more robust version of the well-known K-means clustering algorithm where, to partition data, representative objects in the dataset, called medoids, are considered, instead of the conventional centroids. This makes the PAM algorithm less sensitive to outliers in comparison with the K-means since it is based on medoids that are the most centrally located objects in the clusters, while centroids in K-means are obtained as the means of the coordinates of the objects in the clusters.

The PAM algorithm is a simple but powerful iterative technique that implicitly partitions the available user data into a number *K* of clusters where both the dataset and the number *K* are given in input to the algorithm. The algorithm uses a matrix of dissimilarity and it aims to minimize the overall dissimilarity between the medoid of each cluster and the members of the same cluster. This is achieved by minimizing the following objective function:

$$F(x) = \sum_{i=1}^{N_U} \sum_{j=1}^{N_U} d(\mathbf{u}_i, \mathbf{u}_j) z_{ij}$$

where N_U is the total number of users, $d(\mathbf{u}_i, \mathbf{u}_j)$ is the value of the used dissimilarity metric among users $\mathbf{u}_i$ and $\mathbf{u}_j$, and z_{ij} is a variable that ensures that only the dissimilarity between users from the same cluster is computed. The objective function is minimized by performing two phases, namely the *build phase* and the *swap phase*, summarized in the following.

Build phase:

1 Choose *K* users to become the initial medoids;

2 Calculate the dissimilarity matrix;

3 Assign every user to the cluster corresponding to the nearest medoid;

Swap phase:

4 For each cluster select as new medoid the user with the lowest average dissimilarity;

5 If at least the medoid from one cluster has changed **then** go to step 3 **else** stop the algorithm.

As a result, PAM partitions users into *K* segments. For each segment a user is selected as cluster medoids represented in terms of N_{SV}-dimensional vectors $\mathbf{m}_i = (m_{i1}, m_{i2}, \ldots, m_{iN_{SV}})$, i=1,...,K and N_{SV} the number of the considered segmentation variables. Finally, a user is matched with all medoids and he is associated to the segment corresponding to the nearest medoid.

2.2.4 Segment Profile Definition

The *Segment Profile Definition* step is the last step of the SMART approach for user segmentation. This step is mainly devoted to obtain a description of the user segments derived in the previous step. The ultimate goal of this step is to define, for each user segment, a profile, i.e. a synthetic description that summarizes the peculiar characteristics of the users belonging to the corresponding segment.

Segment profiles provide extensive knowledge about users within segments that can be useful for different purposes. For instance, such knowledge could be conveniently exploited in order to select the most appropriate segment as target segment for a product/service or to plan the most fruitful strategies that effectively address the needs and the expectations of the targeted users.

To define profiles, in the SMART approach, for each derived user segment, the components of the corresponding representative medoid m_{ij} $(i = 1, \dots, K; j = 1, \dots, N_{SV})$ encode the characteristics of users belonging to the *i*-th segment in terms of the actual values taken by the *j*-th segmentation variable.
At the end, the output of this step is a number of K segment profiles $\mathbf{p}_i = \left(\langle vs_1, m_{i1}\rangle, \dots, \langle vs_{N_{SV}}, m_{iN_{SV}}\rangle\right), i = 1, \dots, K$. Each segment profile $\mathbf{p}_i$ is composed of N_{SV} couples $\langle vs_j, m_{ij}\rangle$ where vs_j is the name of the *j*-th segmentation variable and m_{ij} is the actual value taken by the *j*-th segmentation variable in the *i*-th profile (in the medoid of the *i*-th user segment).

2.2.5 The Approach at Work

To assess the suitability of the approach for user segmentation adopted in SMART, we have tested it by considering a case study involving services for the opening of public businesses with administration of foods and beverages.

As a first experimental activity, the proposed approach was applied to derive and characterize segments of entrepreneurs interested in services that are useful to open public businesses in Italy such as café and Bed&Breakfast (B&B).

In the first step of the approach, we have selected the segmentation variables that we have deemed as the most appropriate to characterize and differentiate the users of the considered domain. More precisely, in this specific domain, we have selected as variables useful for the segmentation, a number N_{SV} equal to 12 of demographic and geographic variables, namely gender, age, marital status, family, children number, occupation and, related to the user residence city, size, chief town, altimetric zone, littoral position, mountain position, and tourist vocation.

Successively, in the second step of *User Data Gathering*, we have designed a questionnaire (articulated as specified in Section 2.2.2) in order to acquire knowledge about a sample of entrepreneurs who have experienced the considered services. The developed questionnaire included a number of questions that allowed us to gather the actual values in correspondence of the selected segmentation variables. As concerns the geographic variables, their actual values were determined by integrating the value for the residence city variable provided by users with data of national statistics.

In the provision activity, about 200 entrepreneurs of café and about 250 entrepreneurs of B&B from different Italian regions were contacted. Among these, a total number of 35 entrepreneurs of café and 50 entrepreneurs of B&B have accomplished the questionnaire. Then, at the end of the *User Data Gathering*, we have obtained the dataset **U** expressed as a matrix with 85 rows and 12 columns.

Next, the effective step of *User Segment Derivation* was performed starting from the dataset obtained in the previous step. Before segmenting entrepreneurs, a preprocessing activity was required in order to express user data in a more suitable form to be given in input to the clustering algorithm. In such preprocessing activity, we have mapped the values of the nominal variables (such as *gender*, *marital status*, etc.) of the gathered user data into numerical values. As an example, for the *gender* segmentation variable, we have assigned the numerical value 1 to the nominal value "*Female*" and the numerical value 2 to the nominal value "*Male*". In this way, we have obtained a dataset composed of a total number of 85 vectors (each vector represents the characteristics of each entrepreneur who has accomplished the questionnaire), where each

component of the vector is represented by the numerical value taken by the corresponding segmentation variable.

Hence, the PAM clustering algorithm was applied on the obtained dataset to derive the segments of the entrepreneurs. In particular, we have performed several runs of the algorithm with different initial numbers of clusters K (K=2,...,10) and, to establish the proper number of clusters (segments) to partition the available entrepreneur data, we have employed some validity indexes (Pearson's gamma, separation and Dunn indexes [26]) that are usually used in literature to this aim. Figure 2.2.3 shows the index values obtained in correspondence of the different K values. Higher values for the employed validity indexes indicate better quality of the obtained partitions. As it can be observed in Figure 2.2.3, the highest values were obtained in correspondence of K=3. Thus, we have selected such value as appropriate number of segments to partition the entrepreneurs involved in the questionnaire fulfillment.

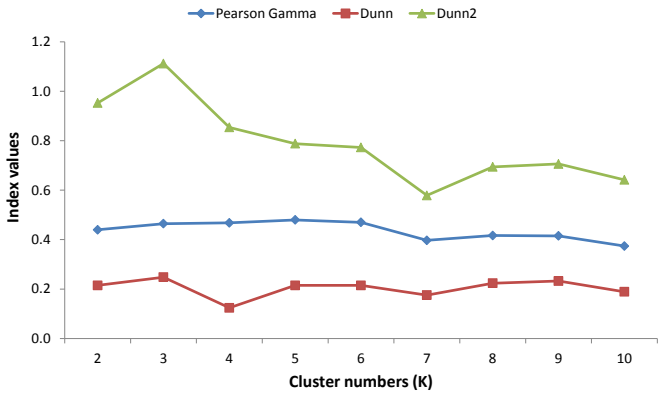

Figure 2.2.3: The obtained index values

Table **Errore. L'origine riferimento non è stata trovata.** shows the medoids determined by PAM in correspondence to the three user segments derived starting from the available entrepreneur data. Each row contains the identifier of the user representing the medoid and the component values of the medoid for the corresponding segmentation variables indicated in the column headers. In addition, for each derived segment, the last column reports the coverage value expressed in terms of the percentage of entrepreneurs belonging to each segment with respect to the total number of entrepreneurs.

Table 2.2.1: The three medoids obtained by the PAM algorithm

	User ID	Gender	Age	Marital status	Family	Children number	Occupation	Residence city: chief town	Residence city: altimetric zone	Residence city: littoral	Residence city: mountain	Residence city: tourist vocation	Residence city: size	Coverage
m_1	1	2	4	1	3	1	4	0	1	1	1	1	3	31%
m_2	55	2	3	1	2	0	3	1	1	1	1	0	7	44%
m_3	21	1	4	1	4	1	4	1	1	1	1	0	7	26%

Finally, in the last step of *Segment Profile Definition* of the adopted approach, the characteristics of users belonging to each derived segment were synthetized by defining the segment profiles starting from the components of the medoids derived in the previous step.

A possible representation of the profiles defined in correspondence of the three derived segments is as follows:

$\mathbf{p}_1$= (⟨Gender,Male⟩, ⟨Age,46-55⟩, ⟨Marital status,Married⟩, ⟨Family,3⟩, ⟨Children number,1⟩, ⟨Occupation,Self employed⟩, ⟨Chief town,No⟩, ⟨Altimetric zone,Plains⟩, ⟨Littoral,Yes⟩, ⟨Mountain,No⟩, ⟨Tourist vocation,Yes⟩, ⟨Size,5.000-9.999⟩)

$\mathbf{p}_2$= (⟨Gender,Male⟩, ⟨Age,36-45⟩, ⟨Marital status,Married⟩, ⟨Family,2⟩, ⟨Children number,0⟩, ⟨Occupation,Employee⟩, ⟨Chief town,Yes⟩, ⟨Altimetric zone,Plains⟩, ⟨Littoral,Yes⟩, ⟨Mountain,No⟩, ⟨Tourist vocation,No⟩, ⟨Size,>250.000⟩)

$\mathbf{p}_3$= (⟨Gender,Female⟩, ⟨Age,46-55⟩, ⟨Marital status,Married⟩, ⟨Family,4⟩, ⟨Children number,1⟩, ⟨Occupation,Self employed⟩, ⟨Chief town,Yes⟩, ⟨Altimetric zone,Plains⟩, ⟨Littoral,Yes⟩, ⟨Mountain,No⟩, ⟨Tourist vocation,No⟩, ⟨Size,>250.000⟩)

The knowledge mined from demographic and geographic data about users, embedded in the defined segment profiles, could be conveniently used to select services able to meet user actual needs.

2.3 Requirements collection and elicitation

2.3.1 Questions addressed and relevant concepts of the step

Questions addressed in the step are shown in Figure 2.3.1.

- Which are user goals ?
- Which are user outcomes?
- Which are laws and rules that presently discipline the administrative services?
- Which are the services that result from goals and laws/rules analysis?

Figure 2.3.1: Questions addressed by the requirements elicitation step

Requirements collection and elicitation has the goal of collecting all the information that is useful to achieve the needs and goals of users of the service to be designed [27] [28] [29]. Further, since administrative services are disciplined by national laws and local rules, one has to collect all these laws and rules to capture all element that are needed to understand the nature and articulation of the service. So, requirements collection and elicitation is often a critical and complex process that can be logically divided in two parts, shown with inputs and outputs in Figure 2.3.2.

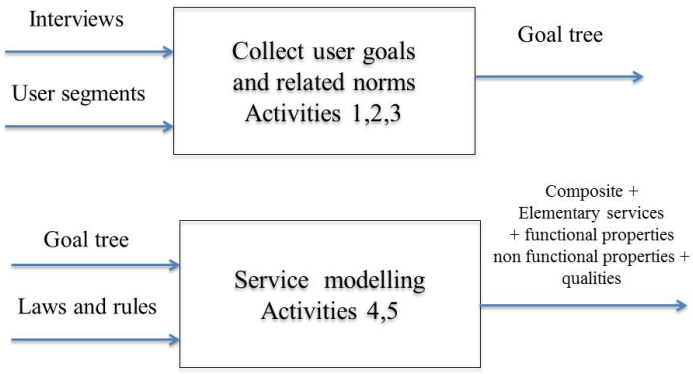

Figure 2.3.2: Structure of the requirement collection step

In the first part, all useful information is collected and the result is the production of a goal tree, see soon its nature and structure. In the second part, the goal tree together with laws and rules enacted to discipline the service has to be transformed, through a modelling activity, into a complete representation of the abstract service, resulting in the articulation of (possible) composite and elementary services and attribution to them of functional/non functional properties and qualities.

Activities mentioned in Figure 2.3.2 are shown all together in the methodology proposed in Figure 2.3.3, where the first three activities are related to collection of user goals and laws/norms, and the last two activities to service modeling. We now consider each one of the five activities, explaining them in terms of a case study, based on a typical event of life of a retail business, when an entrepreneur wants to open the retail store, in the specific case in which the retail store is a cafeteria.

1. Interview representatives of user segments identified in step 1.2
2. Analyze interviews, eliciting requirements in terms of goals and subgoals and building the goal tree
3. Collect laws and administrative rules that discipline the service in the territory of the business
4. Extract from the goal tree and from laws and rules a macro service and refine the macro service in terms of composite and elementary services
5. Extract from the goal tree and from laws and rules and assign to services a. functional properties, b. non functional properties and c. qualities

Figure 2.3.3: Methodology for the requirement collection step

In Italy the law defines bar or cafeteria as "establishments for the administration to the public of food and beverages, or more precisely selling and consumption on the premises". Premises refer to a venue or else to an area open to the public, equipped for this activity. The types of cafeterias and similar activities can be divided into:

- Type A: establishments of catering, that is, restaurants, diners, cafeterias, pizzerias, and similar
- Type B: establishments for the distribution of beverages (bar, cafe, ice cream, pastry shops and similar)
- Type C: those of type B where the distribution of alcoholic beverages of any degree is specifically excluded.

In the following we will refer to types A and B and we will consider in detail each one of the five activities of Figure 2.3.3.

2.3.2 Interview representatives of user segments

In previous steps we seen how to identify user segments that are stakeholders in an initiative related to the service life cycle. As to the event of life "open a cafeteria", we can say that some of the user segments are those ones listed in Figure 2.3.4.

- Entepreneurs
- Municipality employees specialized in authorizations for opening a business
- Plan surveyors
- Technicians for acoustic impact

2.3.4 Examples of user segments relevant for opening a cafeteria

Notice that, although the list could be incomplete, the three actors typically involved in the production and delivery of the service are identified, corresponding to final users (entrepreneurs), public administrations (municipality employees) and private providers (surveyors and technicians). In producing the above list we could have been more precise, leading to a two levels of classification, that e.g. for the user segment "entrepreneurs" results in two types, respectively Italian entrepreneurs and foreigner entrepreneurs. The more we are precise, the more we get useful

knowledge from personalized interviews. At the same time, the more we are precise, the higher is the effort and cost of the subsequent activities. A suitable equilibrium has to be found.

Once identified the types of users segments, we have to organize interviews. First of all we need to create a sample for each one of them, and decide the type of interview. We assume here to adopt a simplified method, where we formulate questions with associated open responses, namely responses resulting in a written text, while closed responses correspond to select a response among a fixed and known list. See examples of questions for entrepreneurs and administrative employees in Figure 2.3.5.

User segment	**Questions**
Enterpreneur	- Which is your main objective? - Could you describe which is in your perception the "best" service you would like to get? - How would you like to pay? - Which are your preferences about what we could call the "efficiency" of service delivery? - Are you italian or english speaking, if not, which is you primary language?
Municipality employee	- Could you describe your daily activity about authorization procedures for opening a commerce? - Which are in your evaluation main drawbacks in your administrative work? - Which are main inefficiencies in the admonistrative procedure? - Which are main compaints of final users

Figure 2.3.5: Examples of questions to entrepreneurs and municipality employees

In Figure 2.3.6 we show excerpts of open answers from entrepreneurs (Italian and Chinese) and employees.

Interview to italian speaking enterpreneur

I wish to open a cafeteria.

I need a simple interaction with the municipality, and that allows me in getting forms that I have to fill, preferbly prefilled for fields known to the PA. I do not want to loose my time to trace the administrative process from Internet.
I want to pay using pos or credit card; as to the time to wait for the authorization, I need it very soon, say, 15 days, and I'm available to pay more than the standard tariff if I get soon, say, 200 € for the whole set of authorizations.

Interview to chinese speaking enterpreneur

I would like to interact with SIUP in chinese..

Interview to employee

……
there is a general norm that constraints/ allows me to conclude the ad-ministrative procedure in at most 60 days

Figure 2.3.6: Responses to interviews

2.3.3 Analyze interviews, eliciting requirements in terms of goals and subgoals and building the goal tree

We have now to analyze requirements, extracting all the elements that allow us to understand and model user goals. To date, there is no de facto standard language for describing goals, and they are

often described in myriad of ways going from informal pictures or text that lack a well-defined formal semantics to very precise predicate logic formulae.

Goals are high-level objectives of a person, business, organization or system; they capture the reasons why a service is needed. Goals are important in several respects. Goals drive the identification of system requirements to support them. Further, they are identified at the very beginning of the service life cycle, their incorrect or partial or ambiguous elicitation influences negatively the whole life cycle.

Goals can be expressed initially in very general terms (in our case: open a cafeteria), and then can be refined in terms of sub goals, leading to the construction of a goal tree. Subgoals in our case can be:

1) Achieve the administrative authorization to open a cafeteria;
2) Achieve further enabling services (loans etc.) for opening the cafeteria.

A classification of goals is the distinction between *hard goals* and *soft goals*.

- Soft-goals are used to specify high level qualitative objectives (e.g., customer satisfaction) that are difficult to measure;
- Hard-goals clearly define a concrete state/target an actor desires to achieve. For hard goals clear achievement criteria and (quantitative) measures are defined.

We assume that hard goals are goals which can be determine by a measure, whereas soft goals have no clear-cut criteria as to whether they are satisfied.

With reference to strategies for goals elicitation, goals can be *elicited* in a *bottom-up* or *top-down* fashion.

- Top-down elicitation of goals can be regarded as refining and decomposing the system's goals. The top-down approach usually starts from analyzing the corporate strategy and translating it into a set of soft goals, which are gradually refined and decomposed into operational level goals.
- Bottom-up elicitation of goals starts with the analysis of the individual autonomous actors/agents, identifies their "private" operational goals and aggregates them into more abstract and higher level goals that concern the whole organization/system.

The former approach (top-down) appears to require more work and inventiveness, since there is no systematic way for refining high level goals into concrete goals. Furthermore, high level goals do not always imply what should be the goal, for example, of a concrete low level process. In the latter approach, the challenge resides in the fact that goals do not always comply with one another. Each stakeholder has different requirements and priorities; very often these interests are conflicting.

While the first type of approach is typical/suitable for organization models in which the control is imposed into a centralized and hierarchical fashion, the second approach is more suitable for organizational models in which the control is distributed over several units/departments. Nevertheless, common to both approaches is the fact that in the end both approaches result into a detailed decomposition of goals in the form of a goal tree in which leafs' granularity is sufficiently fine to allow their operationalisation.

Besides goals, other concepts are central in requirements analysis and collection; they are *stakeholders*, *final users* and *scenarios*. Stakeholders are those people who have an interest in the

success of the service or may share knowledge and visions for its success. Stakeholders also have a social or economic interest to the satisfaction of the goal, achieved through the production and sale of the service. In our case study stakeholders are the government and central and local administrations involved in industrial development, and associations of entrepreneurs. We will not go further in considering stakeholders.

Final users may be described in terms of user segments, we have seen them yet. Scenarios are task-oriented vivid descriptions of envisioned use of the application, which can assist analysts in discovering new requirements, exemplify goals, surface new goals and better define stakeholders. Scenarios are commonly recognized as powerful drivers for goal-based approaches; they are partial descriptions of the wide spectrum of the potential interaction capabilities of the application to be developed. We will not go further in considering scenarios.

The analysis of responses to questionnaires leads to the mapping between the natural language texts and the goals, subgoals, hard goals and soft goals shown in Figure 2.3.7. Notice the in the right hand side of Figure 2.3.7 goals of various types are expressed using natural language, but now the representation of user needs and goals is much more precise and close to the service model introduced in Section 1.3, although further modeling work in needed. We associate to each instance of goal the user segment that mentioned it; in this way we keep the provenance of the goal, and discover possible heterogeneities or inconsistencies among goals from different user segments. For example, the second and fourth hard goal in Figure 2.3.7, they express clearly conflicting points of view, since the entrepreneur wishes the authorization in at most 15 days, while the employee knows that he/she has at most 90 days to conclude the administrative activity. This heterogeneity has not to be solved in this step but we have to keep note of it for further analysis in the life cycle.

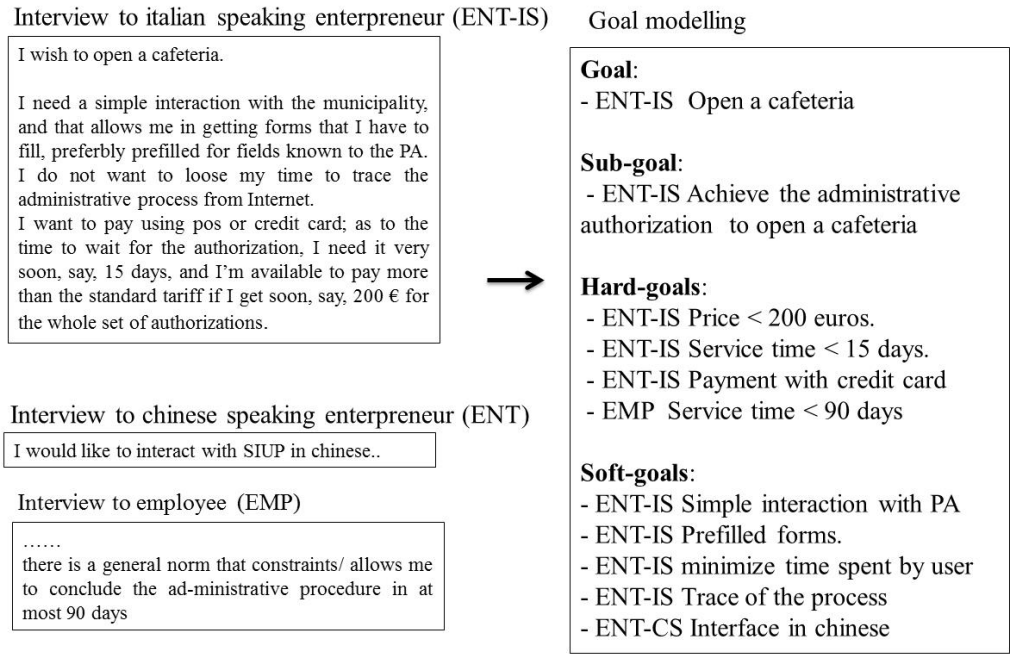

Figure 2.3.7: Goals elicitation through interview analysis

2.3.4 Collect laws and administrative rules

Italian legislation is complex, and often lots of norms exist that discipline an administrative activity. In the area of administrative activities (authorizations, communications, etc.) related to businesses, a

significant simplification has been recently envisaged with the institution of the so called SUAP, whose goal is to unify at the municipality level, and within a unique office desk (physical or virtual) all interactions between businesses and public administration. In Figure 2.3.8, we reproduce the two administrative procedures that can be chosen by the entrepreneur; we recognize in the standard procedure the 90 days upper bound declared by the employee, upper bound that drops to 45 days in case of simplified procedure.

Two administrative procedures

- A *standard procedure*, that has to be concluded in at most 90 days, where every administration involved in the procedure once examined the project produced by the entepreneur provide their own authorization. The SUAP receives the request and forwards it to offices for technical advices. When all offices authorize the request, the administrative procedure ends with a postivie authorization to opne the cafeteria.
- A *simplified procedure*, that has to be concluded in 45 days, where the eneterpreneur produces self certifications for compliance with rules that are in force; such self certifications and related documentation are forwarde by SUAP to offices for administrative check. If after 45 days offices do not reply, the «silent/conset rule» is applied and the authorization is positively provided.

Figure 2.3.8: Excerpt from laws on the institution of SUAP (unified front office for productive activities)

In Figure 2.3.9 we see another excerpt of the laws referring to SUAP, where a list of authorizations or documents that have to be produced is reported. Notice that authorizations and documents in the list correspond to new services and interactions that the entrepreneur needs to perform with administrations of private professional providers. They help us to understand in detail the complexity of the service system involved in service provision. Such complexity is perceived as much higher if we move from national laws to regional regulations (see Figure 2.3.10).

The following documents have to be attached to the request:

1. «Antimafia» certificate
2. Cadastral map
3. Certificate of use and occupancy
4. Noise impact certification
5. ……

Figure 2.3.9: Extract specifying new certifications and services

	Anti-mafia certification	Statement of payment of chargees, rights and expenses	Certification of premises compliance with technical scripts enclosed	Clearance of acoustic and environmentsl impact	Planimetry of the cafeteria	Statement of supervision of premises used as public shop	Certificate of registration at Chamber of Commerce	Statement of environmental impact	Cartification of use and occupancy	Alchool Licence	Relazione tecnica dei locali rilasciata da tecnici abilitati	Cadastral certificate	Parking facilities	Sign blueprint authorization
National regulations	**X**	**X**	**X**	**X**	**X**	**X**	**X**							
Abruzzo	X			X	X	X	X	X	X					
Basilicata	X			X	X	X	X	X				X		
Calabria	X		X		X		X	X		X		X		
Campania	X			X	X		X	X				X		
Emilia Romagna	X		X	X	X	X	X	X		X			X	
Friuli Venezia Giulia	X				X	X	X	X		X	X			
Lazio	X	X	X	X			X	X						
Liguria	X	X			X		X	X		X				X
Lombardy	X	X	X	X	X	X	X	X						
Marche	X	X			X		X	X		X		X		
Piedimont	X	X	X	X	X	X	X	X		X		X	X	
Puglia	X		X				X	X						
Sardegna			X	X	X		X	X	X					
Sicily	X	X					X	X		X		X		
Tuscany		X		X			X			X				
Trentino Alto Adige	X	X	X			X	X		X	X		X		
Umbria							X	X						X
Valle d'Aosta	X	X	X			X	X	X						
Veneto	X			X		X	X	X	X	X	X	X		

Figure 2.3.10: Regional rules

In Figure 2.3.10, columns with a cross in the row "national regulations" correspond to authorizations and services that in part overlap with services mentioned in Figure 2.3.9. Other services are new; e.g. the existence of parking facilities close to the cafeteria is mentioned in regional laws of Emilia Romagna and Piedimont. Anyhow, notice that the presence of a cross in the first group of services means that the service is present in the regional laws, but with some change w.r.t. the national legislation. This means that, assuming a coordinate production of all the versions of the service in a common life cycle, we should diversify the analysis according to exceptions and modifications. This analysis is outside the scope of this report.

2.3.5 Identify from the goal tree and from laws composite and elementary services

We now proceed to model del service(s) for which we have found traces in user goals, laws and rules. First, we have to look to administrative offices and private providers that due to their administrative competence or expertise are providers of services collected in previous activity. Proceeding with a bottom up strategy, we may produce the list of services in Figure 2.3.11; the list is incomplete, to allow us to keep the case study simple enough. For the moment, a unique composite service "open a cafeteria" is associated to all of them. Next, we may represent the service system involved in service provision, in the two cases of standard procedure, and simplified procedure, producing the two styled diagrams of Figure 2.3.12 and Figure 2.3.13.

Service/	Provider	Type of service	Mandatory/discretionary
Payment of chargees, rights and expenses	SUAP Desk - Municipality	Administrative	Mandatory
Antimafia certification	Prefecture	Administrative	Mandatory
Registration in the national business registry	Chambers of Commerce	Administrative	Mandatory
Cadastrial certificate	Plan surveyor	Administrative	Mandatory
Certificate of use and occupancy	Local police	Administrative	Mandatory
Alcohol licencing	Local health agency	Administrative	Mandatory (when needed)
Noise impact certification	Sound technician	Market	Mandatory
Insurance policy	Insurance providers	Market	Discretionary
Sign blueprint authorization	Advertisement office - Municipality	Administrative	Mandatory
Bank loan	Bank	Market	Discretionary
Transfer or registration/ new connection	- Electricity provider - Water provider	Market	Mandatory

Figure 2.3.11: List of elementary services associated with "Open a cafeteria"

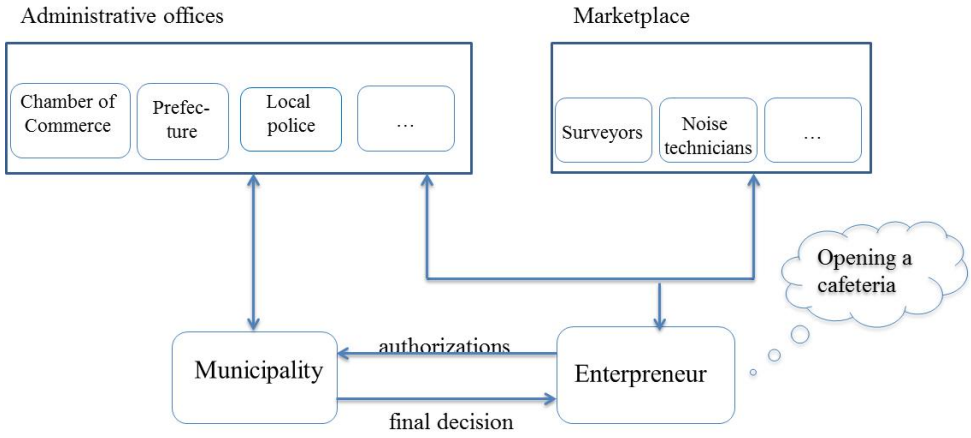

Figure 2.3.12: Service system of the service as is in case of standard procedure

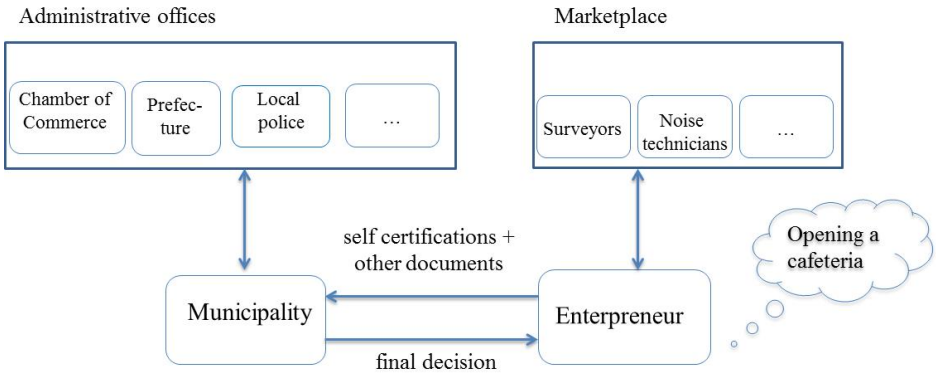

Figure 2.3.13: Service system of the service as is in case of simplified procedure

Finally, we have to provide a more hierarchical structure to the "flat" list of services in Figure 2.3.11. We can organize the composite service "open a cafeteria" into two services, "achieve authorization to open the cafeteria", that is an administrative service, and "enabling service" that is a market oriented service, resulting in the composite service represented in Figure 2.3.14.

Composite serv. – level 2	Composite service – level 1	Elementary Service
Open a cafeteria		
	Achieve authorization	
		Payment of chargees, rights and expenses
		Antimafia certification
		Registration in the national business registry
		Cadastrial certificate
		Certificate of use and occupancy
		Alcohol licencing
		Noise impact certification
		Sign blueprint authorization
	Enabling service	
		Insurance policy
		Bank loan
		Transfer or registration/ new connection

Figure 2.3.14: Composite and elementary services

2.3.6 Extract functional/non functional properties and qualities

We finally have to add to services identified so far functional/non functional properties and qualities that have been collected in the activity of goals elicitation. For each hard and soft goal, we have to map the goal to services in Figure 2.3.14. The result is depicted in Figure 2.3.15.

Composite serv. – level 2	Composite service – level 1	Elementary Service	Non functional property	Quality
Open a cafeteria				
	Achieve authorization		- Service time < 15 days - Service time < 90 days - Multilingual interface	- Simple interaction - Prefilled forms - Minimize time spent by user - Easy trace of process
		Payment of chargees, rights and expenses	- Price < 200€ - Electronic payment	
		Antimafia certification		
		Registration in the national business registry		
		Cadastrial certificate		
		Certificate of use and occupancy		
		Alcohol licencing		
		Noise impact certification		
		Sign blueprint authorization		
	Enabling services			
		Insurance policy		
		Bank loan		
		Transfer or registration/ new connection		

Figure 2.3.15: Composite and elementary services and properties/qualities

We omit functional specifications, assuming that they are for simplicity in one to one correspondence with the service, e.g. the service "bank loan" has as corresponding function the provision of the loan from the bank. As to non functional specifications, it is natural to associate to the "payment service" both the non functional specifications regarding price and the payment method.

We have now to perform a last activity, changing the specifications in Figure 2.3.16 into the final abstract service output from the whole phase of Planning. To do so we have to standardize names of non functional specifications and qualities. As to non functional specifications, we use the reference list reported in Appendix 1. As to qualities, we will introduce in Section 3.2 standard names and definitions for service qualities and metrics; we can anticipate here the standardization activity, keeping trace of metrics expressed in hard goals, and making an attempt for soft goals to provide some approximate metrics, resulting in the specifications listed in Figure 2.3.16, where only services characterized by explicit non functional specifications and qualities are reported.

Composite serv. – level 2	Composite service – level 1	Elementary Service	Non functional property	Quality
Open a cafeteria				
	Achieve authorization		- Delivery time: < 15 days - Delivery time: < 90 days - Supported language: Italian, English, Chinese	- User time: perceived «minimized» - Transparency: 2/3 traces to the user - High accessibility
		Payment of charges, rights and expenses	- Absolute Price < 200 € - Payment method: credit card	

Figure 2.3.16: Abstract service specification

Chapter 3: Assessment of service as-is

3.1 State Reconstruction

The aim of state reconstruction is i) to collect and organize the knowledge about the area in which the eGovernment intervention is going to take place, in order to highlight major resources of the social system, and information and technological system to be dealt with and ii) to ground the subsequent phases of the design and development activities. State reconstruction considers all the facets endorsed in Figure 3.1.1, namely, principles, policies, social system, services, organization, processes, ICT technologies.

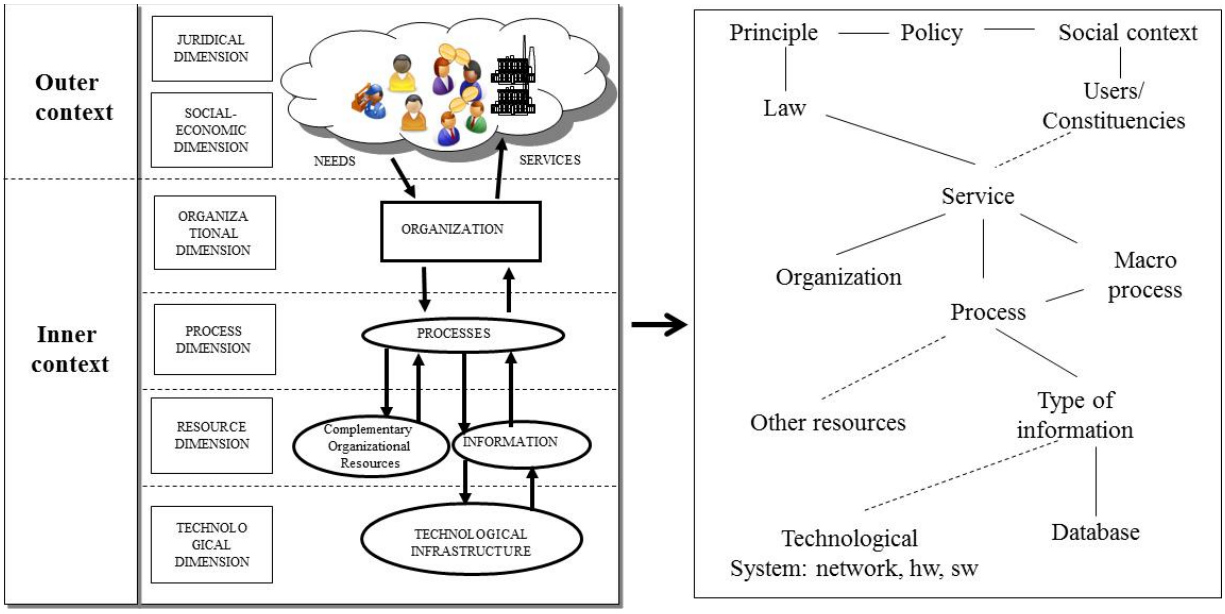

Figure 3.1.1: Characteristics of the service system reconstructed in this step

The outputs of state reconstruction are:

- a set of indicators describing the broad context in which the eGovernment intervention takes place;
- a set of descriptions of major facets involved in eGovernment projects;
- a set of matrixes showing the inter relationships between the facets.

In the section, first we consider the facets, providing several models at different levels of expressiveness to describe them. The more the model is expressive, the more rich knowledge on the facet is collected and represented, but the more the process costs. Thus, the models provided have to be seen as a kit of representations, to be chosen according to the importance of the facets they aim to describe. Then, we discuss relationships in terms of a common representation, namely two columns of matrices. The running example and other local examples are used thoroughly in the chapter.

3.1.1 How to represent Smart facets

In this section we examine the facets in Figure 3.1.1, focusing, however, on laws, services, processes and data.

Services

The concept of service has been thoroughly defined and discussed in the introductory chapter. Here we provide several possible classifications according to which services can be organized, and several metadata that can be used for the description of their properties.

A first type of classification has the definition of classes of services as a goal on the basis of their functional characteristics (e.g., a service that produces as output a certificate is an instance of the class *certification*). We will call this classification *functional classification of services*. Most relevant classes of services are shown in Figure 3.1.2, in some cases related by IS-A relationships.

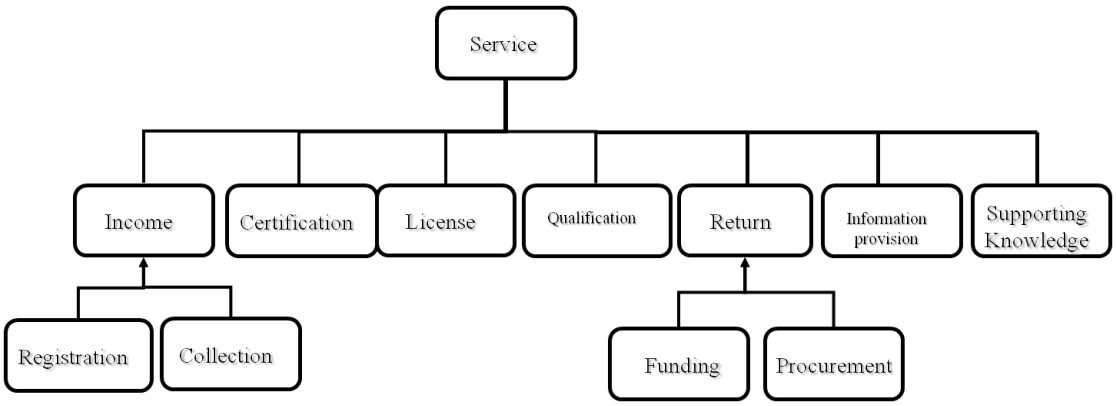

Figure 3.1.2: Functional classification of services

The classes have the following meaning:

1. *income* is an action or payment due to public administration by a law or rule; income can be further classified in terms of:
   a. *registration*, services related to recording object- or person-related data in official registers with respect to administrative obligations,
   b. *collection*, payment of an obligation, such as a tax;
2. *certification*, provision of a document testifying to a property or the truth of something;
3. *license*, official or legal permission to do or own a specified task;
4. *qualification*, meeting the proper standards and requirements for position or task;
5. *return*, every type of payment from Public Administration to persons or businesses; among return services we distinguish:
   a. *funding*, an amount of money or other resources set aside for a specific purpose, usually for supplying a project or an activity;
   b. *procurement*, payment for service or goods provision;
6. *information provision*, the action of providing information to Public Administration of an event or state;
7. *supporting knowledge*, every type of knowledge managed in Public Administration archives and data bases that Public administration can provide to citizen and businesses.

In Figure 3.1.3, we see examples of services belonging to the above classes.

Class	Examples
Registration	•Birth Registration •Land and property registration
Collection	•Licence tax payment •Patent tax payment
Information provision	•Change of place of a retail activity •Value added tax statement •Customs declaration
Collection	•Licence tax payment •Patent tax payment
Certification	•Birth certification •Permanent address certification
Licence	•Real estate restructuring •Planning permission
Qualification	•Authorization to start a business •Authorization for pershable goods transportation
Funding	•Small business financing •Real estate restructuring loan
Procurement	•Access to public auction •Call for bids
Information provision	•Change of place of a retail activity •Value added tax statement •Customs declaration
Supporting knowledge	•Access to laws •Information on services provided •Territorial marketing

Figure 3.1.3: Examples of services for the different functional classification items

In functional terms, each class of services can also be associated to the conceptual schemas of data that have to be accessed in order to provide the service. In Section 1.4, we called such schema as the service data schema.

Another typical classification used for services is the classification based on events of life. The motivation for introducing this metaphor comes from the fact that citizens and businesses perceive the need to request services from the Public Administration mainly when some events occur in their life, such as e.g. the need to travel abroad for citizens, or the start up of a business. The classification based on events of life has been proposed in order to simplify the interaction with users, grouping services for significant events. The more the grouping is granular and distinct for a wide number of events, the more the users need to understand and identify the administrations to interact with is simplified. An example of classification of services for citizens in terms of life events is shown in Figure 3.1.4.

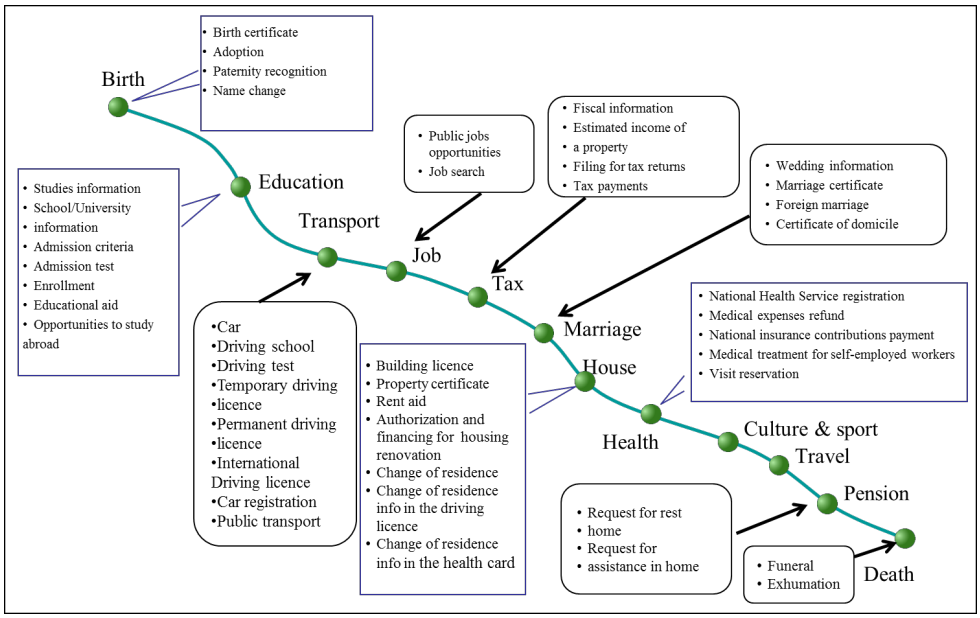

Figure 3.1.4: Classification of services for citizens in terms of life events

The above two classifications can be considered together as first types of meta-data that may be associated to services represented in a *repository of services*. Such a repository aims to be a rich description of services actually provided by administrations in terms of several descriptive properties expressed by meta-data. The repository of services can be useful in principle for three types of players, namely i) public administrations, ii) external users, and iii) service developers and providers. A snapshot of a repository is provided in Figure 3.1.5.

Service Description	**Service Provider**	**Type of Users**	**Classification**	**# of potential users (National)**	**Yearly service frequency**	**Access channels**
Provision of Fundings for Agricolture	Province of Rome	Farmers	Return	600.000	1.200.000	- Physical desk - Call center - SMS
Communication of change of address	Municipality of Milan	All businesses	Registration	5.000.000	1.000.000	-Physical desk & Internet -Call center and SMS - Kiosk and SMS

Figure 3.1.5: A snapshot of a repository of services

Apart from the two classifications introduced above, other properties concern:

1. a service description, a short natural language description of the service, which should emphasize as much as possible how the service is perceived by users;
2. the classification of the service in terms of functional and life events based classifications;
3. the types of users who may need the service;
4. the estimated number of users who need to access the service, and their evolution in time. For instance, the service "Obtain a fishing license" is needed in a country by fishermen the first time they go fishing, and has to be confirmed after a given interval time; here we have to quantify the approximate number of fishermen who need a license every year;

5. the frequency of use, in terms of average number of invocations of the service per user in a given interval of time (e.g. a year);
6. statistics on access channels (e.g. physical desk, internet, cell phone, etc.) presently provided to invoke the service.

Laws

A law is a system of rules, usually enforced through a set of institutions. Laws are enacted over the years, resulting in a corpus of rules and obligations which all together are defined as a legal framework. Laws can be of different types, such as, e.g., constitutional laws or decrees. Consequently, legal frameworks are in general structured as a hierarchy of rules; Figure 3.1.6 shows an example that generalizes the legal framework of Italy and other Mediterranean Countries such as Tunisia. Besides constitution, International treaties are the highest set of rules governing all the other types of rules, namely, Decrees, Decrees with force of Law, Ordinance, and Administrative Rules, these latter governing specific administrative procedures.

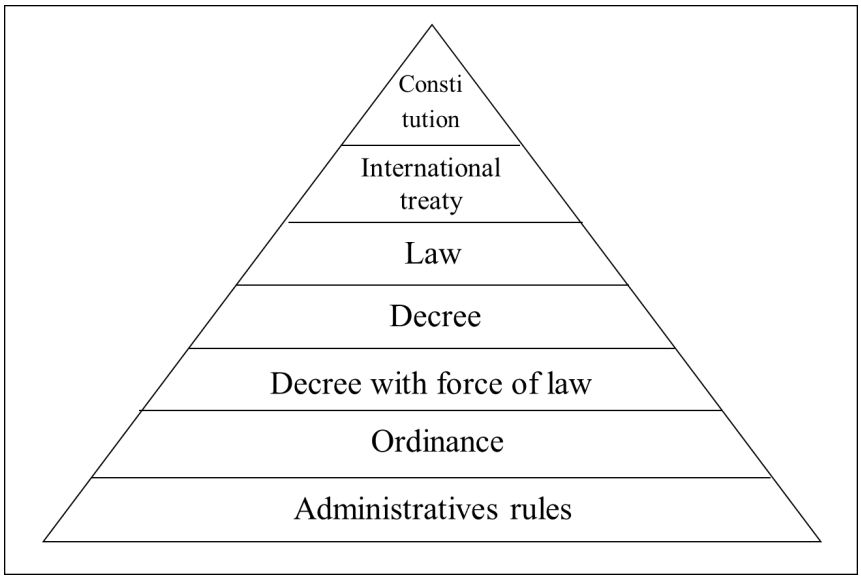

Figure 3.1.6: Example of legal framework

The above model of legal framework is quite general and has to be specialized to specific legal contexts of the different countries. E.g., in Italy local public administrations such as regions may issue laws, called regional laws, which discipline several themes in which Regions have jurisdiction, such as health, welfare, agriculture, whose only obligation is not to contrast with national laws.

Organization

The structure of Public Administration in many countries consists of central and local agencies that together offer services to citizens and businesses. For example, in Italy, central PAs are of two types, *ministries* such as Internal Affairs, Finance, and other *central agencies* such as Social Security, Accident insurance and the Chambers of commerce. Main types of local PAs correspond to regions (21), Provinces (about 100) and municipalities (about 8.000). The previous four tier model is adopted only in certain countries, in others a three tier model holds, and so on.

In this phase of state reconstruction, starting from the above mentioned high level organizational chart, we should refine the representation of the public administrations involved in eGovernment, producing at least one or two level descriptions which comprise (notice that the nomenclature may change from country to country), the directorates, divisions or offices. The refinement should stop when the office responsible for the service is found. Typically, the attribution of competence on services to an Administration is established by law, and a public entity (in the following, the *service owner*) is chosen as responsible for service issue; a central PA or, collectively, a type of local PA can be chosen as owner of a service, e.g., in Italy municipalities are owners of the service "certify the residence address of a citizen". While the owner is unique, the service may be supplied by one or more public or private providers.

Another consequence of the above discussion is that for many services the administrative process which performs the service provision may involve information systems both of several central and of several local administrations, resulting in the need to establish a technological framework which makes both central and local administrations to cooperate in service provision.

Processes

In the context of eGovernment, an administrative process is a set of activities or subprocesses performed to produce a service to be used internally in an Administration, which we call *internal service*, or else a service to be delivered to an external user that we call *external service*. If the process produces an internal service, in order to transform the internal service into an external one it has to be an input to a new process. A macroprocess is a sequence of processes that all together satisfy a service request made by an external user producing the required external service.

Besides administrative processes, we are also interested in modeling a second type of processes, namely *business processes*, i.e. the activities performed in businesses to produce and sell goods and services. When not ambiguous, we will use the terms process and service instead of administrative or business process, and internal or external service.

The concept of process is central in Smart, since in order to provide high quality services for citizens and businesses we have to act on processes producing them. In the book, we provide three solutions with different levels of expressiveness and related complexity in order to represent processes, namely, hierarchical classification, metadata, and a formal language. We now discuss the first two solutions; details about the formal language for process description are in Appendix 2.

The hierarchical classification of processes supports the specification of processes in terms of subprocesses, together with a short definition of them. As an example, we may express the process of "Procurement" in terms of the following subprocesses:

1. Demand estimation is the first phase of a procurement process in which an organization estimates its needs: basically, it responds to the question "what do we need?".
2. Budget definition, through which the previously identified needs are related to the available economic resources.
3. Needs specification matches the needs detected in the first process with available resources in order to determine the actual specifications of the goods and services that can be procured to fulfill the users needs.
4. Supplier scouting, consists in looking for vendors who could provide services and goods compliant with the specifications drawn in the previous process.

5. Supplier qualification, aims to verify if the potential suppliers selected in the previous process satisfy some general prerequisites fixed by the buyer organization in terms of quality and reliability.
6. Request for proposal, is the process in which the buyer organization can request that the suppliers fulfil the criteria defined in the previous process to formulate proposals which could satisfy the specific requirements drawn in the needs specification process.
7. Tendering is the process by which offers to perform activities or provide goods are called for in a competitive environment. It covers the preparation of an offer by tenderer and its submission to the awarding authority.
8. Awarding, that begins with the opening of tenders that are checked in order to select the winning tender. The chosen tenderer and rejected suppliers are informed of the results of the evaluation.
9. Contracting, in which the awarding authority establishes commercial agreements with the awarded supplier. In this process a negotiation process may take place about the provision stipulations.
10. Ordering, in which the buyer issues an order to the supplier for the services or goods it needs. Obviously it is necessary to distinguish between orders of common use and non common (or extraordinary) use according to the complexity and frequency of procurement of such objects.
11. Supplying, in which the supplier, once he has accepted the order, provides the buyer with the ordered goods or services.
12. Invoicing, in which after the successful delivery accomplished in the previous process, the supplier issues the invoice and actual payment from buyer to supplier.

Notice that the above list does not provide the description of the control sequence of execution of the subprocesses, neither exceptions and other typical flows of control primitives; such aspects can be described using the language provided in Appendix 2.

The second solution provided for processes is in terms of a set of metadata that can be organized with a form such as the one of Figure 3.1.7 that describes several characteristics and properties of the process “Invoice accounting”. The fields in the form have an intuitive meaning; we do not provide further details.

Process goal Invoice accounting		**Organizational units involved** Accounting office
Input/ Activation events Invoice supply		Output (documents/goods/services) Update of expense item Order of payment emission
Data Bases Accounting data base		
Activities 1. Check of cash on hand 2. Update of balance sheet 3. Order emission		
Internal/external users Responsible of accounting/Suppliers	Volumes 100 transactions a day	
Reference laws/norms Accounting laws		
ICT Technologies Server + sw accounting package + DBMS + local network		Sw applications Accounting package

Figure 3.1.7 - Example of the form describing the process of invoice management

3.1.2 Relationships among facets

Once adequate documentation is produced on the relevant issues in eGovernment, we have to investigate the relationships among issues. Here we simplify the overall problem, focusing on binary relationships, namely relationships among pairs of issues and among them, on the most relevant one. The tool that we will uniformly use to represent the relationships is the matrix, where in rows and columns we represent the possible instances of two related facets, and in the cells the type of relationship defined among the instances. To achieve compactness, in this section we introduce tables and matrixes directly expressing them in terms of the running example.

Services, processes, macroprocesses

The services we are interested in this book are requested by citizens to be able to perform a wide set of activities, such as to go abroad, to get a driving license, etc. and by businesses to perform their business processes, such as, e.g., to open a new sales point. Due to this aspect of the relationship between PAs and businesses, we are interested to model:

- the relationships between services provided and the internal administrative processes;
- the relationships between business processes and services requested by businesses.

The first representation is useful since it allows us to understand how ICT technologies can be used to provide better services through administrative process automation and/or reengineering, the second representation is useful for businesses to understand how their own processes can be improved when the execution of the process proceeds, making use of some service provided by the public administration. We examine them separately.

In order to model the relationship among services and administrative processes and macroprocesses we may use two different types of representations, namely a simple matrix shaped representation and a richer representation in terms of the BPMN language described in Appendix 2. An example of the matrix shaped representation is shown in Figure3.1.8 that represents all processes and services

involved in a specific macroprocess M. It is important to note that in this case the matrix is generic and does not refer to the running example.

Service/process/macro process M	Service1	Service2	Service3	…….	Servicen
Process 1	X		X		X
Process 2		X	X		
Process 3		X			X
…..					
Process n	X		X		X

Figure 3.1.8: Processes, macroprocesses and related services

The relationships between business processes and services requested by businesses are modeled considering the following scenario. Businesses, to perform their business processes, need authorizations and other types of interactions with Public Administrations. If we see Business to Government interactions from the point of view of businesses (see Figure 3.1.9), the execution of a business process can be seen as a chain of activities internal to the business (some of them require the interaction with other businesses) interwoven with requests of services to the Public Administration. A more effective provision of services by the Public Administration results in more effective business processes.

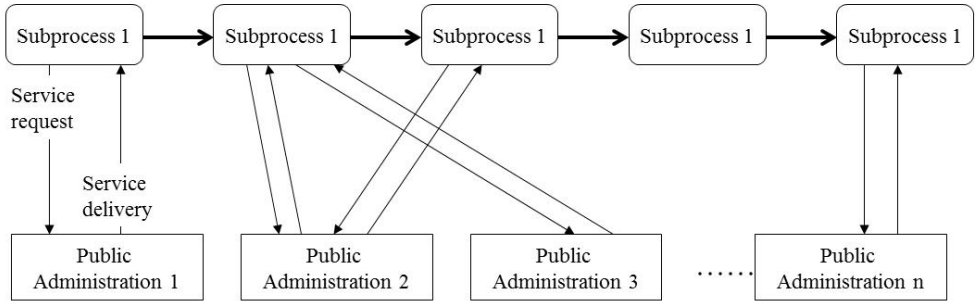

Figure 3.1.9: Business processes and services requested

As an example, consider the process of choosing a new point of sale, typical of chains of shops, retail businesses, restaurants which expand their activity. The process can be described using the hierarchical classification of hierarchical process in terms of the following subprocesses and activities:

1. Location search and identification
* Data collection and analysis.
* Real estate identification.
* Technical activities

2. Design of the new point of sale
* Execution phase.
* Dressing of premises.
* Personnel selection and training

3. Operations start up
* Communication and advertising.

* Go live

For each subprocess and activity we may investigate which services are needed by law from the Public Administrations, or else which services may be offered to businesses to make more efficient and effective their business, and the PAs involved. An analysis of requirements and interviews with businesses may produce the matrix of Figure 3.1.10.

Subprocess	Service	Agency involved	Classification of service
Data collection and analysis	Collection of socio-economic information on a given area	Central and Local Bureau of Statistics	Supporting knowledge
Data collection and analysis	Collection of information on competitors	Chamber of commerce	Supporting knowledge
Real estate identification	Collection of information on available real estate in the area	Land registry office	Supporting knowledge
Execution phase	Authorization for security in the working environment	Social security agency	Qualification
Execution phase	Send communication to Chamber of Commerce	Chamber of Commerce	Communication of administrative data
Execution phase	Send communication to rubbish collection agency	Rubbish collection agency	Communication of administrative data
Execution phase	Request of authorization to firemen office	Fireman Unit	Qualification
Execution phase	Request for administrative licence	Municipality	Licence
Execution phase	Request of authorization for signs	Municipality	Communication of administrative data
Execution phase	Request of compliance of electrical grounding	Local health unit	Qualification
Execution phase	Request for sanitary authorization	Local health unit	Qualification

Figure 3.1.10: Subprocesses, services requested and public agencies in the point of sale business process

Looking at the classes of services we see that, from the point of view of expected sales and revenues, services which support knowledge may be crucial, since having rich and updated information on the territory where to locate the point of sale may significantly optimize the revenues resulting from the new activity. When we discuss issues related to qualities in Chapter 3.2 we will see that in this case we refer to the effectiveness of the service. At the same time, the value related to services providing qualifications and licenses is in the fact that they enable the new activity, so acting on them reduces the total time needed to conclude the process; consequently, it influences the efficiency of the process. Finally, the services related to information provision are less significant from the point of view of effectiveness and efficiency. At any rate, they have to be activated on time and should provide correct information. Effectiveness and efficiency of business processes have been investigated in the area of the value chain, here we do not address this issue, the interested reader may refer to [30].

Processes and organizations

In the process/organization matrices we describe, for each process, the roles of the various organizational units involved in the process. There are two possible roles, namely *decides* and *collaborates*. When the external user of the service is involved in bringing data and documents from

one administration to another, a collaborates-role is assigned to the external user for the process. Figure 3.1.11 illustrates the matrix for the three main processes of the running example.

Process/ Organization	Change of Residency	Provide/Update Driving Licence	Provide/Update Health card
Citizen	Cooperates	Cooperates	Cooperates
Old Municipality	Cooperates	-	-
New Municipality	Decides	Cooperates	Cooperates
Traffic Authority	-	Decides	-
Health Authority	-	-	Decides

Figure 3.1.11: The process/organization matrix

Organizations and types of data

Organizations have different roles in creating and managing data. Figure 3.1.12 shows such roles in terms of the running example.

Type of Data/ Organization	Type of Public Administration	Residency	Driving Licence	Health card
Municipality	Local	Provides Updates	-	-
Traffic Authority	Central	-	Certifies/ Provides	-
Regional Health Authority	Local	-	-	Provides
Local Health …	Local	Uses	-	Provides
Ministry of Interior	Central	Governs	-	-
Ministry of Finance	Central	Certifies/ Uses	Uses	Certifies/ Governs
Ministry of health	Central	Uses	-	Governs

Figure 3.1.12: The organization/type of data matrix

Roles used in the matrix are: (i) *governs*: the administration controls the management of information in service provision, assuring the correctness and the accountability of the procedure and in case (e.g. when a national registry for citizens is available) maintaining and preserving the data used in the information flows; (ii) *certifies*: the administration is responsible by law for the certification and service provision of the related data; (iii) *provides*: the administration (or a private delegated actor) physically provides the data for the related services; (iv) *uses*: the administration (or other actors) uses the information to accomplish further activities related to service provision.

The representation of the types of data exchanged and the roles of the involved organizations puts in evidence governance constraints in service provision, both at the technological and organizational level. Roles indicate which administrations have to be involved in the eGovernment initiatives in

further phases. In our example, the Ministry of Finance certifies data both for residency and for health card provision, and co-governs with the Ministry of Health the health card provision data flow. Whereas, the Ministry of Interiors governs the residency data flow. This situation suggests the undertaking of a common initiative for the certification of residency and health card provision, where the overall governance is led by the Ministry of Finance.

To conclude, note that in the above matrix, data are expressed in terms of names of concepts, without any reference to the ER conceptual schema. Another possibility, as we said before, is to describe in the header of the column the ER schema which represents the concept. E.g. the concept Residency may be seen as an ER schema defined in terms of a relationship “Residency” that connects two entities “Person” and “Municipality”.

3.2 Service quality assessment

3.2.1 Questions addressed and relevant concepts of the step

Questions addressed in the step are listed in Figure 3.2.1.

- Which quality dimensions are to be considered for the service to-be?
- Which is the quality level of the service as-is and of the process that delivers the service as-is?
- Which is the quality level of network/HW/S W/data infrastructures that support service delivery?

Figure 3.2.1: Questions addressed in the step

Quality is a first class citizen in Smart. Users of services do not want to lose time in their interactions with administrations, they do not want to suffer to provide information which is already present in public administration databases and they do not want to be bothered by inefficiencies and errors in administrative processes. E.g., the time period a company has to wait in Italy to be registered in the official public registry and start to operate is ten times the time needed in Great Britain and France. Yet, time is money, and such inefficiencies deeply influence business development. The same for citizens, who greatly appreciate fast, efficient, proactive and transparent administrations. All the previous aspects are captured by the concept of quality. In Smart, the quality assessment phase aims to identify and measure the most relevant qualities of the different layers of the Service System introduced in Section 1.2. Among them, the most important ones are service qualities. Considering only service qualities in the planning activity hides issues that may deeply influence the nature of new projects, since services are produced by processes that are performed in administrations, whose functions are defined by laws.

In Section 3.2.2 we define the concepts related to quality, and introduce typical methods existing in the literature to observe and measure service related qualities. In Section 3.2.3, we describe the Smart quality registry that represents and defines qualities for all the layers discussed before. Such qualities pertain to the categories of efficiency, effectiveness, accessibility, and accountability.

3.2.2 Introduction to quality

According to a quality of an artifact, a product or a service is the degree to which a set of inherent characteristics of the artifact, process or service fulfills requirements. Qualities can be classified in terms of characteristics and sub-characteristics; instead of characteristics/sub-characteristics, we will use the general term *quality dimensions*, or simply *dimensions*.

Two modalities are used to assign a value to quality dimensions, namely:

- a measure, performed with a measurement procedure that results in a metric, namely a value in a domain;
- the evaluation of the perception of users with questionnaires and focus groups.

According to the first modality, a measurement procedure consists in a sequence of steps that leads to measuring a value for the dimension in a specific domain. For instance, an efficiency dimension for services is the temporal efficiency, which corresponds to the time related to service provision. A first possible metric for temporal efficiency is the user time, namely, the time the user has to spend

in: i) service request, ii) possible further interactions with the administration, and iii) service acquisition.

Another metric for temporal efficiency is the *service provision time*, the time passed from the timestamp of the request to the timestamp of the delivery. This interval of time can be measured easily and with low cost if the administration involved in service provision manages a workflow procedure that captures the request time and the delivery time. In case the macro-process involved in service provision crosses more than one administration, it is also necessary to identify the inputs and outputs associated to the different processes, in such a way that they can be univocally associated to the service request.

Notice that temporal efficiency can be also evaluated through user perception. In this case we are looking for an average perception, since we can find intolerant users and patient users, so the user's sample has to be chosen in such a way to be representative of the universe of users. For methods related to the choice of samples and segmentation of users. Not all perceived dimensions can be measured with a measurement procedure: e.g. the kindness of the front office personnel of an administration cannot be measured, it can only be evaluated through the perception of users or else of a third party human observer.

The literature on quality is characterized by many proposals on how to model and assess the quality of services. One of the most popular proposals referring to the user's perception, concerns Parasuraman [31]. In the approach of Parasumaran, user's service expectations are compared to user's service perceptions; this is done using questionnaires whose questions refer to a set of quality dimensions. Although the approach of Parasumaran is quite popular, in this book we prefer to propose a different approach where the quality of services is seen as intrinsically related to the quality of administrative processes, the quality of Public Administration organization, the quality of laws and norms, and, finally, the quality of the ICT technological support framework. In the following we discuss this approach.

3.2.3 The Smart quality registry

In this section we introduce and define all the quality dimensions considered in Smart. Since administrative processes and the organization of the Public Administration are strictly related, we will refer generically to qualities of organization/processes. All the quality dimensions considered are represented in the Smart quality registry, see Figure 3.2.1, clustered in terms of the service system layers mentioned above.

Dimensions belong to four general categories:

- *efficiency*: the amount of resources (including time) needed for service provision;
- *effectiveness*: how close is the service provided to user's expectations;
- *accessibility*: how easy and feasible it is for the user to request the service, in terms of technological resources available and friendliness of the interactions;
- *accountability*: the assumption of responsibility for actions, products, decisions, and policies of the administration. It includes the obligation to report, explain and be answerable for resulting consequences of service provision.

All of the above categories are meaningful for all service system layers. Each one of the above categories is refined in the following for each layer in terms of dimensions and in some cases in terms of metrics. We focus in the following on all dimensions related to service quality and to the most relevant dimension for other layers.

Efficiency

Service temporal efficiency refers to efficient use of time in service production and provision. As anticipated in Section 3.2.2, it can be expressed in terms of two metrics:

1. the *user time*, the average time spent by users to obtain the service;
2. the *service provision time*, the average time spent by organizational units to produce the service.

To measure the user time for services provided with a traditional desk, we have to sum the time required to go to the desk, the waiting time in line, and the service time at the desk. In case of services which request citizens to collect information, such as certificates from other administrations, we have to also consider the time spent by users in obtaining this information.

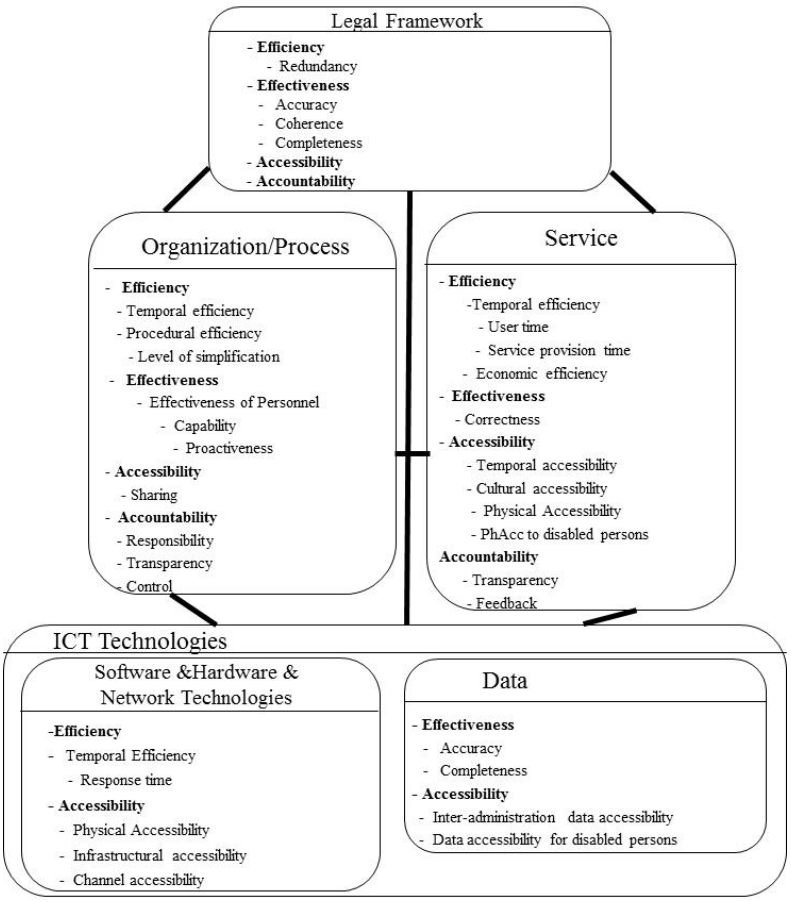

Figure 3.2.2: The Smart quality registry

The service *economic efficiency* concerns the costs sustained for service provision and their trends in time. This economic dimension can be specialized by relating the cost to the output which the service produces; e.g. for services that produce one or more documents in output, we can specify the service economic efficiency by means of a metric expressed as cost/output.

The *Organization/process temporal efficiency* corresponds to time execution of the macro-process which provides the service. The organization/process procedural efficiency concerns the level of bureaucratic simplification. *Procedural efficiency* refers to obligations and constraints that laws impose on the administrative processes and on the interactions between administrations and external

users. We associate a subdimension to the procedural efficiency, consisting in the *level of simplification*, and a metric, the number of interactions required by users to provide useful information in order to complete the service.

Effectiveness

Effectiveness concerns the closeness to user needs and expectations. Sometimes, it is not easy to distinguish between efficiency and effectiveness. Furthermore, to evaluate efficiency we can ignore user expectations, and focus on the output produced by the service and the resources used. To evaluate effectiveness, we have to know precisely the user's expectations. We can say that effectiveness tends to "do the right things" while efficiency has the objective of "doing things right".

Service effectiveness expresses the property that the service achieves users' expectations. Proper metrics of effectiveness can be the *users' perception* of the usefulness and reliability of the provision of the service. A sub-dimension associated to service effectiveness is service correctness namely, the coherence of the service behavior with the requirements.

At the organization/process level, we are interested in effectiveness of personnel, which results in capability to face and proactiveness. *Capability to face* is the ability of personnel in the relationship with the user and in the resolution of all types of problems arising in process execution. *Proactiveness* corresponds to the ability to foresee and anticipate events, and act in advance to deal with an expected difficulty.

Accessibility

Service accessibility has four dimensions, temporal accessibility, cultural accessibility, technological accessibility and physical accessibility.

Service temporal accessibility expresses the interval of time, usually in a day or in a week, during which the service can be requested. Focusing on a traditional service desk, it can be measured through the amount of business/opening hours of the desks.

Service cultural accessibility concerns the diffusion among the users of the skills and capabilities required for an autonomous usage of the service and the attitudes, preferences and perception (e.g., trust, ease of use) expressed by users towards the usage of the different technological channels which support the provision of the service. A number of metrics can be used to measure this dimension, such as:

- the percentage of words whose meanings can be understood by an average user;
- the number of languages in which the service is provided;
- the richness of the channels for service access;
- the perceived usefulness and perceived ease of use of the access channels.

Service technological accessibility refers to the availability and bandwidth of networks, infrastructures and related services that allow the access to the web.

Service physical accessibility measures the ability of the user to access the service from his/her physical status/functions. Particularly important in the social domain is physical accessibility for disabled persons} physical accessibility for disabled persons}. Metrics and guidelines for physical

accessibility have been proposed, among others, by the World Wide Web Consortium that defines the individuals with disabilities as subjects who:

- may not be able to see, hear, move, or process some types of information easily or at all;
- may have difficulty reading or comprehending text;
- may not have to or be able to use a keyboard or mouse;
- may have a text-only screen, a small screen or a slow Internet connection;
- may not speak or understand a natural language fluently.

Accountability

Dimensions referring to accountability, defined at the service level, are transparency and feedback. Transparency concerns the knowledge that the PAs provides to users on the characteristics of the service and on what they could expect or claim using the service. Feedback refers to the effective level to which users' opinions reach the PAs in charge of the service and influence the provision. Metrics for this dimension are:

- the % of offices for which users can make a formal complaint in case of error or failure of the service;
- the presence of two-way interaction channels between users and PA (so called public relation offices);
- the % of responses to complaints;
- the average response time to complaints.

3.2.4 Case Study

The approach adopted for the assessment of the service quality has been applied in order to evaluate the overall quality of the services involved into the scenario for the opening of a cafeteria. In particular, the quality of the involved services has been evaluated by taking into account the perceptions expressed by a sample of entrepreneurs who have recently experienced services useful for the opening of such kind of business activity. In the considered scenario, a set of services may be individuated as services useful to an entrepreneur who intends to start-up a cafeteria. Such services can be distinguished into two main categories: (i) *permission services* that offer functionalities required by laws and (ii) *supplementary services* that realize functionalities helpful in the opening of a cafeteria. Services that fall in the first category are, for example, services for the request of certifications such as the Italian anti-mafia attestation, the acoustic influence attestation that the law requires in the case of public business opening. Examples of supplementary services are the stipulation of the insurance policy, the request for the wi-fi, the creation of the web site, and so on that help and facilitate an entrepreneur in the activities necessary to open a cafeteria.

To assess the quality of services, first of all, we have identified a set of aspects related to properties of the considered services as effective components that determine and affect the quality of the same services. Such components are substantially service aspects concerning their functional properties and non functional properties of the services. To provide an example, if we refer to the *insurance policy* service that is one of the supplementary services involved in our study case, the following aspects have been identified as relevant properties that contribute to determine the service quality:

- Cost: the amount paid by the user as annual price of the insurance policy;
- Insurance limit: the limit of coverage of the policy;

- Request time: the time spent by the user to request the service;
- Delivery time: the time passed from the request to obtain the service;
- Transparency: the possibility of the user to be informed about the progress after the request until the service activation;
- Need fulfillment: the ability of the service to satisfy the user needs;
- Quality: the overall quality of the service perceived by users.

Starting from the identified service aspects, successively, we have gathered the perceptions of the users about these aspects based on their usage experience of the considered services. To accomplish this, we have devised a questionnaire that includes two main sections to collect respectively demographic information (essentially exploited to identify user segments in the step of user segmentation) and information about the usage experiences on services for opening public business in Italy. More precisely, this last section of the questionnaire (that is the section more relevant for the step of quality assessment) includes a number of questions related to the identified service aspects that require the users to express their perception. Users may express their perceptions by rating each aspect choosing one of the levels among those included in Likert scales that are commonly used in survey researches [32]. In Figure 3.2.3, we provide some examples of questions (with the corresponding possible values for the answers) useful to gather the perceptions about the considered aspects of the insurance policy service.

1) How do you rate the amount paid as annual price?		
□ Cheap	□ Fair	□ Expensive
2) How do you rate the insurance limit?		
□ Low	□ Fair	□ High
3) How do you rate the time passed to obtain the insurance policy?		
□ Short	□ Fair	□ Long
4) How do you rate the time employed to request the insurance policy?		
□ Short	□ Fair	□ Long
5) How do you rate the possibility to be informed about the progress status on the policy obtainment?		
□ Satisfactory	□ Acceptable	□ Unsatisfactory
6) How do you rate the capacity of the service to fulfill your needs?		
□ Satisfactory	□ Acceptable	□ Unsatisfactory
7) How do you rate the overall quality of the service?		
□ Low	□ Fair	□ High

Figure 3.2.3: Example of questions for the quality assessment of the insurance policy service

The considered aspects do not have all the same importance and different users may ascribe them different relevance degrees. In order to determine the aspect importance, the questionnaire includes questions requiring users to sort the aspects according to their relevance. Figure 3.2.4 shows an example of question included in the questionnaire in order to learn the relevance degree of the service aspects.

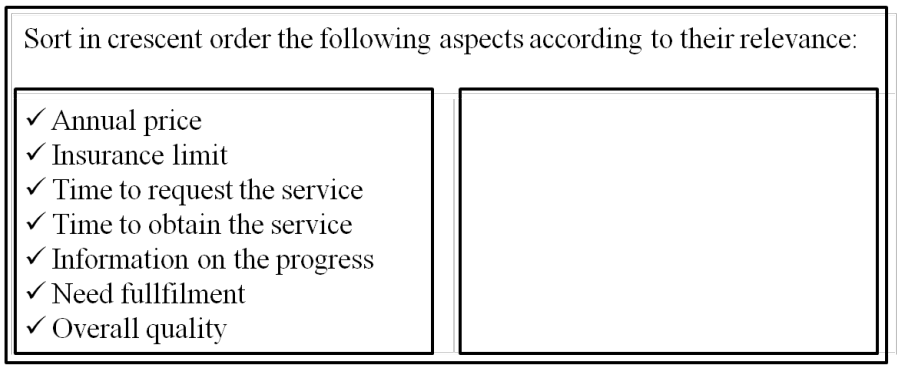

Figure 3.2.4: Example of question for gathering the relevance of the service aspects

Once the questionnaire has been devised, we have contacted a sample of entrepreneurs who recently had opened a cafeteria (the same sample engaged to compile the questionnaire for the step of user segmentation). As already specified in that step, about 450 entrepreneurs have been contacted and, among these, a total number of 85 entrepreneurs have accomplished the questionnaire.

Next, the data about perceptions on service aspects gathered by means of the questionnaire have been preprocessed and analyzed in order to obtain an evaluation of the overall quality of the services as perceived by the users. The preprocessing of perception data has been performed in order to express data in a form more suitable for the successive phase of data analysis. More precisely, for the sake of uniformity, the perception values have been mapped into three different levels that respectively indicate the negative, neutral and positive polarity of the expressed perceptions. For instance, since the cost usually represents a sacrifice for a user, cheap perception may have a positive polarity. On the other hand, expensive perception may have a negative polarity and fair one may have a neutral polarity. Then, perception data have been analyzed and, for each aspect, we have computed some statistical descriptors that may represent useful and synthetic indicators of the service quality. As an example, in Figure 3.2.5 we show the perception distributions for all aspects of the insurance policy service. We may observe that, for the quality and the need fulfillment, the most of the entrepreneurs have expressed perceptions with positive polarity. Only few entrepreneurs have appeared neutral and very few negative. As concerns the delivery time and the request time, the prevalence of the users have expressed positive perceptions while a lower number of users have given neutral perceptions. A few number of users have a negative perception about the time aspects. Perceptions on the transparency are essentially split in uniform way among positive and neutral with some negative perceptions. Regarding to the insurance limit the most of entrepreneurs were not able to provide perceptions and however the obtained perceptions have been neutral. Finally, the perceptions about the cost aspect have been substantially distributed in uniform way.

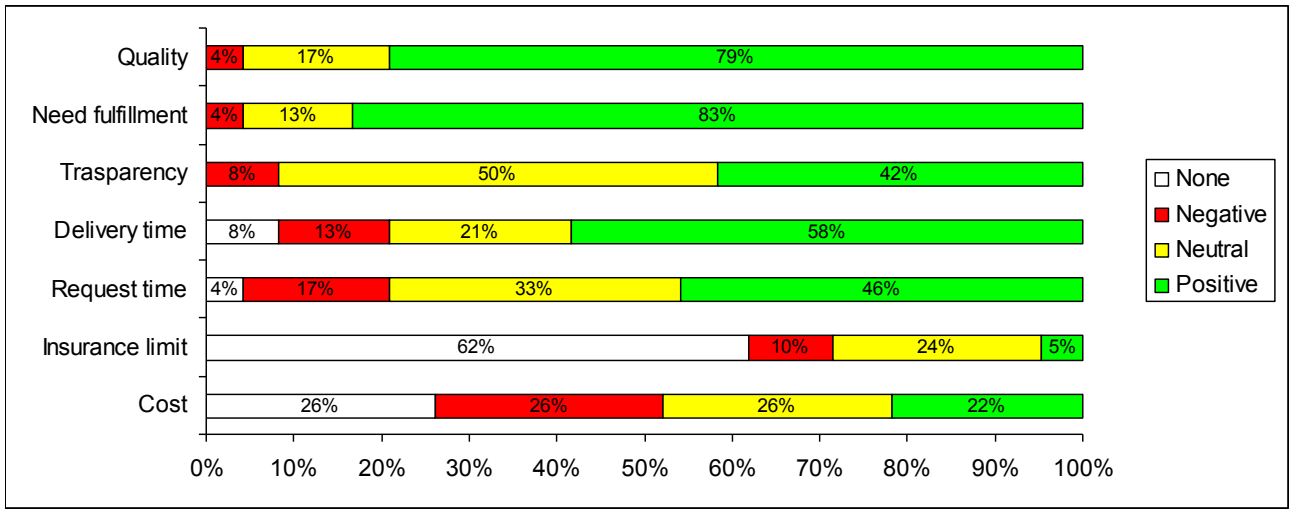

Figure 3.2.5: Perception distributions for all aspects considered for the insurance policy service

The distributions of the relevance degree ascribed by entrepreneurs to all the aspects of the insurance policy service have been depicted in Figure 3.2.6. As it can be seen, quality and cost have been the aspects considered as the most important. In effect, the quality aspect has not ever been placed into the last two positions. Also, the need fulfillment have been retained as an important aspect and, like quality, this have not appeared in the last two positions. As concerns the time aspects, the relevance ascribed by users has been quite uniform with respect to all positions. Moreover, the insurance limit for the most of users has resulted less relevant. Finally, the transparency has been still less important aspect than the insurance limit.

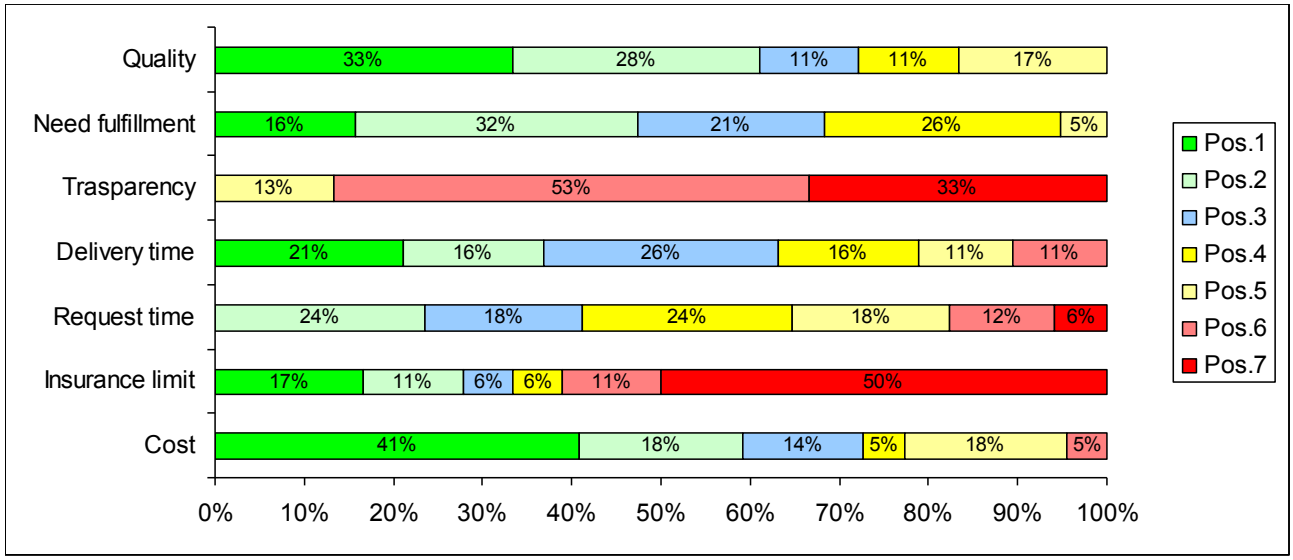

Figure 3.2.6: Relevance degree distributions of all aspects considered for the insurance policy service

3.3. Service value assessment

3.3.1 Questions answered in the step and relevant concepts

Questions answered in the step are listed in Figure 3.3.1.

- Which is the user perception of the value in use of the service as-is?
- How user perception of value in use changes for the different user segments?
- Which relevance (or weight) is associated by the users/user segments to the different benefits and sacrifices associated to service value in use?
- Which is the value in exchange of the service as-is?

Figure 3.3.1: Questions answered in the step

Value is the most relevant concept in Smart. Three types of values are considered:

- value in use that is perceived by the user when achieves a services delivered by public administration or private provider;
- value in exchange that a private provider achieves when it sell services;
- Public, social or civic value achieved by public administration when it delivers administrative or other types of services.

In the following we deal with the first two types of value. Both value in use and value in exchange can be expressed as v = f(benefits, sacrifices); in the two cases benefits and sacrifices have different components, and, consequently also the formula changes.

Benefits in information systems literature are classified in three types, namely a. tangible, and more specifically a1. monetizable and a2. quantifiable, and b. intangible. In service science, as to value in use, benefits come from the change of state in the user that the service enables. So, benefits come from all the properties of the service, namely a. functional properties, b. non functional properties, and c. qualities. Sacrifices for value in use come first of all from price, and secondly from the effort the user have to spend to invoke and obtain the service (effort that can be mental, temporal, monetary, etc.) and finally from the risk the user perceives as to service failure or service not respecting one or several of the above properties.

Benefits for value in exchange are closer to the concept of benefit in information systems, and correspond first of all to revenues coming from service selling. Other benefits are intangible, such as the popularity of the brand, or the trustworthiness in the provider. Sacrifices for value in exchange correspond essentially to costs sustained to produce, sell and maintain the service.

We investigate more in depth the formulas for the value in use and value in exchange.

3.3.2 Value in use

A general formula for the value in use evaluation is shown in Figure 3.3.2

Value in use of a service s = f (benefits; sacrifices) where f can be a ratio, a difference, a combination of arithmetic operators, a correlation statistical table, and benefits and sacrifices are as follows.

Benefits (s)=$f_{ben}(F_s,NF_s,Q_s,W_{Fs},W_{NFs},W_{Qs})$
where:
- F_s,NF_s,Q_s are, respectively, normalized values representing value perceived by users for functional properties, non functional properties, and qualities of s
- W_{Fs} is the set of weights in the [0..1] interval of benefits perceived by users with reference to functional properties F_s
- W_{NFs} is the set of weights in the [0..1] interval of benefits perceived by users with reference to non-functional properties NF_s
- W_{Qs} is the set of weights in the [0..1] interval of benefits perceived by users with reference to qualities Q_s
- Sum of W_{Fs} ,W_{NFs} eW_{Qs} is equal to 1

Sacrifices (s)=$f_{sac}(pr_s,eff_s,w_{pr},w_{eff})$
where:
- pr_s is the normalized sacrifice perceived by the user for the price of s
- eff_s is the normalized effort perceived by the user for invoking and getting service s
- w_{pr} is the weight in the [0..1] interval of sacrifices perceived by the user for the prices of pr_s
- w_{eff} is the weight in the [0..1] interval of sacrifices perceived by the user for effort eff_s
- Sum of w_{prs}, e w_{eff} is equal to 1

Figure 3.3.2: Formula for value in use evaluation

There are two choices for function f in the formula, the first one corresponds to choose one mathematical or statistical function among the different ones available. E.g. in some papers in the literature it is suggested that, when a user has to choose among different services, he/she tends to compare services according to a normalized indicator that evaluates the benefits for each unit of sacrifices; in this case function f is a ratio. When instead one has to pay for the service, at that point the evaluation is made on the level of prevalence of benefits w.r.t sacrifices, so function f is a difference. The second choice corresponds to keep benefits and sacrifices separate, leaving to users the evaluation of a global perception of value.

As to the components of the formula, we distinguish between benefits and sacrifices. As to benefits, all functional and non functional properties and qualities can be considered as contributing to benefits. In practice, only a limited subset of them are considered by users; furthermore, questionnaires for evaluating a large set of components are boring and after a few questions to be answered users become tired and tend to respond casually or else to not respond. What is important after having selected the most relevant properties is to evaluate the relative importance of the different properties in the user perception, to be expressed in terms of weights. Sacrifices in the literature are in a sense more focused, and correspond to price, effort and risk of failure. In this case we have focused on such parameters that, as for benefits, have to be weighted.

Since users are, it is trivial to say, the one different from the other, previous measures should be acquired after previous sampling based on user segments identified in Step 1.2. The analysis on questionnaire response should lead to evaluate the average and at least the variance of values filled by users; variance is important to be able to understand whether questions were clearly formulated and whether users have correctly understood. A high variance should lead to exclude corresponding

unreliable responses. A discussion on statistical methods that can be used in questionnaire analysis is outside the scope of this book.

Assessing value in use of concrete services presently delivered by providers (public administration or private providers) is useful both for users and for providers. Users are able to monitor and compare in time the value of the actual service with the value of future services, and providers are able to understand which are, among properties and qualities of the services, the levers to act on to improve user satisfaction. For private providers, this is the essential marketing strategy to achieve new market shares, for public administration this is the knowledge needed to plan better services for citizens and businesses. A procedure for assessing the value in use of concrete services is shown in Figure 3.3.3.

1. Fix the formula for value in use.
2. Design a questionnaire to be provided to a sample of user segments identified in Step 1.2
3. Experiment the questionnaire with a limited group of volunteer users (5. to 10).
4. Correct the questionnaire, and include at the end one general question with open answer.
5. Send the final questionnaire to users.
6. Collect responses, and evaluate statistical parameters that allow to filter unreliable responses.
7. Evaluate weights and values of parameters chosen for benefits and sacrifices.
8. Evaluate, if present, the function in the formula and produce a global value.
9. Analyze open answers, and classify them in terms of homogeneous topics addressed.

Figure 3.3.3: A procedure for value in use assessment

An example of questionnaire for value-of-service measurement is shown in Appendix 3.

3.3.3. Value in exchange

The value in exchange quantifies, for a given private provider and a given period of time t, revenues had by the provider due to service selling, compared with costs sustained to produce, manage and maintain the service. Since both revenues and costs have monetary values, the comparison corresponds to the net difference. Now, in case the service is actually in the portfolio of services produced and sold by the provider, revenues and costs can be evaluated from the accounting system. In case the service is new, costs can be estimated in advance, defining first a cost model, and evaluating each item in the model on the basis of various parameters, such as effort needed, cost of equipment, and other factors of production. Revenues are more difficult to esteem, since they correspond to the foreseen number of services to be sold in the period t, multiplied by the price of service; value of price can be fixed on the basis of costs sustained, while the number of service to be sold is estimated on the basis of experience or market surveys. Finally revenues and cost are summarized in the net income, that is the provider income minus cost of goods sold, expenses and taxes for an accounting period.

3.3.4 Case study

The model for service value assessment has been applied on the case study “Opening of a cafeteria” where we have analyzed services needed for entrepreneurs who want to open public businesses with administration of food and beverage. Among these, we focus on the results obtained from the value

analysis performed on the service of Internet connectivity provision to public businesses being one of the most experienced services among those considered in the case study.
As a first step, we have selected the service aspects to consider as value components. For the considered service, the selected aspects are listed in the following, distinguished according to their type:

- Non-functional properties:
  - *activation price*: the amount paid by the user to activate the service;
  - *monthly price*: the amount paid each month by the user to use the service;
  - *request time*: the time spent by the user to request the service;
  - *delivery time*: the time passed among the request and the activation of the service;
  - *transparency*: the possibility for the user to be informed about the progress of the service request.

- Functional properties:
  - *user need fulfillment*: the ability of the service to satisfy the user needs.

- Qualities:
  - *quality*: the overall quality of the service.

Next, user perceptions about the selected aspects have been gathered by questionnaires investigating the usage experience of services useful to open public businesses in Italy. At the end of this step, a total number of 85 questionnaires filled by entrepreneurs have been collected (as already specified in the step of quality assessment).

Each entrepreneur has been required to answer questions about up to three experienced services. Thus, for the Internet connectivity service involved in the considered case study, the perceptions expressed by about 20 entrepreneurs on the aspects previously selected have been gathered.

Successively, we have determined benefits and sacrifices related to each aspect. Precisely, as concerns non-functional properties, we have defined a set of fuzzy rules for each aspect starting from the gathered perceptions. As an example, the fuzzy rule set defined for the *request time* aspect is shown in Figure 3.3.4.

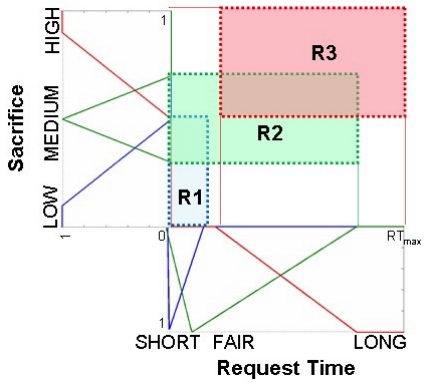

Figure 3.3.4: Graphical representation of the rules for the *request time* aspect

As it can be seen, three rules have allowed us to cover the gathered perceptions and to establish the relationships among *request time* and *sacrifice* values. The derived relationships expressed in linguistic terms by fuzzy IF-THEN rules have been synthesized in Figures 3.3.5 and 3.3.6 show the sacrifice curve obtained by the inference of rules for all possible request time values.

R1: **IF** *request time* is SHORT **THEN** *sacrifice* is LOW
R2: **IF** *request time* is FAIR **THEN** *sacrifice* is MEDIUM
R3: **IF** *request time* is LONG **THEN** *sacrifice* is HIGH

Figure 3.3.5: Rule set for the *request time* aspect

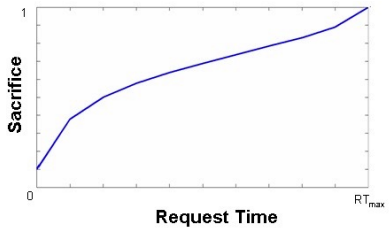

Figure 3.3.6: *Sacrifice* curve for the *request time* aspect

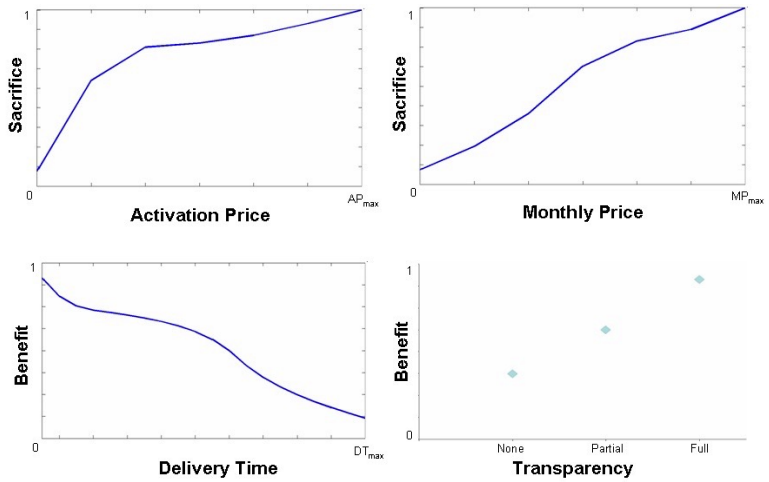

Figure 3.3.7: Benefits/sacrifices for activation/monthly prices, delivery time, and transparency

In Figure 3.3.7, we show the trend of benefits and sacrifices obtained for the other considered aspects related to non-functional properties. Particularly, the transparency values are not in a continuous range (like for the other considered properties), but 3 different levels have been considered, namely None, Partial, and Full, corresponding to the different degrees with which entrepreneurs receive information about the provision progress of the requested service.

As concerns the functional properties and qualities, the gathered perceptions have been aggregated by the average operator. The obtained values have been 0.64 and 0.67, respectively.

Successively, the weights of all the aspects have been calculated starting from the ordered lists provided by users (as specified in the step of quality assessment) and following a ranking schema inspired to the score assignment process in sport competitions. We report the weight values in the third column of Table 3.3.1.

Table 3.3.1: An example of value in use assessment for a sample service

Aspect	**Actual value**	**Weight**	**Benefit**	**Sacrifice**	**Value in use**
Activation price	98 €	0.20		0.81	
Monthly price	45 €	0.60		0.83	
Request time	1 day	0.20		0.38	

Delivery time	7 days	0.46	0.63		
Transparency	Partial	0.18	0.30		
User need fulfillment		0.18	0.64		
Quality		0.18	0.67		
Overall			**0.58**	**0.74**	**0.78**

To definitively assess the value in use of a specific service, the actual values of the aspects have been required. Thus, by considering a service for Internet connectivity provision characterized by the actual values reported in the second column of Table 3.3.1, benefits and sacrifices of each aspect have been computed by exploiting the curves derived for the non-functional properties and values derived for functional properties and qualities. Such values are reported in the respective columns of the same Table 3.3.1. By computing the weighted average of benefits and sacrifices that we have previously obtained, the overall benefits and sacrifices were determined having respectively 0.58 and 0.74.

Finally, the value in use of the considered service has been derived as the ratio of overall benefits and sacrifices obtaining a value equal to 0.78.

The performed value analysis points out that entrepreneur perceived the monthly price as the most relevant aspect (weight 0.60) and the related perceived sacrifice was also the highest (0.83). On the other hand, the second most important aspect (weight 0.46) was the delivery time for which entrepreneurs perceived a quite high benefit (0.63). In correspondence of all the other aspects, entrepreneurs associated a low relevance degree (weight 0.18 or 0.20) and, consequently, these components weakly affected the assessed value. Thus the most important sacrifice perceived for the monthly price was mainly alleviated by the benefit perceived for the delivery time. As a consequence, the resulting final value in use (0.78) was quite near to 1 (that corresponds to the situation in which benefits balance sacrifices) despite the most relevant sacrifice referred to the monthly price.

Such kind of analysis could be useful whenever a user has to choose among different available services. In fact, in such situations, indicators about perceived benefits and sacrifices might provide helpful cues to support users in selecting the most valuable and personalized service.

Chapter 4

4.1 Business model

4.1.1 Questions addressed and relevant concepts

A *business model* describes the model of how an organization creates, delivers, and captures value (economic, social, or other forms of value). The process of business model construction is part of the Business Strategy. In Smart, the business model step consists in the results of planning and assessment must be represented together. In Figure 4.1.1, we see questions that are addressed in the step dedicated to the business model.

- Which are strategic partners and related agreements to be arranged in the service value chain?
- Which are service production costs?
- Which are sales forecasts?
- Which are marketing initiatives for services to be delivered?

Figure 4.1.1: Questions addressed in the step

In theory and practice the term business model is used for a broad range of informal and formal descriptions to represent core aspects of a business, including purpose, offerings, strategies, infrastructure, organizational structures, trading practices, and operational processes and policies. Hence, the business model gives a complete picture of an organization from a high-level perspective.

A business, whenever it is established, it either explicitly or implicitly employs a particular business model that describes the architecture of the value creation, delivery, and capture mechanisms employed by the business enterprise. The essence of a business model is that it defines the manner by which the business enterprise delivers value to customers, persuades customers to pay for value, and converts those payments to profit: it thus reflects management's hypothesis about what customers want, how they want it, and how an enterprise can organize to best meet those needs, get paid for doing so, and make a profit.

Business models are used to describe and classify businesses, but they are also used by managers inside companies to explore possibilities for future development. Also, well known business models operate as recipes for creative managers. Business models are also referred to in some instances within the context of accounting for purposes of public reporting.

4.1.2 Model and activities chosen for the step

The methodology adopted for this step a "buy approach", choosing to adopt a very popular model, the *Canvas* model. The Canvas model was proposed by Alexander Osterwalder and it outlines several prescriptions which form the building blocks, see Figure 4.1.2.

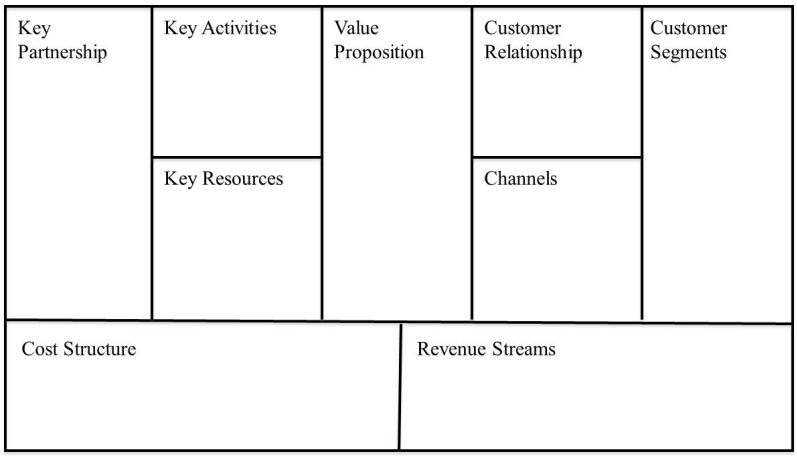

Figure 4.1.2: Building blocks of the Canvas model

The Canvas model enables businesses to focus on operational as well as strategic management and marketing plan. The aspects on which the Canvas model proposes to focus attention, and then the activities to be carried out in this step include:

1. *Key Partnerships* - The network of suppliers and partners. Companies implement alliances with other partners to optimize their business, reduce risk and gain resources.
2. *Key activities* - Most important activities that a company must put in place to create business. The activities (e.g.: production, platform, etc.) are required to create value
3. *Value proposition* - Identification of the elements that contribute to the creation of social value and economic value.
4. *Customer relationships* - The types of relationships that the provider establishes with specific user segments.
5. *Customer segments* – The groups of segments that due to their income, culture, habits, social state, have similar purchase preferences.
6. *Key resources* - The most important assets required to produce the business (e.g., human and financial resources, potential users, etc.).
7. *Channels* - How a company communicates and reaches the user segments to deliver them value.
8. *Cost structure* - Costs incurred to operate a business. Creating and delivering value, maintaining relationships with customers and generating revenues imply costs.
9. *Revenue streams* - Economic revenue that a company generates from each segment of users.

In synthesis all previous element participate in the creation of value and in determining the final incomes of the provider, deriving from the evaluation of costs and of revenues, see Figure 4.1.3.

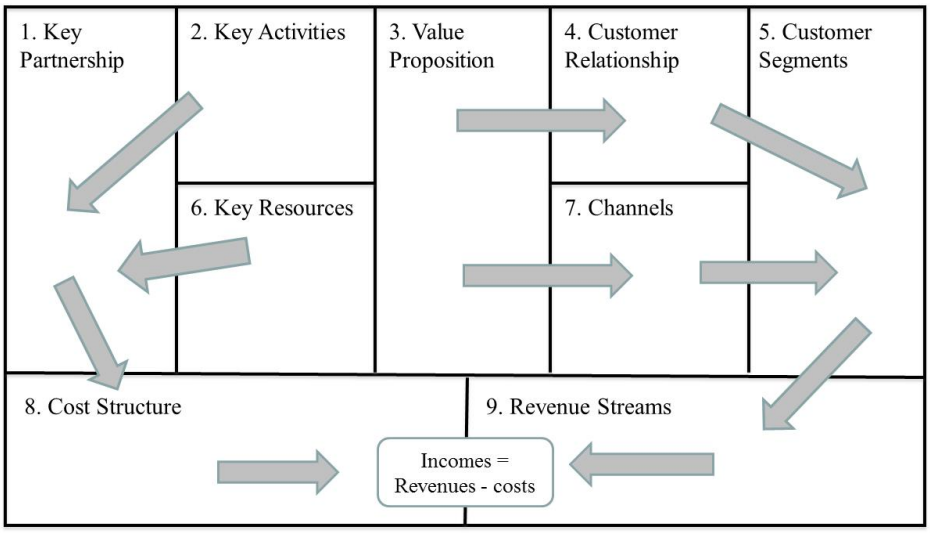

Figure 4.1.3: Relationships between costs and revenues

4.1.3 Case Study

In the following it is shown how a service provider can apply the Smart methodological step. We mainly consider a provider of services to businesses, e.g. authorizations to open retail commerce, but most of considerations can be applied for other types of services. Here, we refer to a new service (Smart service, in the following) that supports the creation and personalization of value-added services (VAS) in our reference scenario "Open a cafeteria".

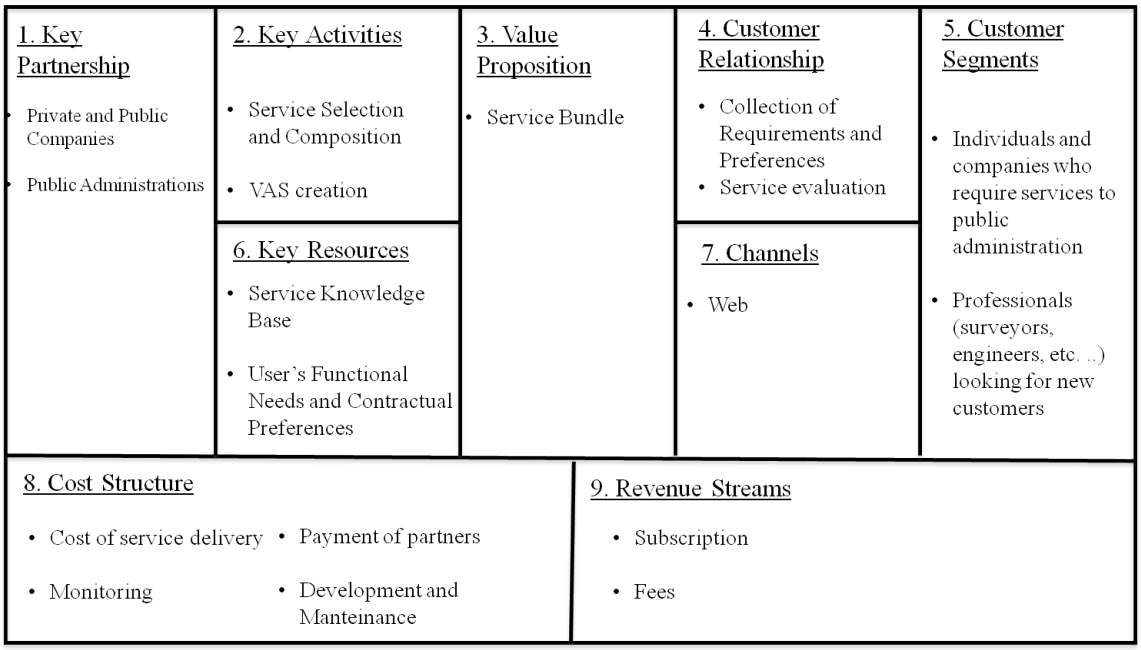

Figure 4.1.4: The business models Canvas for the case study

Figure 4.1.4 shows the business model canvas for the Smart service, where the building blocks are filled as follows:

1. *Key Partnerships* – The network of providers and partners has to chosen in such a way to highlight the contribution of each actor, and optimize potential incomes for each one. Types of partners are:

a. strategic alliances between non competitors
b. coopetition: alliances between competitors
c. joint ventures created for a new business
d. client supplier relationships in the value chain.

The key partners for the Smart service are public administrations and third parties organizations, both public and private. With regard to private providers, the Smart service does not point to replicate the services provided by the municipalities; rather it aims to offer users the ability to "build" a composite service, invoking it through a single economic transaction.

2. *Key activities* – The activities to be carried out to provide services to end users are:

- the production and delivery of VAS; an efficient product leads to the possibility to sell services at lower prices and equal value;
- the selection and composition of services that are value-oriented;
- the orchestration of the different actors in the service network of value.

3. *Value proposition* – A value proposition consists in a set of services and related products that satisfy the needs of a specific user segment. So, the provider has to clearly identify the elements that create social and economic value to customers. Value creation can be pursued in several ways:

- best price, for example through the compression of the capacity;
- best product, namely, for example, the best technology applied;
- best service to the customer, i.e. customer value and customer satisfaction: service "turnkey" and the customer no longer has to think about anything.

o For the Smart service, the value creation consists in the creation and personalization of value-added services (VAS), also named service bundles.

4. *Customer relationships* - Customer relationships are typically dealt with in the monitoring phase, where the system collects feedbacks and preferences expressed by user segments, in such a way to perform a maintenance activity that further optimizes the service w.r.t. user preferences.

5. *Customer segments* – This activity of the business model step aims to identify the different groups of people and organizations that the provider wants to reach and serve, such as:

a. mass market:
b. niche market;
c. segmented market.

A business model can identify one or more user segments. The decision whether consider one or more groups depends on the homogeneity or heterogeneity of user needs, preferred or available channels, potential revenues, willingness to pay for a personalized service.

Customer segments are the objects of one of the very early steps of Smart that is input to another early step, requirements collection, in such a way that all other critical choices are influenced by this selection. Furthermore, segments can be dynamically updated and extended during the monitoring activity.

6. *Key resources* – Key resources are the most important human, financial, intellectual assets that allow the provider to create value, extend the market and get revenues. Smart key resources are:

• knowledge on services, especially administrative services, accumulated during the Smart projects with studies, experiments, surveys;
• knowledge on the goals, needs and preferences of user segments, that allow Smart to satisfy the expressed and unexpressed needs of the users.

7. *Channels* – Types of channels can vary; possible alternatives are:
a. direct channel, when the provider chooses its own business units for distribution;
b. indirect channel, when the provider chooses in the market the distribution channel;
c. a channel of a partner, when in the agreements with partners one is chosen as distribution channel.

As to the resources/technologies used for channels, they may include physical store/office, postal system, the Web, etc. Channels are used to manage the relationship with clients in all the life cycle of the relationships, a. request, b. delivery, c. post selling, etc.

In the case of the Smart service, the resources/technologies used for channels is exclusively the Web (i.e., the Smart service will be defined as a Web service).

8. *Cost structure* – With reference to the cost structure business models may be based on two philosophies:
• cost driven when they focus on cost minimization;
• value driven when they focus on the creation of value.
The costs for the Smart service are due to:
• development and maintenance of the run time platform;
• production costs and service provision costs;
• payment of fees to the government and to third parties involved in providing the service;
• monitoring costs.

9. *Revenue streams* – Revenues usually come from:
• Service/product selling
• rents or lease for use
• rents or lease for subscription
• licenses
• advertising
• post selling services
For the Smart service, the revenues come from:
• payment for the provision of services (fees) by the end user;
• subscription fee of professionals who want to be part of the provider network created by Smart.

4.2 Service value optimization

4.2.1 Questions answered in the step and general concepts

The service value optimization step has the goal to analyze the abstract service that has resulted from requirement collection, and the concrete service that has been assessed in quality and value assessment, to verify, before subsequent design and development steps, if further optimizations can be made to the service, in such a way to improve the value in use that the user gets from the service exchange, both from private providers and from public administration. Questions addressed in the step are listed in Figure 4.2.1.

- Final users and Providers
  - Which is the optimal value in use for the different user segments?
  - How service value can be increased for the different user segments?
- Providers
  - How value in exchange can be optimized for a given vaule in use?
  - How value in use can be optimized for a given value in exchange?
  - Which is the optimal process for the service system?
  - Which are more effective service models (functional and non functional properties, composite services, service bundles) for value optimization?

Figure 4.2.1: questions addressed in the step

As input to the step we have:

- the abstract service modeled in the requirement collection step, in which expected values of functional and non functional properties from user segments are expressed;
- the concrete service assessed in the value and quality assessment steps.

We remember that the formula adopted to measure the value in use of a service *s* has the following general structure:

Value in use (s) = weighted and normalized sum of benefits / weighted and normalized sum of sacrifices (1)

The optimization step has different activities depending if it is done on one service or a group of services. The rest of the section is organized accordingly.

4.2.2 Value optimization for one service

A black box view of value optimization for one service is shown in Figure 4.2.2, where the service s1 in input and the service s1* in output are modeled according to the set of properties introduced in Section 1.3.

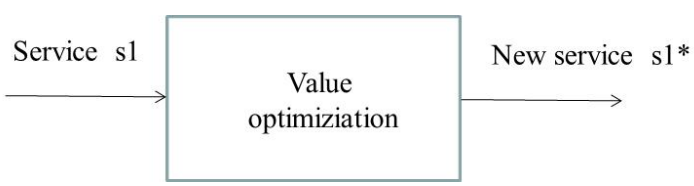

Figure 4.2.2: Input output view of value optimization for one service

In the case of one service we may act on each one of the elements in the numerator or denominator of formula (1), analyzing how we can increase the elements participating in the benefits, or else we can decrease the elements participating in the sacrifices, with the final goal to increase the value of the ratio, that corresponds to the value in use. We distinguish here two subcases:

- Ranking of potential functionalities offered by the service;
- Optimization acting on the whole set of functional properties, non functional properties and qualities.

Ranking of functional properties

An input/output description of the activity is shown in Figure 4.2.3.

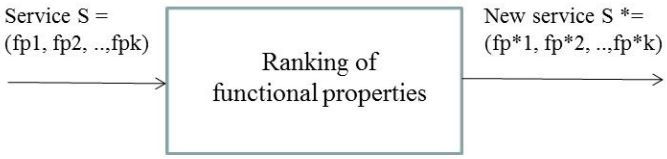

Figure 4.2.3: Optimization based on ranking of functional properties

A methodology for this activity is shown in Figure 4.2.4. The objective is to rank the functionalities of a service according to how they are perceived by the final users. The ranking allows for the identification of new functional properties to be added to the service to-be in order to improve its value in use.

1. Identifies a sample of users considering the user segment identified by step 1.2
2. Provide a survey to estimate the ranking
3. Collect and analyze questionnaire responses and produce the rankings

Figure 4.2.4: methodology for optimization based on ranking of functional properties

As an example we consider an experimental work that analyzed the preferences of Austrian and German users of the National Health Service about functional properties potentially related to the Electronic Health Record (EHR). A questionnaire, whose organization in terms of questions is shown in Figure 4.2.5 was supplied to a sample of users of the National Health service in the two countries.

- Questions about demographic data (such as sex and age) and the use of IT (5 questions).
- Questions about the private collection of medical documents including the type of storage, type of documents, and reasons for storing (7 questions).
- Questions concerning the concept of Electronic Health Record and desired functionalities (12 questions).

Figure 4.2.5: questionnaire supplied for the investigation on EHR in Austria and Germany

Preferences expressed by users in the two countries are reported in percentage in Figure 4.2.6.

Functionality	Austria	Germany
Electronic vaccination record	90	88
Online information on doctors and hospitals	90	76
Administration of appointments and reminders	83	82
Electronic medication list (provided by the physician)	77	78
Electronic access t ofindings and medical materials	71	76
Online appointment booking	69	55
Online consultation of specialist	68	49

Figure 4.2.6: Preferences about functions available with EHR

The final ranking of the EHR service functionalities is produced considering, for each functionality, the average of preferences reported in Figure 4.2.6, weighted on the cardinality of the sample of users.

Optimization on the basis of the whole set of properties

We recall first of all the formula for service value in its more general expression, see Figure 4.2.7.

Value of service s = f (benefits; sacrifices) where f can be a ratio, a difference, a combination of arithmetic operators, a correlation statistical table, and benefits and sacrifices are as follows.

Benefits (s)=$f_{ben}(F_s,NF_s,Q_s,W_{Fs},W_{NFs},W_{Qs})$
where:
- F_s,NF_s,Q_s are, respectively, normalized values representing value perceived by users for functional properties, non functional properties, and qualities of s
- W_{Fs} is the set of weights in the [0..1] interval of benefits perceived by users with reference to functional properties F_s
- W_{NFs} is the set of weights in the [0..1] interval of benefits perceived by users with reference to non-functional properties NF_s
- W_{Qs} is the set of weights in the [0..1] interval of benefits perceived by users with reference to qualities Q_s
- Sum of W_{Fs} ,W_{NFs} eW_{Qs} is equal to 1

Sacrifices (s)=$f_{sac}(pr_s,eff_s,w_{pr},w_{eff})$
where:
- pr_s is the normalized sacrifice perceived by the user for the price of s
- eff_s is the normalized effort perceived by the user for invoking and getting service s
- w_{pr} is the weight in the [0..1] interval of sacrifices perceived by the user for the prices of pr_s
- w_{eff} is the weight in the [0..1] interval of sacrifices perceived by the user for effort eff_s
- Sum of w_{prs}, e w_{eff} is equal to 1

Figure 4.2.7: General formula for service value

Starting from the above formula, we can act both on benefits and on sacrifices as follows:
- Increase the number of functional properties (as in the example shown above);
- Improve some non functional property (e.g. extend the warranty from two years to three years);
- Improve some service quality (e.g. reduce service time or else reduce the effort for the user, simplifying the interface or reducing the number of documents he/she has to produce);

- Reduce the price.

Since all of the above characteristics appear in the formula of value in use, we can start the analysis from highly weighted items. At the same time, there is usually a correlation between most functional and non functional properties and qualities from one side and the price from the other side. If functional relationships are known, we have to evaluate by hand, or else with an optimization routine the optimal tradeoff.

4.2.3. Optimization of value in use of n services

Inputs and outputs of the activity are shown in Figure 4.2.7.

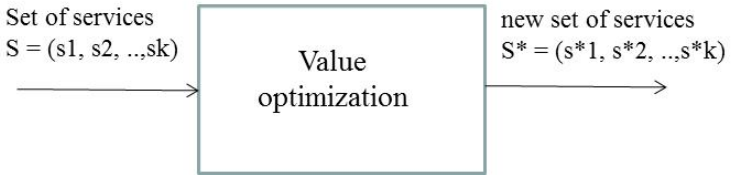

Figure 4.2.7: Input output description of value optimization in case of n services

The activity is further divided into two sub-activities:
1. discovery of new services
2. aggregation of services into composite services.

In fact the idea here is that to enrich the service s we have to extend its set of goals, finding new services (sub-activity 1) that in the needs and goals of user segments are explicitly or implicitly related to s. Furthermore, the value of a cluster of services increases if we see the cluster as a unique composite service (sub-activity 2).

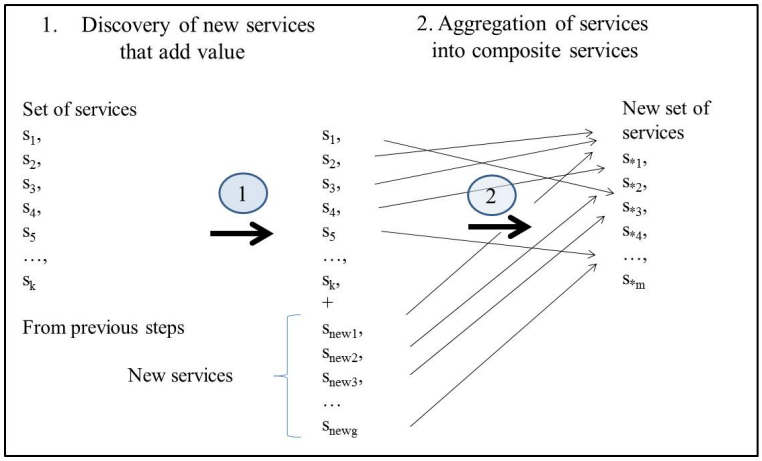

Figura 4.2.8: The two steps of the optimization in case of n service

Discovering new services

Administrative services that can be discovered in this activity can be of two types:

1. services that are part of a same procedure managed by a public administration and disciplined by law. This kind of services should be easily discovered looking at the administrative web sites or administrative rules.
2. other optional services that a municipality or other public administrations offer. E.g., when there is in a family a change of home address, competitive schools in the neighbors of the new address can offer a service that advertises the school and offers "zero time lost" transfer procedure for children from the old to the new school. These services are more difficult to discover.

In any case, discovering new services is hardly expressible in terms of steps and activities, and needs intuition and creativity. We provide the following set of suggestions:

1. *Search on the web* services that add new functionalities to one of services in input. E.g. a new payment service, characterized by short service time can be useful for a lot of market services in which the user does not want to spend too time in the payment.
2. *Make use of a new enabling ICT technology* that provides new services that add efficiency and effectiveness w.r.t. previous ones. E.g., a smartphone, as to other channels, guarantees georeferencing, enabling in such a way lot of new opportunities such as point of interest location, neighborhood search etc.
3. *Search services that are logically related with one or more services in input* – This case is typical of Public Administration, but extend also to private providers. Consider the change of home address, when one changes home address, typically he/she changes the bank agency, insurance contracts, etc. All these changes can be logically related to the unique service "change of home address".
4. *Search services that are temporally related in a story with one or more of services in input* – This case is similar to the previous one, the difference is that the unifying coordinate considered here is time. E.g. one can discover all services related to interactions with public administrations resulting from a child birth.

Among services that can be discovered in this activity, quite relevant while complex to discover are those services that correspond to implicit needs of users, and, therefore, were not intercepted during requirement collection. These services should be discovered with alternative scouting strategies. Service mining techniques can be adopted looking at the sequence of interactions of users with web "administration to user" or "business to consumer" web sites, analyzing most frequent selections and repetitive patterns.

Aggregation of services into composite services

There is a huge number of services provided by administrations to citizens. E.g., in Italy about 500 primary services provided to citizens have been identified, and a similar number to businesses. In order to optimize the budget available for projects it is not convenient to proceed service by service in the identification of project solutions, rather we have to group services in clusters, according to criteria inspired for budget optimization.

A cluster of services is a group of services characterized by some type of relationship, which can be exploited in the design of solutions that optimize the cost of projects. Which knowledge can we use for identifying clusters of services? We propose three criteria.

First criterion: cluster similar services - A first criterion corresponds to cluster services according to their similarity, measured by their being in the same class in the functional classification. The

idea here is that, e.g., two different certification services correspond to similar administrative processes, made up of:

1. a request performed providing some kind of identification of the person who needs the certificate (managed by the front office);
2. a query to a database containing the data to be mentioned in the certificate (managed by the back office);
3. the production of the certificate (managed by the front office).

Note that the above description of the process is oversimplified, since e.g., querying data could need to perform transformations on data, exception conditions have to be managed, etc.

Second criterion: cluster services according to their membership in common life events - This criterion is based on the assumption that two services corresponding to the same life event should be invoked and provided together, and should lead to related operations to be executed together. Note that life events are related by means of taxonomy. E.g., the life event “change of residency” and the life event “change of residency in the same municipality” are the first a superset of the second one. The exploitation of this taxonomy can make the clustering process more structured and effective, since we may start from general classes and proceed by specialization to more specific ones.

Once we have identified clusters of services, we have to add new services to them that did not emerge from previous analysis. Public administrations, when they provide services are mainly driven by the obligations related to applying laws and rules. Thus, it may happen that services that are perceived (often tacitly) as useful by users are not considered as an obligation by public administrations. So, they may not be included in the repository of services neither be discovered using the two classifications above, but, instead, are discovered by means of investigations and questionnaires or user needs and requirements.

Such discovering of new services allows us to extend clusters to identify bundles of services namely, groups of services that are needed together by users, and, consequently, can be provided and delivered together, satisfying in such a way all the requirements of users. Private service providers, whose business activities provide and sell services in the market, are specifically interested in identifying groups of services to be sold together in bundles. Consequently, new services and bundles can be discovered by means of social or marketing researches.

Third criterion: cluster services according to common data used - A specific feature available in Smart for this goal, due to the dual service- and data-oriented approach of the methodology, is the joint usage of the service repository and the data repository. In the following, we show an example of common usage of the service and data repository.

In the example, to make the discussion more effective, we assume that, due to the ”one service at a time” typical attitude of public administrations, only the change of residency event of life and related service has been considered so far. Thus, in the service repository we initially represent the service ``Change of residency'', which can be seen as the union of services “Communication of change of residency to the old/new municipality”. The service is related in the data repository to its service data schema, namely, the schema of data concepts (entities and relationships in the Entity relationship model) that are involved in the execution of the administrative process that produces the service. The idea here is to move from the service repository to the data repository, in order to understand which entities are close to the entities in the original service data schema, making the assumption that such entities belong to schemas of services that are candidate to be in the same

bundle. Moving from the service repository to the data repository and looking for entities adjacent to *Person*, we obtain the schema in Figure 4.2.9.

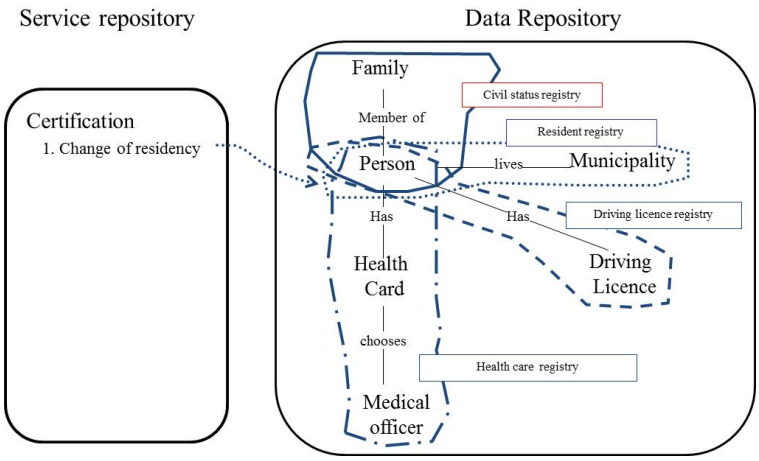

Figure 4.2.9: Example of bundle identification using the service and data repository together: first step

In the figure we also represent with closed lines the service data schemas and in rectangular boxes the databases where the entities are represented and managed. Considering the databases leads us to identify the administrations managing that have to be involved in the project solution related to the bundle we are constructing.

We move now in the inverse direction, from the data repository to the service repository, looking at services that have the schemas identified in the previous step as data schemas (or suitable compositions of those ones), see Figure 4.2.10. Notice that at this stage we find two new services, namely "Choose the school of children" and "Choose the medical officer" that have never been discovered before in the running example, referring to the school of children and the choice of the new medical officer.

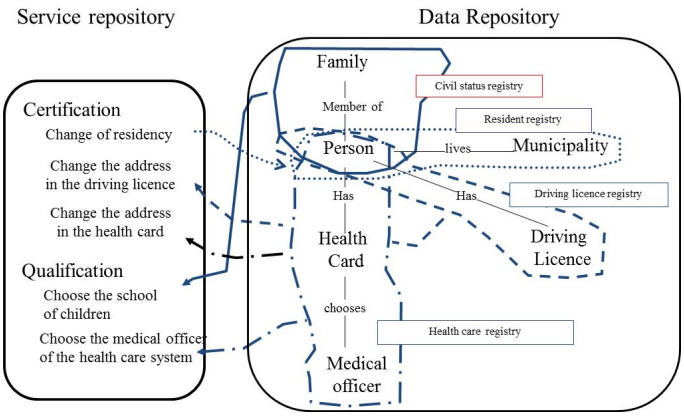

Figure 4.2.10: Example of bundle identification using the service and data repository together: second step

4.3 Service contract design

4.3.1 Questions addressed by the step

Questions addressed in the step are shown in Figure 4.3.1.

- Which is the full set of non-functional properties that characterize a service?
- How many contracts a service is associated with?
- Which are the contractual terms included into each service contract?
- Which is the service contract offered to a specific user segment?

Figure 4.3.1 - Questions addressed by the service contract design step

Service contract design has the goal of defining one or more contracts to be associated with each service identified in previous phases of the methodology. A contract is an exchange of promises and agreements [33] [34] between the service provider and a user segment, defined by means of contractual terms that regulate the service provisioning. Each contractual term is defined on a specific non-functional property (NFP) and it specifies **how** the service performs the offered functionalities.

So, service contract design is often a critical and complex process that can be logically divided in two parts, shown with inputs and outputs in Figure 4.3.2.

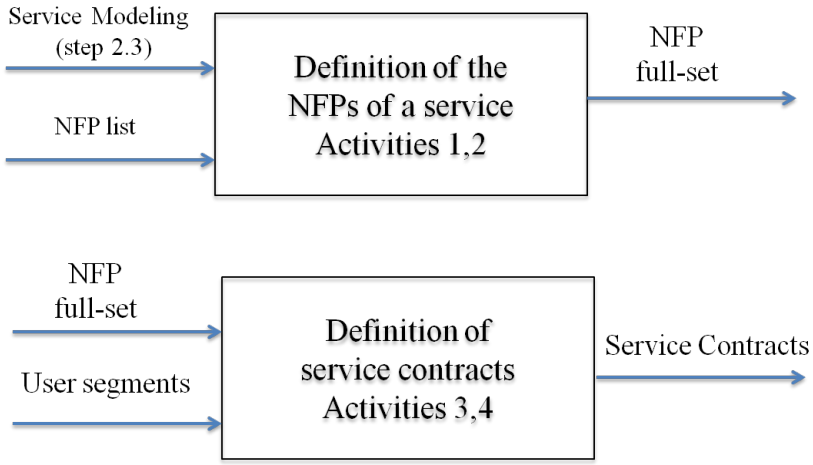

Figure 4.3.2 - Structure of the service contract design step

In the first part, the list of NFPs of each service produced along step 1.3 is extended with additional relevant NFPs extracted from a reference list. Such list supports the identification of the full-set of NFPs and the relationships among them. In the second part, the full-set and the specification of user segments are used to define the service contracts to be associated with each service.

Activities mentioned in Figure 4.3.2 are shown all together in the methodology proposed in Figure 4.3.3, where the first two activities are related to the definition of the NFPs of a service, and the last

two activities to the definition of service contracts. We now consider each one of the four activities, explaining them by considering a specific service: the insurance policy service.

1. Extension of NFPs identified in step 2.3 with additional relevant NFPs described into the reference list.
2. Definition of the full-set of NFPs of a service considering dependencies among NFPs described into the reference list.
3. Definition of service user segments and related service contract types.
4. Definition of contractual terms for each identified service contract type.

Figure 4.3.3 - Methodology for the service contract design step

4.3.2 Relevant concepts of the step

Before proceeding with the specification of the activities included into the methodology for the service contract design step, it is necessary to introduce a detailed description of the model adopted for the service contract representation.

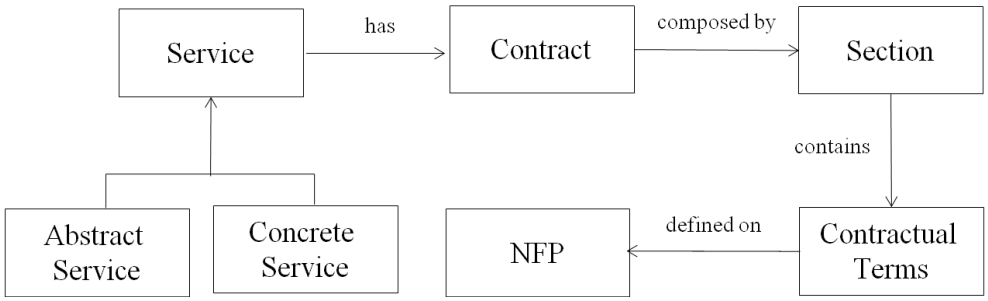

Figure 4.3.4 - The service contract model

A shown in Figure 4.3.4, a contract is composed by means of contractual terms clustered in sections. The reference structure of a contract is composed by the following 17 sections:

1. *Heading / Title Description*: defines a name that identifies the contract.
2. *Purpose*: describes the purpose of the contract and its applicability conditions.
3. *Parties*: defines the producer, the supplier (provider) and the user of the service that is object of the contract.
4. *Term and Period of the Contract*: defines contractual terms related to the validity of the contract over the time. Possible contractual terms included in this section are e.g., *starting date* (i.e., time instant (date and hour) in which the contract will be active) and *temporal duration* (i.e., period of time in which the contract will be valid).
5. *Pricing*: defines contractual terms related to the price of the service that is object of the contract. Possible contractual terms included in this section are e.g., *absolute price* (i.e., monetary amount to be paid for using the service) and *payee discount* (i.e., discount applied on the proposed absolute price).
6. *Payment Terms*: defines the contractual terms related to the payment of the service that is object of the contract. Possible contractual terms included in this section are e.g., *payment method* (i.e., available methods to perform the payment of the service) and *payment schedule* (i.e., time limit for service payment).
7. *Service Provisioning*: defines the contractual terms related to the service provisioning. Possible contractual terms included in this section are e.g., *weekly service availability* (e.g., week

timetable in which the service is supplied) and *request mode* (i.e., possible modes to request the service provisioning).

8. *Security and Confidentiality*: defines the contractual terms related to the security and confidentiality of the service user. Possible contractual terms included in this section are e.g., *identification* (i.e., methods used to recognize the service user) and *encryption technique* (i.e., technique used to transmit data on the network in a secure manner).

9. *Rights*: defines the contractual terms related to the rights of the parties that stipulate the contract. Possible contractual terms included in this section are e.g., *right of delegation* (i.e., user right to delegate a third-party in the interaction with the service provider) and *right of privacy* (i.e., user right to be protected on the current law related to the privacy of the provided data).

10. *Levels of Risk*: defines the contractual terms related to the limits of liability of the parties that stipulate the contract. A possible contractual term included in this section is e.g., *liability limitation* (i.e., possibility for the provider to be protected on sanctions related to accidental termination of the service).

11. *Sanctions*: defines the contractual terms related to penalties applied to the parties that stipulate the contract in the case of violation of other contractual terms. Possible contractual terms included in this section are e.g., *loss of right penalty* (i.e., penalty applied to the provider in case of denial of user rights) and *suspension penalty* (i.e., penalty applied to the provider in case of temporal and involuntary suspension of the service).

12. *Trust*: defines the contractual terms that consent to certify the service, object of the contract. Possible contractual terms included in this section are e.g., *received endorsement* (i.e., declaration of the provider about an approval given by a third-party) and *professional body membership* (i.e., declaration of the provider about its subscription to a certified professional body).

13. *Compliance with Laws and Standards*: defines the contractual terms related to the compliance with international, national or local laws and with specific standards. Possible contractual terms included in this section are e.g., *compliance with law* (i.e., compliance of the service with a specific law) and *compliance with standard* (i.e., compliance of the service with a specific standard).

14. *Renegotiation / Renewal*: defines the contractual terms related to the method of re-negotiation and renewal of the contract. Possible contractual terms included in this section are e.g., *right of renewal* (i.e., user right to request the extension of the service) and *right of refusal* (i.e., user right to request and use an option over the contract in object).

15. *Termination, Suspension and Withdrawal*: defines the contractual terms related to the methods for the termination, suspension and withdrawal of the contract. Possible contractual terms included in this section are e.g., *termination method* (i.e., mode for requesting the termination of the service object of the contract) and *termination time* (i.e., time limit for requesting the termination of the service object of the contract).

16. *Technical aspects*: defines contractual terms related to technical aspects of the service. Possible contractual terms included in this section are e.g., *versioning* (i.e., the version of the service, object of the contract) and *physical location* (i.e., the physical location of the machines involved in service provisioning).

17. *Obligations and responsibilities*: defines contractual terms related to obligations and responsibilities of the user that signs the contract. Possible contractual terms included in this section are e.g., *user behavior obligations* (i.e., conditions to be maintained by the user during the service provisioning) and *banned user activities* (i.e., actions which the user cannot perform during the service provisioning).

A contract can be associated with either an abstract service (e.g., insurance policy service) that a concrete service (e.g., ABC insurance policy service, where ABC identified a specific concrete service provider). A contract associated with an abstract service includes contractual terms that are

inherited by contracts associated with related concrete services. Different concrete services of the same abstract service can be different in terms of specific contractual terms e.g., ABC insurance policy service accepts only credit card as payment method; XYZ insurance policy service accepts credit card and bank transfer as payment methods.

Contractual terms are characterized by the following two different types of dependencies:

- ***Type 1 - dependency:*** a contractual term t_x has a type 1 dependency to contractual term t_y (with $x \neq y$ and $x,y \in N/\{0\}$) $t_y \rightarrow t_x$ if and only if it is possible to specify t_x in a contract *c* only after the specification of t_y in *c*.
  - ✓ E.g.,: "t_x – Payment Security" can be specified only after the specification of "t_y – Payment Method", so $t_y \rightarrow t_x$.

- ***Type 2 - dependency:*** a contractual term t_x has a type 2 dependency to contractual term t_y (with $x \neq y$ and $x,y \in N/\{0\}$) $t_y.exp \Rightarrow t_x$ if and only if it is possible to specify t_x in a contract *c* only after the specification of t_y in *c* with a value defined by *exp*.
  - ✓ E.g.,: "t_x – Payee Discount" can be specified only after the specification of "t_y – Absolute Price" with value '>' than "0", so t_y >'0' => t_x.

Moreover, each contractual term is characterized by a value of *multiplicity* and a value of *cardinality*.

- ***Multiplicity***: Number of distinct values assumed by the same contractual term t_x in the same contract.
  - ✓ E.g.,: "t_x – Request Mode" assumes, in the same contract, the following values "phone, e-mail, mail", so its multiplicity is equal to 3.

- **Cardinality**: Number of distinct instances of the same contractual term t_x in the same contract. A contractual term t_x can be defined more times to allow the specification of t_y, t_z with whom t_x has a type 1 or a type 2 dependency.

Examples of multiplicity and cardinality are in Figure 4.3.5. The term "Request mode" is specified only once but it assumes three different values (i.e., phone, e-mail, mail). This means that a customer can request the services using one of the three possible request modes. For this reason, the term "Request mode" has cardinality=1 and multiplicity=3. Since "Delivery time" has a type 1 dependency with "Request mode", for each possible value of "Request mode" a new instance of "Delivery time" is defined. For example, an instance of "Delivery time" with value equal to 1 day is created for the phone request mode. For this reason, the term "Delivery time" has cardinality=3 and multiplicity=1.

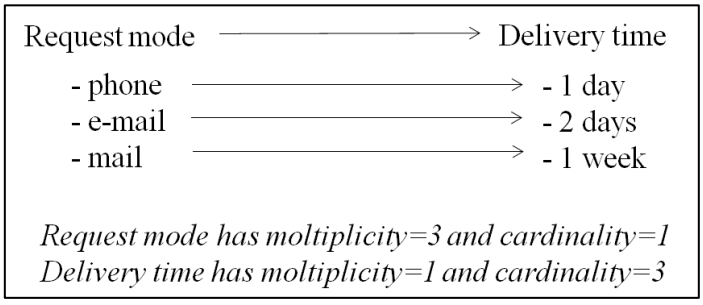

Figure 4.3.5 – Example of multiplicity and cardinality

4.3.3 Extension of the NFP set

Let us assume that the step 1.3 of the methodology has produced for the insurance policy service the list of NFPs shown in Table 4.3.1.

NFP	Description
Price	Monetary amount to be paid for using the service.
Payment method	Available methods to perform the payment of the service.
Request mode	Possible modes for requesting the service provisioning.
Coverage on "fire and theft"	Insurance coverage in case of (i) theft, (ii) damages caused by attempted theft, (iii) fire, robbery, burst, explosion or lightning.
Excess on "fire and theft"	Percentage of the refund for "fire and theft" that remains in charge of the insured.
Coverage on "act of vandalism"	Insurance coverage for damages caused by act of vandalism.
Excess on "act of vandalism"	Percentage of the refund for "act of vandalism" that remains in charge of the insured.

Figure 4.3.6 – NFP associated to the insurance policy service (From step 1.3)

The first activity of the service contract design step consists in using a reference NFP list in order to check additional relevant NFPs to be used to better describe the exchange of promises and agreements between the service provider and potential service consumer. The reference list defines domain-independent terms often included into service contracts.

The usage of the reference list allows us to extend the NFP set in Figure 4.3.6. The new relevant terms are in Figure 4.3.7.

NFP	Description
Starting date	Time instant (date and hour) in which the contract will be activated.
Temporal duration	Period of time in which the contract will be valid.
Right of privacy	Customer right to be protected according to the current law on the privacy of the provided data.
Right of termination	Customer right to terminate the service provisioning.

Figure 4.3.7 – New NFPs associated to the insurance policy service

4.3.4 Definition of the full-set of NFPs

Starting from the NFP set produced by the previous activity, the objective of this new activity is to define the final full-set of NFPs for the insurance policy service. The full-set is produced using the

reference list that includes the specification of dependencies (type 1 and type 2) between contractual terms.

The activity is performed as follows:
each NFP nfp_i is checked in the reference list;
- if nfp_i is available, get all the terms $t_1,..,t_n$ that have dependencies (type 1 and type 2) with nfp_i;
- add $t_1,..,t_n$ in the final full-set.

The result of this activity is shown in Figure 4.3.8. As an example, checking the term "Payment method" in the reference list, we discover its dependencies with four other terms ("Payment schedule", "Payment location", "Payment traceability" and "Payment security"). All the terms are included into the final NFP full-set.

NFP	Dependent NFP	Description
Price	Price validity	Time limit to accept the contract and ensure the proposed price.
	Price negotiability	Possibility to negotiate the proposed price.
Request mode	Delivery time	Time required for service activation.
Right of termination	Termination time	Time limit for requesting the termination of the service object of the contract.
	Termination method	Mode for requesting the termination of the service object of the contract.
Payment method	Payment schedule	Time limit for service payment.
	Payment location	Geographic or electronic place where it is possible to perform the payment.
	Payment traceability	Possibility to have information about payment's status.
	Payment security	Mode utilized to guarantee the security of payment.

Figure 4.3.8 – Identified dependencies among NFPs

4.3.5 Definition of service user segments and related service contract types

This activity has the objective to define the target user segments for the policy insurance service and related service contract types. Two main target user segments are identified:

- **User segment 1**: An entrepreneur who is looking for a basic and low-cost insurance policy. Basically, he/she wants to satisfy the amendments of having an insurance policy required to submit a request for opening a new business. This user segment is not interested in additional coverage terms.
- **User segment 2**: An entrepreneur who is looking for a secure insurance policy with additional terms covering e.g., damages caused by fire, attempted theft and acts of vandalism.

For each target user segment, different contract types are proposed. As shown in Figure 4.3.9, a contract type consists in a high-level description of the contractual terms that will be included in the final contract. As an example, the "basic" insurance contract (designed for user segment 1) consists

in a low-cost solution. The low price is guaranteed by the absence of additional coverage and the on-line management of the policy activation.

User segment	Contract type	Description
User segment 1	Basic	A low-cost solution for an insurance policy. No additional coverage. To reduce the costs, the offer is valid for a short time period and it is offered only on-line.
	Plus	A low-cost solution for an insurance policy with coverage on "Fire and theft". To reduce the costs, the offer is offered only on-line.
User segment 2	Advanced	A good solution for a full-coverage insurance policy. Early termination of the policy is not allowed.
	Premium	A optimal solution for a full-coverage insurance policy. Early termination of the policy is allowed.

Figure 4.3.9 – User segments of the service insurance policy and related contract types.

4.3.6 Definition of contractual terms

The final activity of the service contract design step consists in the definition of the contractual terms to be included into each identified service contract type. Basically, the high-level description of the service contract type (produced in the previous activity) is now detailed with the definition of contractual terms. Such terms are defined on the final full-set of NFPs above described.

The service contract types and their contractual terms are shown in Figures 4.3.10 and 4.3.11. To be noticed that, an interval of values is used to specify the term "price". Such indicative price will be finalized only at the step 5 of the methodology.

Contract type	Contractual terms
Basic	**Price**: [500€..750€] – **Price validity**: 1 day – **Price negotiability**: NO
	Request mode: on-line – **Delivery time**: 1 day
	Payment method: credit card – **Payment schedule**: immediate **Payment location**: online – **Payment traceability**: YES **Payment security**: {verified by Visa, Mastercard securecode, etc...}
	Coverage on "fire and theft": NO
	Coverage on "act of vandalism": NO
	Starting date: immediate
	Temporal duration: 1 year
	Right of privacy: YES
	Right of termination: NO
Plus	**Price**: [750€..1000€] – **Price validity**: 1 month – **Price negotiability**: NO
	Request mode: on-line – **Delivery time**: 1 day
	Payment method: credit card – **Payment schedule**: immediate **Payment location**: online – **Payment traceability**: YES **Payment security**: {verified by Visa, Mastercard securecode, etc...}
	Coverage on "fire and theft": YES – **Excess**: 10%
	Coverage on "act of vandalism": NO
	Starting date: immediate
	Temporal duration: 1 year
	Right of privacy: YES
	Right of termination: NO

Figure 4.3.10 – Contractual terms of the *basic* and *plus* contract types.

Contract type	Contractual terms
Advanced	**Price**: [1000€..1500€] – **Price validity**: 1 month – **Price negotiability**: NO
	Request mode: {on-line, mail} **Delivery time (on-line request)**: 1 day **Delivery time (mail request)**: 15 days
	Payment method: credit card – **Payment schedule**: day of activation **Payment location**: {online, on site} – **Payment traceability**: YES **Payment security**: {verified by Visa, Mastercard securecode, etc...}
	Coverage on "fire and theft": YES – **Excess**: 10%
	Coverage on "act of vandalism": YES – **Excess**: 10%
	Starting date: day of activation
	Temporal duration: 1 year
	Right of privacy: YES
	Right of termination: NO
Premium	**Price**: [1500€..2000€] – **Price validity**: 1 month – **Price negotiability**: NO
	Request mode: {on-line, mail} **Delivery time (on-line request)**: 1 day **Delivery time (mail request)**: 15 days
	Payment method: credit card – **Payment schedule**: immediate **Payment location**: online – **Payment traceability**: YES **Payment security**: {verified by Visa, Mastercard securecode, etc...}
	Coverage on "fire and theft": YES – **Excess**: 5%
	Coverage on "act of vandalism": YES – **Excess**: 5%
	Starting date: day of activation
	Temporal duration: 1 year
	Right of privacy: YES
	Right of termination: YES – **Termination time**: 1 month **Termination method**: registered mail with acknowlegment

Figure 4.3.11 – Contractual terms of the *advanced* and *premium* contract types.

Chapter 5: Development of service to-be

In this phase we take into account more closely implementation technologies for the service to-be and for the process that implements it. A process consists of a set of activities that are performed in coordination in an organizational and technical environment [35]. These activities jointly realize a business goal, each of them producing a "partial" concrete service. Further, non functional properties and qualities that have been modelled in previous phases, now guide the choice of concrete services. The phase is made of two steps, shown in Figure 5.1:
1. Public and private process modelling,
2. Private process implementation.

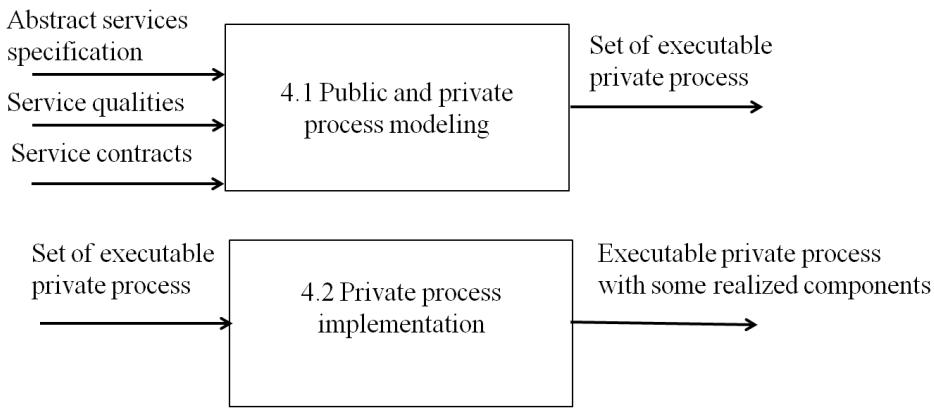

Figure 5.1: Structure of the phase

5.1 Public and private process modelling

5.1.1 Questions addressed and relevant concepts of the step

Questions addressed in the step are shown in Figure 5.1.1, while Figure 5.1.2 shows the set of activities relevant in the step.

- Which process can satisfy the specification?
- How to model the process?
- Which concrete services have to be chosen to produce the process?
- Which intermediate concrete services have to be implemented to produce the process?

Figure 5.1.1: Question addressed in this step

1. Create a public process
   - Enrich the process with non functional properties (NFP) and qualities by means of Text Annotations associated with: activity, data and process
2. Create the non-executable private process pointing to the internal details in public process:
   - Indicate the conditions in the decision points that determine the execution flow
   - Include activities that implement the new specifications
3. Create the executable private process
   - Find a list of concrete services that meet specifications (defined in previous activity)
   - If no concrete service of the defined list meets specification, we have to decide between:
     - choose, however, the concrete service, although it does not fully meet the demand;
     - split the concrete service specification into more granular specifications corresponding to more granular concrete service and step backward to activity 2;
     - continue to step 4.2, in which new software component will be realized starting from concrete service specifications
   - If more than one concrete service meets the concrete service specification must make the ranking of services identified on the basis of the offer

Figure 5.1.2: Activities of the step

The first activity consists of defining the public process. The purpose of a *public process* is to put in evidence in the process the messages with the outside world, and the order in which they must be exchanged to interact with the process. The public process is a process that includes:
1. the activities (which include functionalities);
2. non-functional properties and qualities, using Text Annotations.

In order to fully model the execution of a specific service, it is necessary to move from the public process to the private process, which can be non-executable or executable.

The second activity of the step consists in the definition of the non-executable private process. A *non-executable private process* is modelled for documenting the behaviour of a process; it extends the public process with the descriptions of the concrete services that realize the specified activities. In the following, we will call such descriptions as *concrete service specifications*. Basically, a non-executable private process is a process that includes:
- the activities;
- non-functional properties and qualities;
- the conditions in the decision points that determine the execution flow.

The third activity consists in the definition of the executable private process. An *executable private process* is a process modelled in order to be executed according to the semantics defined by the process; enforcement is made possible by connecting each activity of the process with a web service. The enforcement is performed by extracting a list of concrete services for each concrete service specification modelled in the non-executable private process. These concrete services should meet users' goals that emerged from step 1.3 (Requirement collection). If no concrete service meets completely the specifications, there are three different possibilities:
- choose one of the concrete services, although the service does not fully meet the demand;
- divide the functional property into two or more functionalities and add to the process the new related activities. Go back to activity 2 and create the non-executable private process;
- skip to step 4.2 (Private process implementation), in which starting from concrete service specifications the service will be realized by means of a new software component.

Instead, if more than one concrete service meets the concrete service specifications, in order to choose among them, we have to perform a ranking of identified services. We now consider each

activity of step 4.1 in more details, making use of a case study based on the "open a cafeteria" service.

5.1.2 Creating a public process

An entrepreneur that wants to open a cafeteria in Milan needs to request several services identified in the requirement collection step. In order to simplify the analysis, in the following we focus on a subset of the complete list of services. Figure 5.1.3 shows the considered services associated with a service contract (output of step 3.3) and quality requirements (output of step 1.3). Since more service contracts can be associated with a specific service and offered to different user segments, also the public process creation must consider a specific user segment. Here, we focus on segment 2 identified in step 3.3.

Composite serv. – level 2	Composite service – level 1	Elementary Service	Service Contract	Quality
Open a cafeteria				
	Achieve authorization		**Basic Contract** - Service delivery time < 15 days - Multilingual interface: Italian, English, Chinese	- Simple interaction - Prefilled forms - Minimize time spent by user - Easy trace of process
		Payment of charges, rights and expenses	**Basic Contract** - Payment method: credit card, paypal	
		Antimafia certification		
		Noise impact certification		
	Enabling services			
		Insurance policy	**Advanced Contract** - Price: [1.000€-1.500€] - Coverage on "Fire and Theft" – Excess: 10% - Coverage on "Act of Vandalism" – Excess: 10%	

Figure 5.1.3: Services, and related contracts and qualities, considered in the following

Now we represent the process related to service "Open a cafeteria", which results in the execution of activities represented in BPMN and shown in Figure 5.1.4. Such activities correspond to a. the request of forms, b. the request of the "Antimafia certification", c. the signing of an insurance policy, d. the payment of administrative costs and e. the request of a noise impact certification. Finally, after f. the submission of the application, the entrepreneur waits for g. the notification of the authorization (outcome) by the municipality.

In this case, some quality identified in the requirement phase leads to the definition of new process activities; for example, "Notification of receipt of the practice" is in response to the quality requirement "Easy trace of process".

After the BPMN representation, we proceed with the annotation of the process with the contractual terms and qualities (e.g., the outcome notification should be available in Italian, English and Chinese; the payment should be done using credit card or Paypal and the insurance policy should cost [1.000-1.500€] and have some other characteristics).

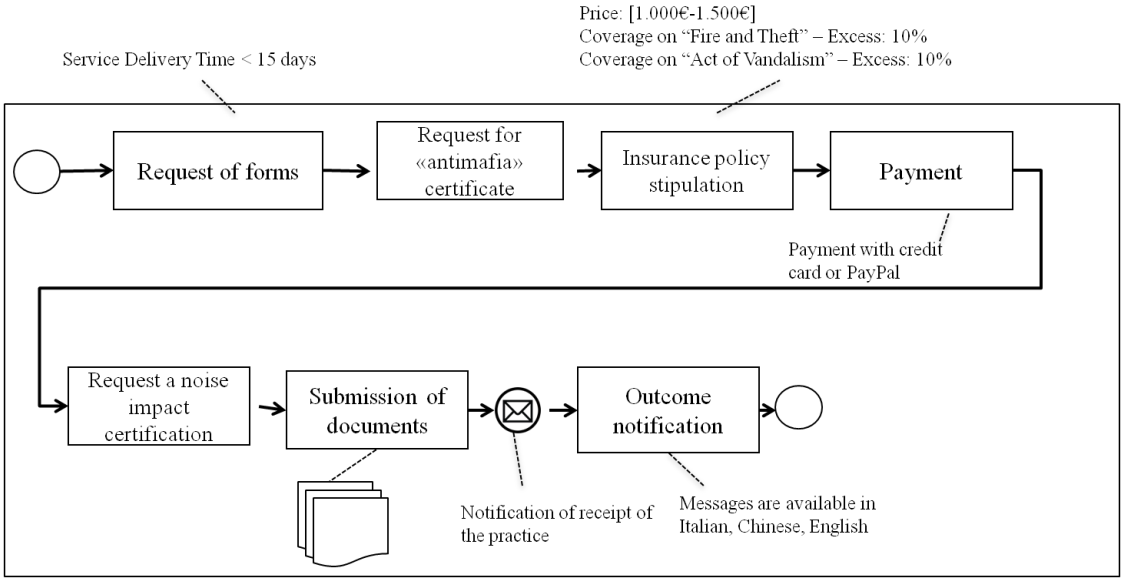

Figure 5.1.4: Public Process with annotations

5.1.3 Creating a non-executable private process

To create the non-executable private process it is necessary to explicit conditions in the decision points. With reference to the process of Figure 5.1.4, a first condition occurs after the first activity "Request of forms". As shown in the previous step, the request that the entrepreneur shall submit to the SUAP implies the submission of the "antimafia" certification. If the entrepreneur is already in possession of such a certificate, he/she can skip this step and proceed with the signing of the insurance policy, as shown in Figure 5.1.5. A second condition is created in the step of notification of the authorization: in the Italian law if the municipality did not give the entrepreneur notice of the outcome of the request after 45 days, thanks to the principle called "tacit consent" it can be considered as accepted.

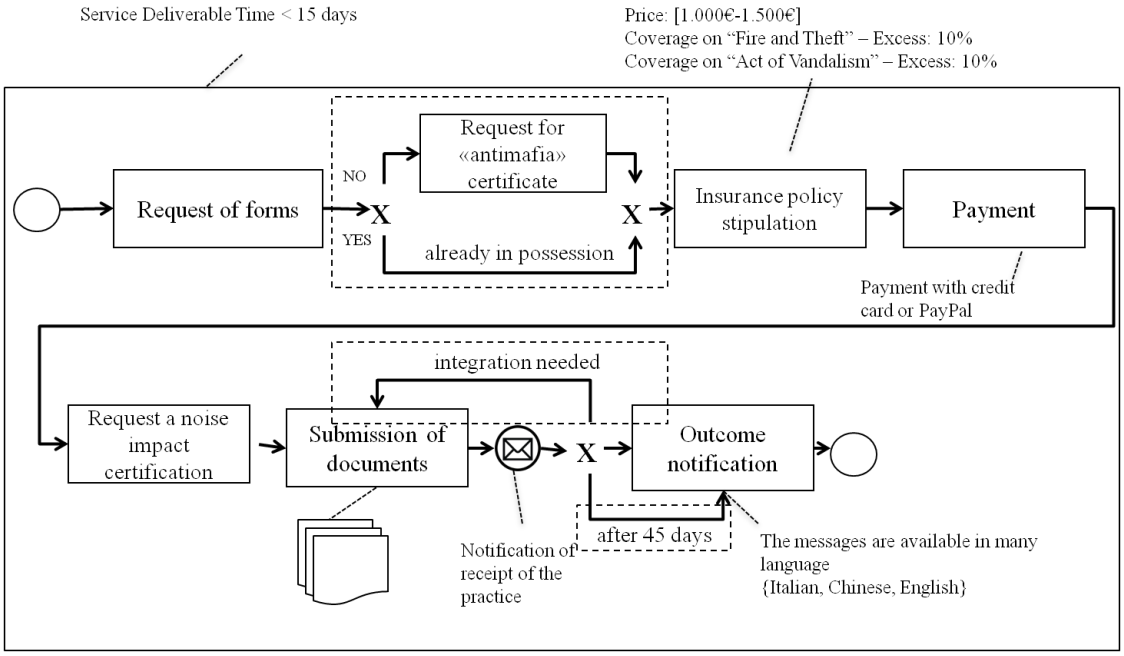

Figure 5.1.5: Non-executable private process

5.1.4 Creating an executable private process

Each activity modelled in the public process is matched into a specific concrete service provided in the territory of the municipality. Consider the example of an entrepreneur who wants to achieve authorization to open a cafeteria in the town of Milan. For each activity of the public process several concrete services that implement the activity have been identified, see Figure 5.1.6.

Activity in the BPMN provate process	Concrete service	Provider
Request of forms	SUAP: Request of forms	Municipality of Milan
Request an Anti-Mafia certificate	Anti-Mafia certificate	Chamber of Commerce
	Anti-Mafia certificate	Prefecture of Milan
Submission of Documents	SUAP: Submission of Documents	Municipality of Milan
Outcome notification	SUAP: Outcome notification	Municipality of Milan
Insurance policy stipulation	Secure Cafeteria	Insurance company I
	Business without thoughts	Insurance company II
	Insurance for cafeteria	Insurance company III
Making payment	Virtual POS	Post office
	Credit card payment	Bank of Milan I
	Bank transfer	Bank of Milan II
Request a noise impact certification	Noise certification	Noise Relevation Company

Figure 5.1.6: List of concrete services for each process activity

As shown in Figure 5.1.6, for some activities of the private process we have identified more concrete services that meet the user requirements. For example, in Figure 5.1.7 three different concrete services are shown that correspond to the activity "Insurance policy stipulation".

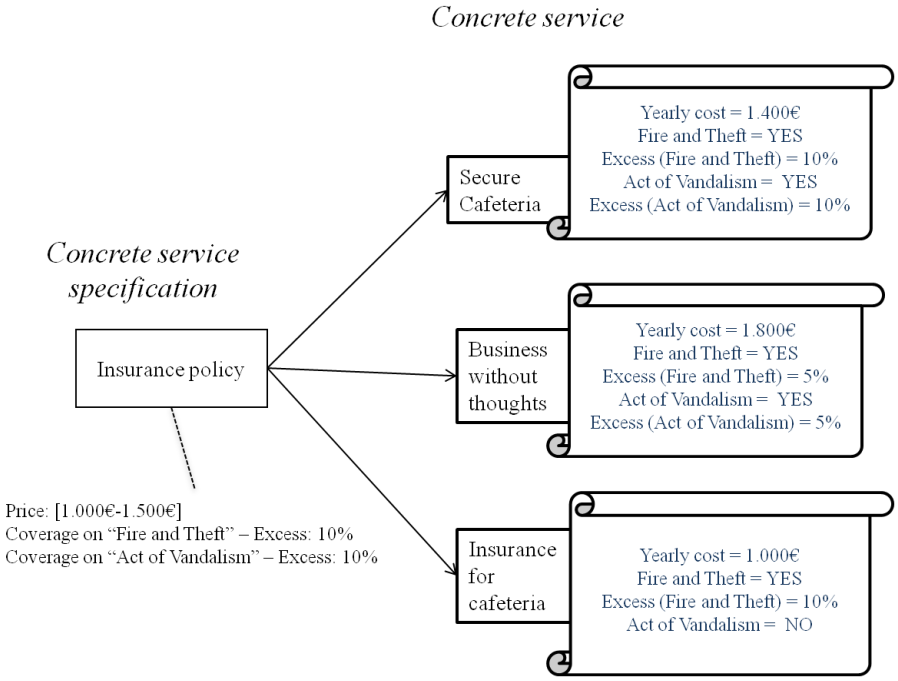

Figure 5.1.7: Correspondences between the concrete service specification and concrete “Insurance policy” services.

Whereas we have three possible choices we must rank identified services in relation to the service contract and the user's request. In this case "Secure cafeteria" is the service that best satisfies the goals of the user, as it exactly matches the concrete service specification. The second candidate concrete service is “Business without thoughts”, which satisfies the requirements on “Fire and theft” and “Act of vandalism” but it has an higher price. The lowest ranked service is "Insurance for cafeteria" which has a low price but it does not satisfy the requirement on “Act of vandalism” coverage.

For what concerns the "Outcome notification" service, no concrete service that satisfies the requirements is identified.

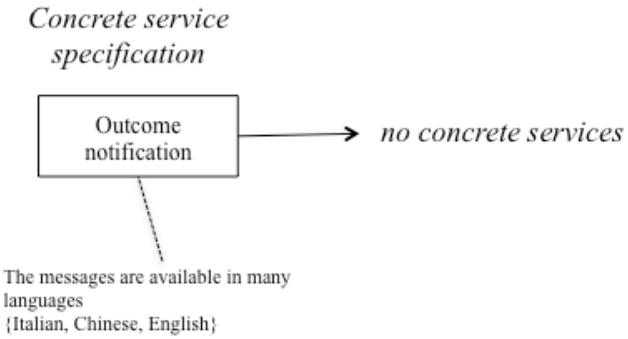

Figure 5.1.9: No concrete service has been found for the outcome notification

Since no concrete “outcome notification” service meets the concrete service specification, we split the service into more granular specifications corresponding to more granular concrete services and step backward to the activity 2 “Creating of the non-executable private process”. The result consists in including a new activity called “Translate message” as shown in Figure 5.1.9.

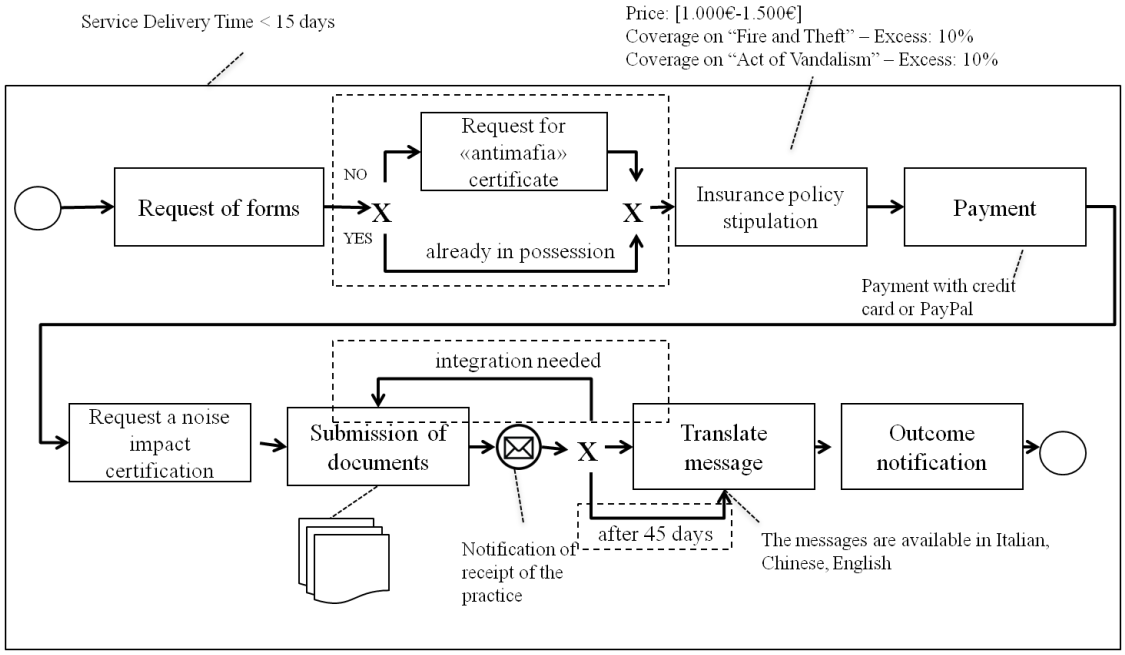

Figure 5.1.9: New non-executable private process

The association of a specific concrete service for each activity modelled in the new non-executable private process allows its transformation into an executable private process.

We can model several executable private processes from the non-executable private process choosing one of several concrete services identified in the Milan area for each activity. The next three figures (5.1.10, 5.1.11 and 5.1.12) shown three examples of executable private process.

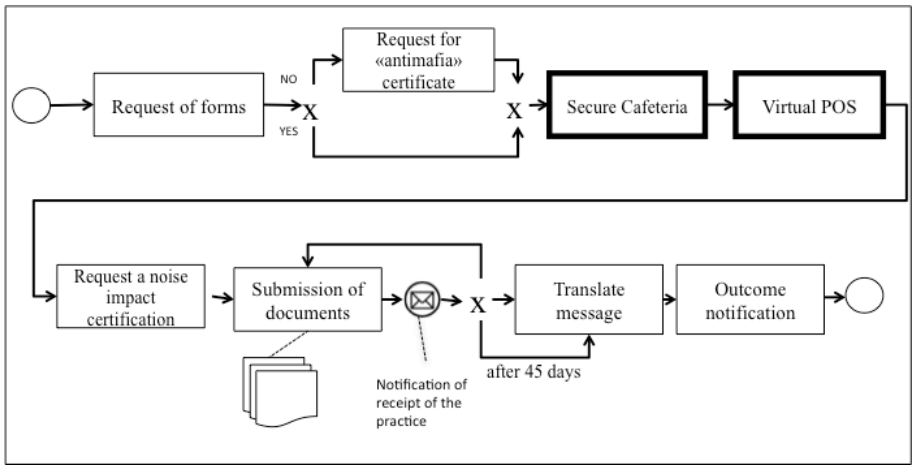

Figure 5.1.10: An example of executable private process with "Secure Cafeteria" and "Virtual POS" concrete services

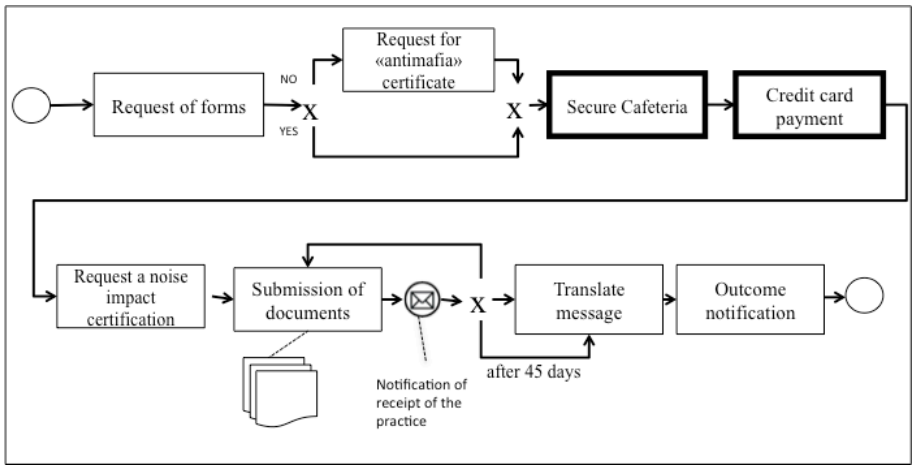

Figure 5.1.11: A second executable private process with "Secure Cafeteria" and "Credit card payment" concrete services

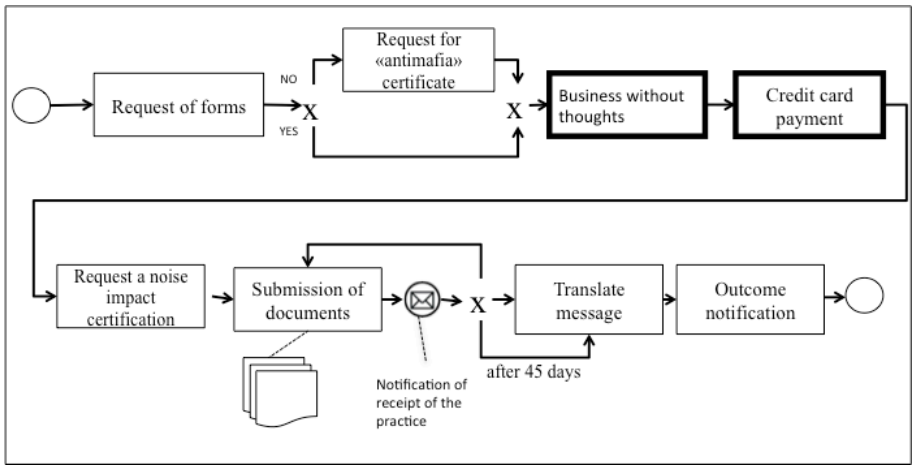

Figure 5.1.12: A third example of executable private process with "Business without thoughts" and "Credit card payment" concrete services.

5.2 Private process implementation

5.2.1 Questions addressed and relevant concepts of the step

Questions addressed in the step are shown in Figure 5.2.1.

- Which is, among others, the private process to be realized?
- Which intermediate concrete services have to be implemented to produce the private process?
- Which intermediate concrete services/components have to be implemented to produce the private process?
- Is the private process produced at the end of the step executable or it is necessary to return to the modeling phase?

Figure 5.2.1: Question addressed in the step

In the previous step, several executable private processes have been identified, in which all activities, or a subset of them, have been associated to concrete services. In this step we need to locate the private executable process that is closest to the service requirements, carrying out an analysis of the properties associated with each specific concrete service. The private process implementation follows the activities mentioned in Figure 5.2.2.

1. Evaluation of executable private process and choice of the process that must be implemented
2. Software requirement and specification collection
3. System modeling
4. Application of the software process

Figure 5.2.2: Activities of the step

5.2.2 Evaluation of executable private process and choice of the process that must be implemented

In relation to the first activity, it is possible to identify two sub-activities closely related to the previous step (step 4.1); the first involves a search in the market for concrete services, that can be associated with the abstract services, and a subsequent evaluation of compatibility based on contractual terms and qualities with the user requirements. This assessment should consider the single task (local evaluation) and then the set of all activities (global evaluation). For example, as shown in the step of the user requirement collection the user has specified the need to obtain the authorization for opening a cafeteria in less than 15 days; for this reason the composition of the "service time" of each concrete service must be less than this value. In the case of the specific services identified support these requirements, you can proceed with the integration of these services in the process, possibly developing communication components for the invocation of these; if you cannot find a concrete service you have to proceed with an ad-hoc implementation (Figure 5.2.4).

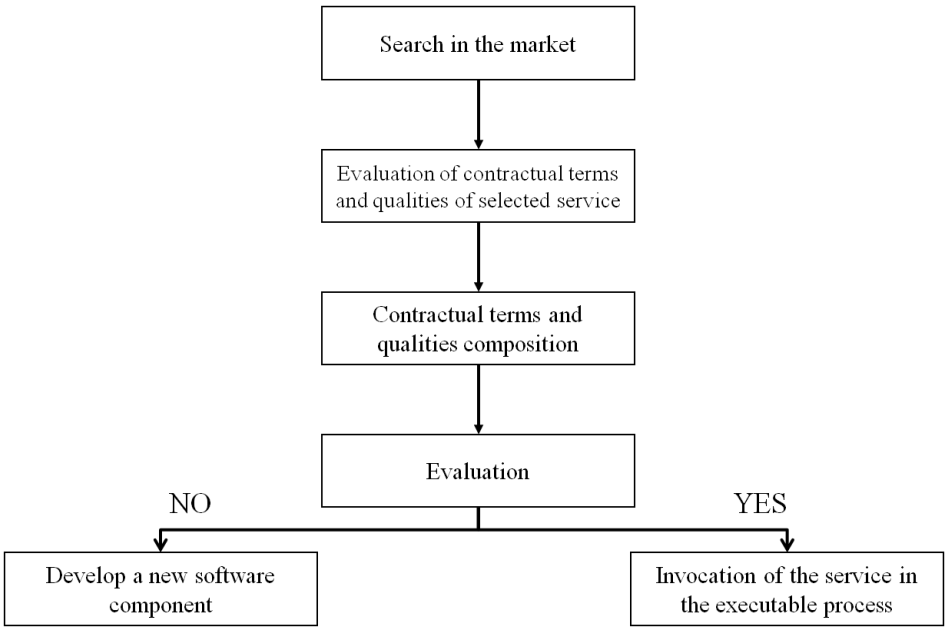

Figure 5.2.3: Sequence flow of the activity

5.2.3 Software requirements and specification collection

In the second case, the first step consists in eliciting further software requirements for new services. This phase is assisted by some of the methodological steps above, in particular from step 1.3 of requirement collection.

Compared to the step of collection requirement, in which the output is characterized by business requirements, in this step we will focus primarily on the definition and extraction of software requirement from the goal-tree and from the abstract services. The requirements for a system are the descriptions of what the system should do, the services that it provides and the constraints on its operation. These requirements reflect the needs of customers for a system that serves a certain purpose such as controlling a device, placing an order, or finding information. It will also present a method for the extraction of software specifications starting from the user requirements. The term itself indicates a specific set of features aimed at compliance with business requirements identified during the previous methodology steps.

The output of this second activity is represented by a formal modelling of requirements (the "Software Requirements Document", sometimes called the "Software Requirements Specification" or SRS).

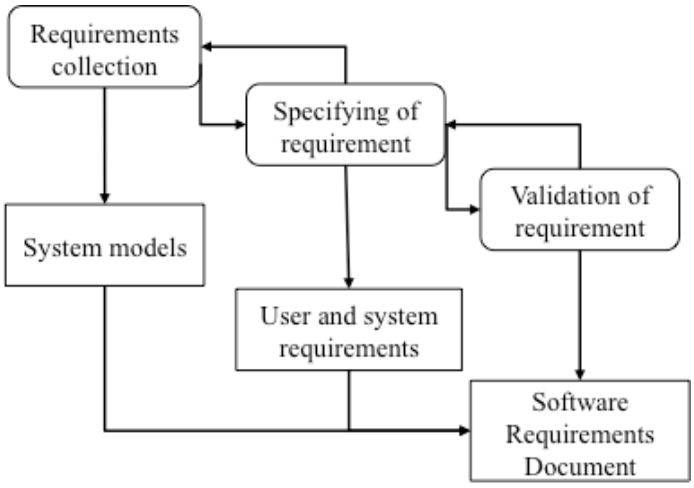

Figure 5.2.4: Activities and their output for the definition of software requirements and specifications

In the first step of Figure 5.2.4 is necessary to describe the identified requirements in detail. You need to write requirements at different levels of detail (user and system requirements) because different readers use them in different ways. The readers of the user requirements are not usually concerned with how the system will be implemented and may be managers who are not interested in the detailed facilities of the system. The readers of the system requirements need to know more precisely what the system will do because they are concerned with how it will support the business processes or because they are involved in the system implementation. An example is shown in Figure 5.2.5.

User Requirement Definition

The payment shoul be done using pos and credit card

System Requirement Specification

The system permit to transfert funds from a bank account of the user by pos circuit
The system permit to transfert funds by Mastercard international circuit

Figure 5.2.5: Example of user and system requirements

Software system requirements are often classified as functional or non-functional requirements. The first one describes the system and its functions, while the latter specifies the constraints on the system and the development process. A further specification of non-functional requirements appears in Figure 5.2.6, where these requirements are divided into: Product Requirement, Organizational Requirements and External Requirements.

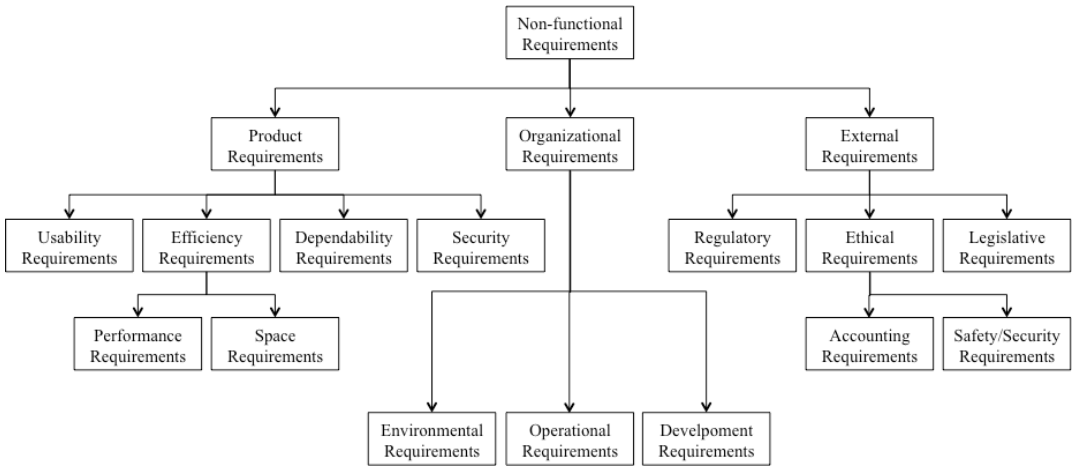

Figure 5.2.6: Types of non-functional requirement

Among the functional requirements are also considered the requirements of the domain, which are specific to a given context of application of the system. Domain requirements are derived from the application domain of the system rather than from the specific needs of system users. They may be new functional requirements in their own right, constrain existing functional requirements, or set out how particular computations must be carried out.

As previously indicated, the output of this activity consists of a software requirements document: it is an official statement of what the system developers should implement. It should include both the user requirements for the system and a detailed specification of the system requirements. The level of detail that you should include in a requirements document depends on the type of system that is being developed and the development process used.

A possible organization for a requirements document based on an IEEE standard (IEEE, 1998) [1], is shown in Figure 5.2.7. The proposed structure should be customized according to the need of the organization.

1. Preface
2. Introduction
3. Glossary
4. User requirement definition
5. System architecture
6. System requirement specification
7. System models
8. System evolution
9. Appendices
10. Index

Figure 5.2.7: Structure of a requirement document

5.2.4 System modeling

The third activity of the step involves the system modeling: the process of developing abstract models of a system, with each model presenting a different view or perspective of that system.

System modeling has generally come to mean representing the system using some kind of graphical notation, which is now almost always based on notations in the Unified Modeling Language (UML) [36]. However, it is also possible to develop formal (mathematical) models of a system, usually as a detailed system specification.

Models are used during the requirements engineering process to help derive the requirements for a system, during the design process to describe the system to engineers implementing the system and after implementation to document the system's structure and operation.

The models (context, interaction, structural and behavioural) through their graphical representations are more understandable than a natural language description of system requirements, thus creating a bridge between the processes of analysis and of design.

Different models can be used to represent the system from different perspectives. For example:
1. An external perspective, where you model the context or environment of the system.
2. An interaction perspective where you model the interactions between a system and its environment or between the components of a system.
3. A structural perspective, where you model the organization of a system or the structure of the data that is processed by the system.
4. A behavioural perspective, where you model the dynamic behaviour of the system and how it responds to events.

UML has many types of diagram and so supports the creation of many different types of system model; it is possible, however, identify 5 diagrams capable of representing the essential elements of a system related to different perspective: Activity diagrams, which show the activities involved in a process or in data processing.
1. Use case diagrams, which show the interactions between a system and its environment.
2. Sequence diagrams, which show interactions between actors and the system and between system components.
3. Class diagrams, which show the object classes in the system and the associations between these classes.
4. State diagrams, which show how the system reacts to internal and external events.

In the early stages of the elicitation process and requirements analysis is also important to define the boundaries of the system or rather to define what the system is and what is the environment outside the system.

In some cases, these boundaries are sufficiently clear; for example, when an automated system is replacing an existing system, the environment is the same. In other cases, there is more flexibility and is required to define what is the boundary between the system and the environment during the process of requirements engineering.

5.2.5 Application of the software process

The last step of the activity involves the application of a software development model; such models consist of a set of activities that lead to the creation of a software, in our case the implementation of the private process.

Although there are many software processes, it is possible to identify some key activities common to different processes:

1. *Software specification* The functionality of the software and constraints on its operation must be defined.
2. *Software design and implementation* The software to meet the specification must be produced.
3. *Software validation* The software must be validated to ensure that it does what the customer wants.
4. *Software evolution* The software must evolve to meet changing customer needs.

It should be emphasized that the application of the model, and the related development activities, are strongly related to the type of project.

The more traditional approach is represented by the *waterfall model*, characterized by phases with well-defined beginning and end (Figure 5.2.8), and partial results ("artefacts") that are transferred to the next step. The waterfall model assumes that each step is completed before the next begins. The waterfall model takes the fundamental process activities of specification, development, validation, and evolution and represents them as separate process phases such as requirements specification, software design, implementation, testing, and so on.

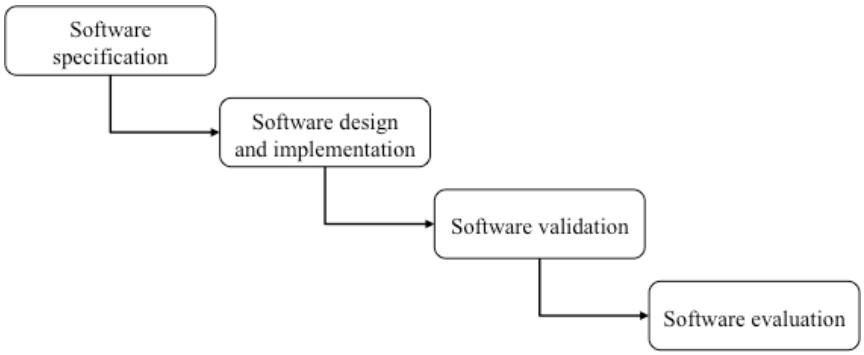

Figure 5.2.8: The waterfall model

The waterfall model is an “ideal model” and for that reason can only be approximated in practice; it is based on the assumption that software development proceeds linearly from analysis to production code. In practice, this cannot happen and it is necessary to provide regulated forms of feedback loops.

A more flexible approach (and not monolithic such as the cascade process) is represented by the *incremental or evolutionary models*. These models include the definition of an early version of software, or prototype, which is used only temporarily, in order to provide to designer enough feedback about the major risks involved in the development of the application (for example, allowing him to capture exactly the requirements). The second version can then be developed according to a model of cascade process. This approach provides a partial solution to some of the problems related to the cascade process, such as the elimination of errors in the requirements. It does not eliminate, however, the temporal distance between the definition of the requirements and the release of the application, and does not stress the need to anticipate change.

The last model reuse-oriented software engineering is based on the existence of a significant number of reusable components. The system development process focuses on integrating these components into a system rather than developing them from scratch.

The high cost of the classical models to software development has led to the definition of new AGILE methods; these are based on the universal approach of specification, development and

cyclical delivery of software. Born as an alternative to traditional methods, outlined above, are proposed as "light" methodology characterized by being models:

- Adaptive rather than predictive: They don't try to plan the development in detail and to meet all the specifications, but they design application thought about to change over time.
- People-oriented rather than process-oriented: Engineering methods aim at defining processes that work for whoever uses them. Agile methods assert a process cannot match the skills of a development team, they only play a support role in development team work.
- They make extensive use of best practices: established industry practices in software development, even if with different features and different intensities, are adopted in all development processes.

	Pro	Cons
Waterfall	Understandable Manageable Appropriate to define contracts between partner Clear milestones	Difficult management of requirement Delays and refers the identification of problems
Incremental	Feedback oriented Better ability to handle the variability of the requirements	It requires skill and preparation adequate in both development and management (eg. Risk management)
Reuse-oriented software engineering	Reducing the amount of software to be developed Reducing cost and risks It usually also leads to faster delivery of the software	Requirements compromises are inevitable and this may lead to a system that does not meet the real needs of users Some control over the system evolution is lost as new versions of the reusable components are not under the control of the organization using them.
Agile	Suitable for particularly innovative projects with not well-defined requirements	It requires great discipline and motivation Not easily understandable by the customer Generally not appropriate to contracts definition

Figure 5.2.9: Comparison between the models of process development

The agile models shown however some problems; for example:
- the impossibility to continued participation of the customer to software development;
- prioritize changes can substantially increase the complexity of management, in particular in systems characterized by many stakeholders (which associate different levels of priority changes);
- maintaining the simplicity of the system requires additional time.

You should also consider how the software requirements document is usually part of the contract between customer and supplier, but since specifications are inherent in incremental Agile methods, writing contracts is a critical task.

Figure 5.2.9 proposes a comparison between the mentioned models for process development. Even if Smart is independent from any model, here we proceed taking into account the development process Disciplined Agile Delivery (DAD) [36] [37], which supports and enhances the values and principles of the Agile Manifesto, "regulating" the activities so to maximize the value of the product (e.g., ROI) and stakeholder satisfaction. The Disciplined Agile Delivery (DAD) life cycle is shown in Figure 5.2.10.

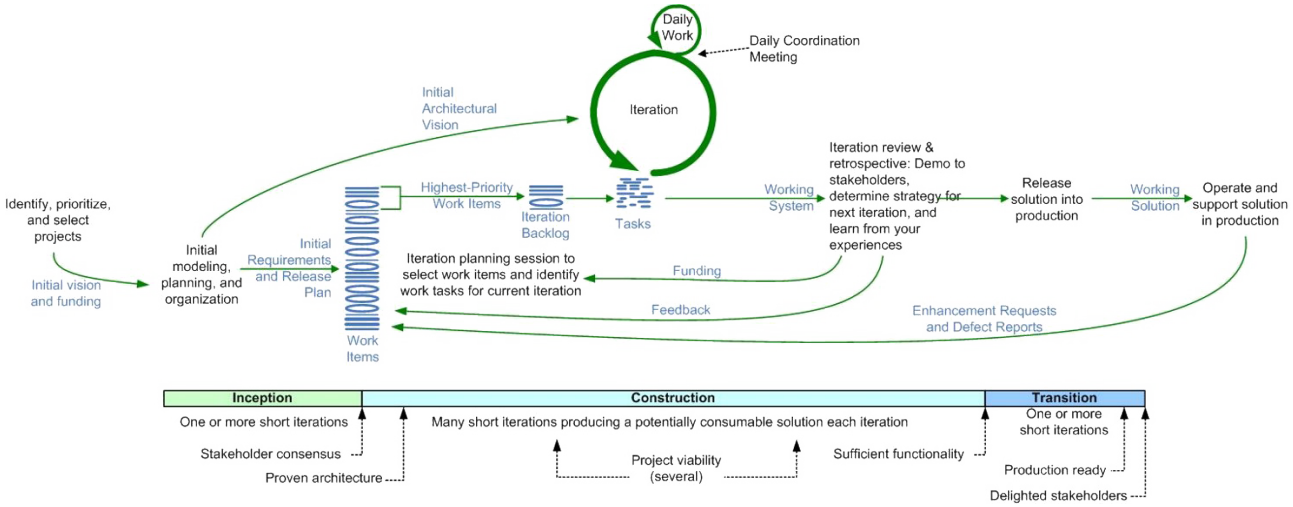

Figure 5.2.10: The Disciplined Agile Delivery life cycle

The DAD methodology is proposed for the entire development cycle so then actually overlaps certain steps of Smart methodology. In particular, the DAD phases of Inception and Construction overlaps the 4.1, while the currently described overlaps the *Transition*.

The transition phase focuses on delivering the system into production (or into the marketplace in the case of a consumer product), for this reason it finds a match with the phase 4 of the SMART methodology (Figure 5.2.11). In particular, all the artefacts (documentation, BPMN, etc.) made in the steps of SMART are used during the Inception and Construction as a Knowledge Base.

SMART	DAD
4.1 Public and private process modeling	Inception
4.2 Private process implementation	Construction
Release solution into production	Transition

Figure 5.2.11: Mapping between SMART and DAD phases

The goal of the inception phase is represented by an assessment of the requirements and feasibility of the project, the definition of an architecture, the development team and plan to release an analysis of the process through public and non-executable private processes. This phase ends when the team has developed a vision for the release that the stakeholders agree to and has obtained support for the rest of the project (or at least the next stage of it).

Figures 5.2.12 shows the INPUT and OUTPUT of the methodology SMART and DAD in relation to step 4.1.

INPUT SMART	OUTPUT SMART/INPUT DAD	OUTPUT DAD
1. Abstract services 2. Nfp and qualities	1. Set of executable private process	1. General vision of service 2. Requirement envisioning 3. Consider feasability 4. Build team 5. Intentional architecture 6. Release planning (initial) 7. Setup environment

Figure 5.2.12: Input e Output of SMART methodology and DAD for step 4.1

The construction phase in DAD is the period of time during which the required functionality is built. The timeline is split up into a number of time-boxed iterations. At the end of each iteration a demonstrable increment of a potentially consumable solution has been produced and regression tested. The construction phase ends where there is sufficient functionality to justify the cost of transition, sometimes referred to as minimally marketable release (MMR), and which the stakeholders believe is acceptable to them.

INPUT SMART	OUTPUT SMART/INPUT DAD	RELATIVE OUTPUT DAD
1. Set of executable private process	1. Executable private process with some realized components	1. Working System

Figure 5.2.13: INPUT e OUTPUT of SMART methodology and DAD for step 4.2

The transition phase focuses on delivering the system into production (or into the marketplace in the case of a consumer product).

5.2.6 Example of development

This section proposes a sample of implementation of the considered process. In the case study of opening a cafeteria, we have identified a process that describes a workflow of a series of concrete services.

The implementation can be done using various architectural patterns:
1. client-server: the application is modeled as a set of services provided by the server and a set of clients that use them;
2. distributed object: the system is composed of a set of objects that expose an interface; other objects invoke these services, no logical distinction between a client (a receptor service) and a server (service provider)
3. service oriented architecture (SOA): services are delivered via the Web (Web services) through the publication of a service interface, specifying the available data and the means of access. A web service is then a standard representation of computing resources or information that can be used by other programs.

In the considered scenario is assumed that for each service there is a web service (provided by a provider) invoked from the process, and then a possible solution is the service-oriented architecture (SOA).

Service-oriented architectures (SOAs) are a way of developing distributed systems where the system components are stand-alone services, executing on geographically distributed computers. Standard XML-based protocols, such as SOAP and WSDL, have been designed to support service communication and information exchange. Consequently, services are platform and implementation-language independent. Software systems can be constructed by composing local services and external services from different providers, with seamless interaction between the services in the system.

The key standards for web SOAs are as follows:

1. SOAP: this is a message interchange standard that supports the communication between services. It defines the essential and optional components of messages passed between services.
2. WSDL: the Web Service Definition Language (WSDL) is a standard for service interface definition. It sets out how the service operations (operation names, parameters, and their types) and service bindings should be defined.
3. WS-BPEL: this is a standard for a workflow language that is used to define process programs involving several different services.

The process of Figure 5.2.14 defines a workflow modeled through the use of BPMN. Mappings have been defined to translate the language to lower-level, XML-based descriptions in WS-BPEL.

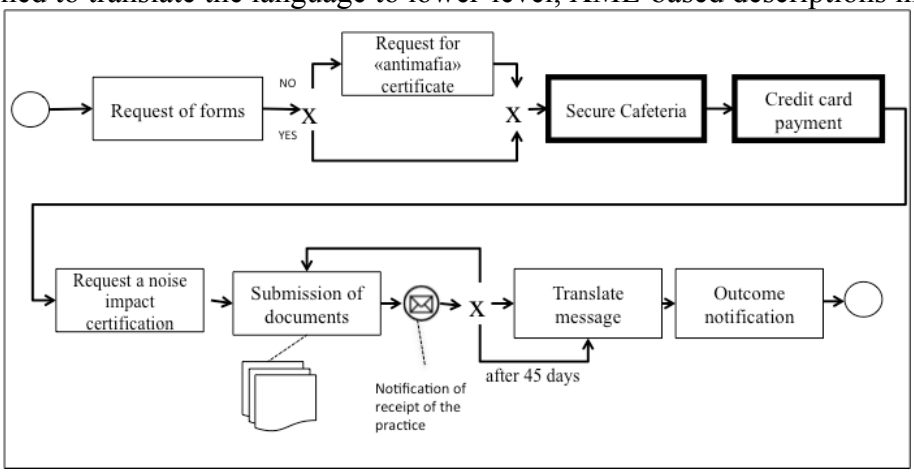

Figure 5.2.14: Executable private process

Once the executable private process is available, it must then be converted to an executable program. This may involve two activities:
1. Implementing the services that are not available for reuse. As services are implementation-language independent, these services can be written in any language. Both Java and C# development environments provide support for web service composition.
2. Generating an executable version of the workflow model. This normally involves translating the model into WS-BPEL, either automatically or by hand. Although there are several tools available to automate the BPMN-WS-BPEL process, there are some circumstances where it is difficult to generate readable WS-BPEL code from a workflow model.

To provide direct support for the implementation of web service compositions, several web service standards have been developed. As explained, the standard XML-based language is WS-BPEL (Business Process Execution Language) which is a 'programming language' to control interactions between services. This is supported by additional standards such as WS- Coordination [36], which is used to specify how services are coordinated, and WS-CDL (Choreography Description Language) [37], which is a means of defining the message exchanges between participants [38].

6.1 Portfolio management in Smart

In this section, we provide the description of the approach to service portfolio management proposed in the Smart project. The service portfolio is useful in the entire life-cycle of the service production process. For this reason, it should not be considered as a methodological step but as a powerful tool to be used across the different methodological phases.

6.1.1 Introduction to portfolio management and service portfolio management

At present, notwithstanding the multidisciplinary efforts in the area of Service Science, the planning and design of services in digital ecosystems still see a focus on the technological perspective as the prevailing one, boosted by the Service Oriented Computing (SOC) paradigm and service oriented design and development methodologies that support the realization of service-based ICT infrastructure. A service ecosystem is a marketplace for trading services that are developed, sold and used. Accordingly, design and evaluation frameworks are required, considering, e.g., socio-economic features of a service ecosystem apart from the technological ones. Likewise, the concept of portfolio has been adopted at the state of the art as well as in what follows as a managerial resource and core component of such kind of frameworks, supporting managers in decision making through all phases of the service lifecycle, i.e., service design, implementation, execution and monitoring.

In this section we provide a framework to enforce reuse along the service design phase of the service lifecycle. The framework adopts a service portfolio perspective. A central artifact in this phase is the repository of services, which plays in the service lifecycle the role of a software applications repository in software engineering, and can be used, among others, for (i) aggregation of elementary services into composite services; (ii) identification of correspondences between services and events of life; (iii) assessing and improving the efficiency of the service production lifecycle, and (iv) optimization of service value.

The concept of portfolio management has been introduced proving that diversification of an investment portfolio is preferable to a homogenous portfolio based on the dimensions risk and return. These concepts have led to the development of the Modern portfolio theory, and to its former applications in the financial domain. However, over the years, portfolio management has been applied for the management of business objects such as business units, products, relationships, projects, or IT applications. Generic goals of portfolio management for new products based on empirical findings are: maximization of value against one or more business objectives, balancing, in order to manage the overall risk of the portfolio; strategic alignment of the portfolio with the strategy. Accordingly, portfolio models used to select projects or review the portfolio can be clustered in seven different categories: financial or economic models; scoring models; probabilistic financial models; behavioural approaches; mathematical optimization procedures; decision support systems.

More recently, a service portfolio perspective has received attention as a way for managing complexity in service asset management, in particular with regard to Web services and SOA based solutions for the service life cycle. Thus, Service portfolio management has been seen as an instrument for supporting decision making on development, reuse, execution, maintenance and evaluation of service asset. Accordingly, in literature authors have proposed frameworks for SPM adapting traditional goals of portfolio management, such as maximization of value against business, and shareholder financial objectives. A service portfolio usually provides three levels of views, which are the conceptual view, the logical view, and the physical view.

In this section a framework for managing and evaluating ICT-enabled service portfolios along the service design phase of Smart is presented. The framework adopts a service reuse perspective and it is made up of i) a model for the representation of a repository of services, ii) a model for the definition of a service portfolio representing current production lines of a service provider organization, iii) a set of metrics for service portfolio evaluation, and iv) a tool supporting managers in decision making for the achievement of design objectives. The proposed metrics and the tool are supposed to allow decision makers to get an improved view of the service design process. Furthermore, the framework enables an informed improvement of production processes as well as operational strategies, resulting in potential reuse initiatives, likewise.

6.1.2 Basic definitions adopted for service portfolio management in Smart

In this section, we assume that the design process of a service *s* is composed, e.g., of five design stages:

- ***Stage 1***: A name is associated to the service *s* and a high-level description is produced. The output of this stage is a textual service description.
- ***Stage 2***: *Is-a* and *part-of* relationships that relate *s* with other services are identified. The output is a schema representing the relationships.
- ***Stage 3***: Service *s* is modeled in terms of functional properties. The outputs are diagrams for the representation of functional properties, e.g. UML diagrams [19] such as: (i) use-case diagrams addressing the user requirements and (ii) class and sequence diagrams describing the functional requirements in detail.
- ***Stage 4***: Service *s* is modeled in terms of non-functional properties. The output is a textual description of non-functional properties.
- ***Stage 5****:* The business process of *s* is modeled. The output is e.g. a BPMN diagram.

Considering provider organizations, services are usually designed by teams of agents that are highly coordinated within the team and, usually, loosely coordinated among teams. With the final goal of defining the concept of production line, we have first to characterize the level of maturity of services as well as of the resources required for their progress in the design process. We introduce the current design stage and effort metrics, referring in general to a *n*-stages design process.

The *current design stage cds(s)* of a service *s* represents the stage st_k, with $k \leq n$, reached by service *s* in the n-stages design process. Given a service *s* and a stage st_i of the n-stages design process, the *effort* $ef(s,st_i)$ is the amount of resources needed to shift the design process of *s* from stage st_{i-1} to stage st_i, with $0 < i \leq n$. In this paper, we size the effort in terms of person/hours.

We now have available all the relevant constructs to introduce the concept of production line. A production line pl of the design process is the set of services $s_1, s_2, \ldots, s_n$ on which a coordinated team operated in the past or else is currently operating. Each service s_i in a production line is characterized by (i) its current design stage $cds(s_i)$ and (ii) the effort $ef(s_i,st_j)$ already spent or estimated to reach each stage st_j of the design process.

Inside the team involved in each production line, we assume that there is a shared knowledge about the set of services on which the team works and on conceptual relationships (i.e. part-of and is-a) existing among them. The shared knowledge can be explicitly represented in some document (e.g., by means of a spreadsheet or a database) or implicitly applied in the team operations (due to the coordination by the production line manager). Such shared knowledge establishes the relevant

property that each service in a production line is designed only once, in other words there is no duplication of effort in the design of a same service in a production line. In this paper we name the explicit representation of the shared knowledge as the (production line) local repository of services.

A *local repository of services* of a production line *pl* is the set of services $s_1, s_2, \ldots, s_n$, of *pl* together with the *part-of* and *is-a* relationships existing among them.

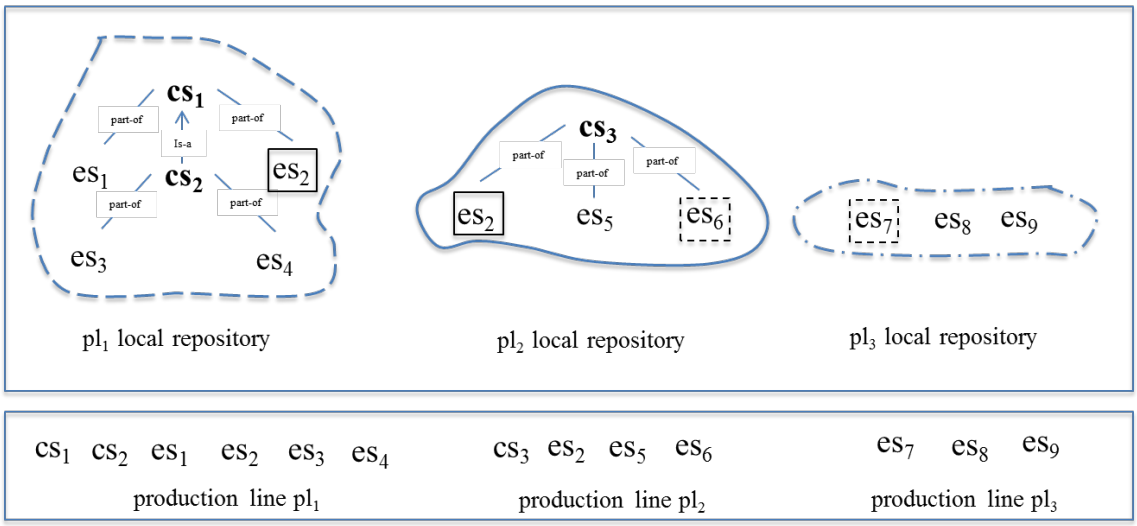

Figure 6.1.1: Examples of production lines and local repositories

Figure 6.1. shows an example of production lines (we omit current design stages and efforts) and related local repositories; we assume a scenario in which:

- local coordination among production lines pl_1 and pl_2 led to the decision that service es_2 is a common production objective of both lines (closed line squares), enabling in such a way service reuse;
- (the absence of coordination between production lines pl_2 and pl_3 led to inefficiency and duplication of effort in the production of es_6 and es_7, that correspond to the same service (dashed lines squares). In the above scenario the reuse of services between different production lines is unevenly applied in the provider organization. With the goal of modeling the two cases in Figure 6.1., we introduce the concepts of equivalent services, conceptual-equivalence class of services, and production-equivalence class of services.

Given two services s_i and s_j produced by two different production lines, we say that s_i and s_j are equivalent ($s_i \sim s_j$) if and only if s_i and s_j produce the same change of state in the real world. E.g., we may assume that two production lines produce respectively the service "change of home address" and "change of residency"; after a simple inspection, one may conclude that two names adopted for services are synonyms, and the two services are equivalent.

A *conceptual-equivalence class CEq* is a set of services $s_1, s_2, .., s_n$ in production lines that are pair wise equivalent. Notice that services s_i can exist such that $CEq(s_i)=\{s_i\}$. We call *trivial* such CEq classes. Equivalent services $pl_1.es_2$ and $pl_2.es_2$ in Figure 6.1. are in the same CEq class. The same happens for services $pl_2.es_6$ and $pl_3.es_7$. We will use the notation <production line>.<service> also in the following of the paper.

In a provider organization it may happen that only a subset of services of a conceptual equivalence class has been recognized as equivalent. We introduce a stricter form of equivalence, characterizing services that since the beginning of production have been recognized as equivalent, and have been

produced only once leveraging reuse. A *production-equivalence class PEq* is a subset of services of a *CEq* class that in the production process have been recognized as equivalent and, as a consequence, have been produced only once. Equivalent service $pl_1.es_2$ and $pl_2.es_2$ in Figure 6.1.1 are in the same PEq class, while $pl_2.s_6$ and $pl_3.s_7$ are in distinct (trivial) PEq classes.

Now we introduce the concept of *global repository of services*: the integrated representation of the whole set of local repositories in a provider organization, where each CEq class of services is represented by a unique service. Given a design process whose services in production lines are grouped in *n* CEq classes, a *global repository of services* is the set of services $s_1, s_2, \ldots, s_n$ representing the *n* CEq classes, together with the *part-of* and *is-a* relationships defined among them. Basically, the repository of services is the result of the integration process of all the local repositories of services of a design process. The global repository of services plays the same role of the integrated conceptual schema adopted in data governance methodologies [6] for the reconciled representation of the set of data base conceptual schemas managed in the information system of an organization. In
Figure **6.1.**, we show (bottom level) production lines and (intermediate level) local repositories of Figure 6.1., and (top level) the corresponding global repository of services where: (i) the two services $pl_1.es_2$ and $pl_2.es_2$ have been unified, and (ii) services $pl_2.es_6$ and $pl_3.es_7$ have been unified and renamed as $es_{6\text{-}7}$. Notice that:

- service es_2 in the global repository has $CEq(es_2) \equiv PEq(es_2) = \{pl_1.es_2, pl_2.es_2\}$;
- service $es_{6\text{-}7}$ in the global repository has a newly discovered $CEq(es_{6\text{-}7}) = \{pl_2.es_6, pl_3.es_7\}$ and two distinct trivial PEq classes.

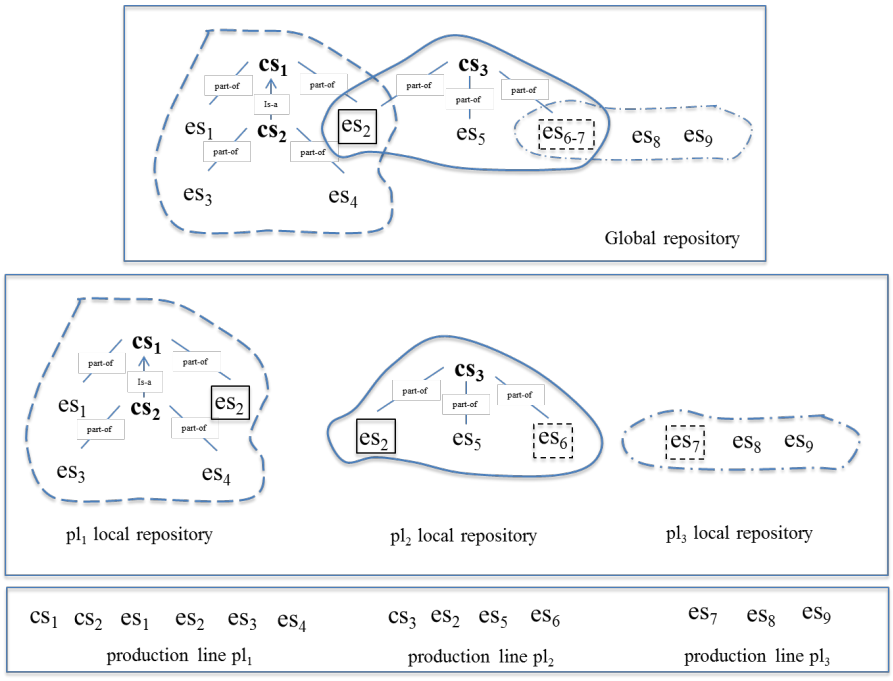

Figure 6.1.2: Production lines and local repositories of Figure 6.1.1.

6.1.3. Service portfolio in Smart for the reuse perspective

The introduced concepts are finalized considering the service reuse perspective. A *service portfolio* is made of : (a) the set of production lines $pl_1, pl_2, \ldots, pl_n$; (b) the global repository of services, and (c) for each service *s* in the global repository, the corresponding *CEq(s)* and *PEq*(s) in the set of production lines. The whole Figure 6.1.2 is an example of service portfolio (except current design

stages and efforts), while Figure 6.1.3 helps to clarify how the service portfolio is created. Both the repository and the portfolio creation start with the analysis of managerial accounting data and interviews to project managers. This knowledge allows defining the production lines and the PEq classes. In case local repositories do not explicitly exist, they are to be created. Local repositories are the input to global repository creation: CEq classes are identified and mapped to unique services in the global repository. Furthermore, the integration process may generate new is-a relationships between services in different local repositories. The global repository, the identified PEq and CEq classes, and production lines metrics (i.e., *cds* and *effort* for each service in production lines) are used for the creation of the service portfolio.

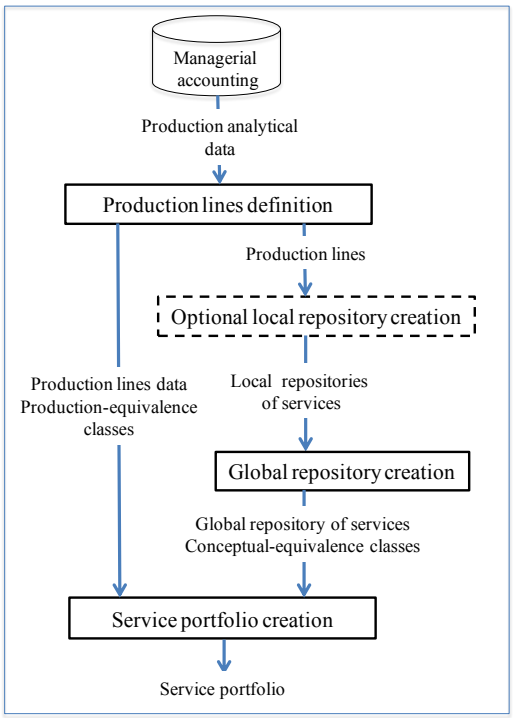

Figure 6.1.3: Repository and Portfolio creation

We proceed to the definition of metrics for service portfolio evaluation. Metrics *effort* and *current design stage* have just been introduced. We recall the assumption that design stages of equivalent services in different production lines have the same effort. The metric *cost to completion* represents the effort needed to reach the stage st_n in the n-stage design process of a service *s*. When a service portfolio is available, we aim to evaluate the advantages, in terms of savings, of leveraging reuse in the future production process. To evaluate such savings, we first introduce the cost to completion of PEq and CEq classes.

The cost to completion of a PEq(s) class of services, namely Pcost(PEq(s)), is the effort required to reach the final stage stn in the design process for any service si in PEq(s). The cost to completion of a CEq(s) class of services, namely Ccost(CEq(s)), is the effort required to reach the final stage stn in the design process of the service si in CEq(s) having the maximum current design stage. Moving to the entire design process of an organization, we can introduce the two costs to completion of the design process without/with the service portfolio. The cost to completion of all services in the set of production lines *PL without the portfolio*, namely *dp_cost_NP(PL)*, is the sum of costs to completion of all PEq classes of services in *PL*.

The cost to completion of all services in the set of production lines *PL with the portfolio*, namely *dp_cost_P(PL)*, is the sum of costs to completion of all CEq classes of services in *PL*.

The application of reuse in the design process determines the effort savings that can be evaluated for a single service or for the design process. We recall that several PEq classes may correspond to a single service in the global repository.

The reuse-driven *effort saving* for a design process with production lines PL, namely *dp_eff_saving(PL)*, is the difference between *dp_cost_NP(PL)* and the related *dp_cost_P(PL)*. The *dp_eff_saving(PL)* represents the *utility* of the integration activities described in Figure 6.1. and it is quantified in terms of person/hours. The related value of integration coincides with the *return on investment (ROI)* for a provider organization adopting the above approach to service portfolio management:

$$ROI = \frac{dp\_eff\_saving(PL) - construction\_cost(SP)}{construction\_cost(SP)} * 100$$

where *construction_cost(SP)* is the cost of all the activities in Figure 6.1., and under the assumption that the hourly cost of persons involved in service design and in portfolio creation is the same.

6.1.4 Case study

TSP s.r.l. is a small size Italian company that works in the ICT sector through the development of enterprise applications, the design and implementation of ICT enabled services and system integration activities. In the last years, the company designed and implemented services related to initiatives for several types of users; the design process has been organized in five production lines. Main application domains involved are the Italian Local Public Administration domain and the Tourism domain. In particular, the company has designed and developed services for: i) local police administrative activities such as car crash analysis and administrative penalty management; ii) entrepreneurs aiming to open new business activities (e.g. restaurants, shops, etc.); iii) tourist support in choosing services provided by local tourism operators (e.g., hotels, restaurants, etc.) in Italy. Services produced by TSP are in some cases very specific to a particular domain (e.g., the "Certification of acoustic impact"), while others are characterized by a wide application, thus, potentially re-usable in different domains and job orders.

In order to create the repository and the portfolio of TSP, we analyzed managerial accounting data (e.g., technical documentation, UML diagrams, Gantt Diagrams, and PERT charts) and we interviewed three project managers, responsible of three job orders and five related production lines. The analysis revealed that only for three out of the five production lines a spreadsheet representing the local repository of services was available. In the other two cases additional interviews to project managers had been required to create local repositories. The total amount of services in the production lines of TSP is equal to 184, subdivided into 138 elementary services and 46 composite services.

We identified nine production equivalence (PEq) classes, among them five PEq classes with cardinality equal to two and four PEq classes with cardinality equal to three; they correspond to cross-domain services such as "payment service" and "certified electronic mail service". The analysis of the 184 services in the production lines has revealed 42 services that form 16 non trivial conceptual equivalent (CEq) classes, among them 9 corresponding to the previous PEq classes, other 7 are new. As an example, "integrated notification service" and "multichannel notification

service" have been recognized to belong to a same CEq class. The resulting TSP repository is made of 157 services, structured according to 282 *part-of* and 17 *is-a* relationships.

The application of the approach in Figure 6.1. resulted in the creation of the TSP global repository and service portfolio. This activity required 228.4 person/hours divided in: (i) 70.4 person/hours for the creation of two missing local repositories; (ii) 97.2 person/hours for the identification of CEq and PEq classes, and (iii) 60.8 person/hours for the integration of local repositories in the global repository and the creation of the service portfolio.

We now discuss how the service portfolio has been used to make the assessment of the TSP design processes. The assessment starts with the analysis of the CEqs and PEqs classes. In order to clarify how the analysis has been performed, we refer to Table 6.1.1, focusing only on non trivial CEq classes. In the *current state* of the portfolio, service es_2 is shared by production lines pl_1 and pl_2 (reuse has been applied). Vice versa, services es_6 and es_7 are conceptual equivalent but not production equivalent. Table 6.1.1 reports also the *worst state* of the service portfolio that represents the state we would have had if the reuse had never been applied. Finally, Table 6.1.1reports the *best state* of the service portfolio that we would have had if the reuse had been applied thoroughly.

	s in GRS	**CEq(s)**	**PEq(s)**
current state			
	es_2	$pl_1.es_2$; $pl_2.es_2$	$pl_1.es_2$; $pl_2.es_2$
	$es_{6\text{-}7}$	$pl_2.es_6$; $pl_3.es_7$	$pl_2.es_6$
			$pl_3.es_7$
worst state			
	es_2	$pl_1.es_2$; $pl_2.es_2$	$pl_1.es_2$
			$pl_2.es_2$
	$es_{6\text{-}7}$	$pl_2.es_6$; $pl_3.es_7$	$pl_2.es_6$
			$pl_3.es_7$
best state			
	es_2	$pl_1.es_2$; $pl_2.es_2$	$pl_1.es_2$; $pl_2.es_2$
	$es_{6\text{-}7}$	$pl_2.es_6$; $pl_3.es_7$	$pl_2.es_6$; $pl_3.es_7$

Table 6.1.1: current, worst and best states of conceptual-and production-equivalent classes of services

The assessment of the design process provides an answer to the following questions:

- Q1: Given the *current state* of a service portfolio, what have been the savings so far with respect to the *worst state*? What has been the waste with respect to the *best state*?
- Q2: Given the current state of a service portfolio, which will be the savings from now on applying thoroughly reuse to complete the design process?

The result of the assessment shows that the effort spent in the past to design the whole set of services is equal to 3.789 person/hours, with a saving respect to the *worst state* (i.e., reuse has never been applied) of 528 person/hours and with a waste respect to the *best state* (reuse has always been applied) of 303 person/hours. The reuse driven effort allocation of future design activities shows potential savings for 1.623 person/hours, in the completion of all services in the design process. Since we know that TSP spent 228.4 person/hours to build the service portfolio, we are now able to quantify the return on investment (ROI) with the assumption that the hourly cost of persons involved in service design and in the portfolio creation is the same. Using the formula in Section 6.1.3, we have that the ROI equals to 610.6%.

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Appendix 1 – Non Functional Property list

Id	Non functional property	Section	Description of the main characteristics of possible service users
1	Provider	Parties	Entity that is responsible of the service provisioning.
2	Subprovider	Parties	Optional term that is defined when the provider contracts out the service provisioning. This term can have one or more under-terms subprovider whit a tree structure.
3	Producer	Parties	Entity that is responsible of the service production.
4	User Profile	Parties	Description of the main characteristics of possible service users.
5	Starting Date	Term and Period of the Contract	Time instant (date and hour) in which the contract will be actived.
6	Temporal Duration	Term and Period of the Contract	Period of time in which the contract will be valid.
7	Refund Period	Term and Period of the Contract - Termination, Suspension and Withdrawal	Time limit for asking the payment refund.
8	Period of acceptance	Term and Period of the Contract	Time limit for the user to accept the service at the conditions defined in the contract.
9	Accepted Currencies	Pricing	Accepted currencies for the service payment.
10	Pre-emption/Priority Cost	Pricing	Cost for pre-emption of the service or for accessing the service with priority.
11	Exchange Rate Period	Pricing	Date in which the exchange rate is defined.
12	Deposit	Pricing	Monetary amount requested as a deposit.
13	Absolute Price	Pricing	Monetary amount to be paid for using the service.
14	Absolute Remuneration of the provider	Pricing	Monetary amount totally paid to the provider.
15	Tax on Absolute Price	Pricing	Taxes paid on service price.
16	Subscription Price	Pricing	Monetary amount to be paid for using the service in a limited period.
17	Remuneration in subscription of provider	Pricing	Monetary amount totally paid to the provider for using the service in a limited period.
18	Tax on Subscription Price	Pricing	Taxes paid on service subscription price.
19	Termination Price	Pricing	Monetary amount to be paid for service termination/cancellation.
20	Remuneration for terminate of service for provider	Pricing	Monetary amount totally paid to the provider for service termination/cancellation.
21	Tax on Termination Price	Pricing	Taxes paid on termination price.
22	Payment Interest Default	Pricing	Monetary amount proportional to the period in time that the user must pay to the provider in case of payment delay.
23	Payment Default	Pricing	Monetary amount that the user must pay to the provider in case of payment delay.
24	Interest Default for Service Delay	Pricing	Proportional monetary amount that the provider must pay to the user in case of delay in service provisioning.
25	Service Delay Default	Pricing	Monetary amount that the provider must pay to the user in case of delay in service provisioning.
26	Price Validity	Pricing	Time limit to accept the contract and ensure the proposed price.
27	Price Negotiability	Pricing	Possibility to negotiate the proposed price.
28	Payee Discount	Pricing	Discount apply on the proposed price.
29	Discount Condition	Pricing	Conditions for payee discount application.
30	Establishment Fee	Pricing	Monetary amount to be paid for the registration to the provider's service network.
31	Proportional Price	Pricing	Monetary amount to be paid for a specific quantity of resource offered by the service.

32	Ranged Absolute Price	Pricing	Interval of values that the absolute price can assume.
33	Ranged Proportional Price	Pricing	Interval of values that the proportional price can assume.
34	Payment Discounts	Pricing - Terms of Payment	Discount applied on the price determined by the chosen payment method.
35	Payment Method	Terms of Payment	Available methods to perform the payment of the service.
36	Payment Schedule	Terms of Payment	Time limit for service payment.
37	Payment Location	Terms of Payment	Geographic or electronic place where it is possible to perform the payment.
38	Payment Traceability	Terms of Payment	Possibility to have information about payment's status.
39	Payment Transferability	Terms of Payment	Possibility to transfer the payment to external organization
40	Bank Fee	Terms of Payment	Monetary amount to pay as a commission for payment.
41	Payment Security	Terms of Payment - Security and Confidentiality	Mode utilized to guarantee the security of payment
42	Nominated Service Availability	Service Provisioning	Temporal instant (date and hour) in which the service is supplied.
43	Weekly Service Availability	Service Provisioning	Week timetable in which the service is supplied.
44	Monthly Service Availability	Service Provisioning	Month timetable in which the service is supplied.
45	Annual Service Availability	Service Provisioning	Annual timetable in which the service is supplied.
46	Supported Languages	Service Provisioning	Language used in the interaction with the user along service provisioning.
47	Service Provisioning Time	Service Provisioning	Time limit for starting the service provisioning.
48	Service Accessibility	Service Provisioning	Possible modes to access the service.
49	Data Accessibility	Service Provisioning	Possible modes to data used or produced by the service.
50	Failure Modes	Service Provisioning	Possible modes for the management of service failures.
51	Service Requirement	Service Provisioning	Set of resource (e.g., personal data, sensible data and information) that are required from the provider to the user as a requirement for a correct execution of the service.
52	Service Request Mode	Service Provisioning	Possible modes to request the service provisioning.
53	Service Coverage	Service Provisioning	Geographic region where the service can be provided.
54	Service location	Service Provisioning	Physical or virtual place where it is possible request the service.
55	Notification of inefficiency	Service Provisioning	The possibility for the user to know a planned service inefficiency.
56	Update rate	Service Provisioning	Time limit for the provider to update the data related to the service.
57	Communication Channel	Service Provisioning	Channel used by the provider to communicate information related to a specific contractual terms.
58	Identification	Security and Confidentiality	Methods used to recognize the service user.
59	Encryption Technique	Security and Confidentiality	Technique used to transmit data on the network in a secure manner.
60	Access Rights	Rights - Service Provisioning	User right to access the service object of the contract.
61	Right of Traceability	Rights - Service Provisioning	User right to get or receive information on the service's status.
62	Method for Traceability Information Access	Rights - Service Provisioning	Method for the user to access service traceability information.
63	Right of Delegation	Rights - Service Provisioning	User right to delegate a third-party in the interaction with the service provider.
64	Right of Privacy	Rights - Security and Confidentiality	User right to be protected on the current law related to the privacy of the provided data.
65	Right of Intellectual Property	Rights - Security and Confidentiality	User right to be protected on current law related to intellectual property.
66	Right of Warranty	Rights - Level of Risk	User right to request a substitution of the service or a reimbursement.

67	Right of Liability Limitation	Rights - Level of Risk	User right to be protected on sanctions related to accidental termination of the service.
68	Right of Recourse	Rights - Renegotiation / Renewal	User right to appeal against an action related to the service provisioning.
69	Right of Extension	Rights - Renegotiation / Renewal	User right to request the extension of the service.
70	Right of Refusal	Rights - Renegotiation / Renewal	User right to request and use an option over the contract in object.
71	Right of Suspension (provider side)	Rights - Service Provisioning	Provider right to suspend the service provisioning.
72	Right of Suspension (client side)	Rights - Termination, Suspension and Withdrawal	User right to suspend the service provisioning.
73	Right of Termination	Rights - Termination, Suspension and Withdrawal	User right to request the termination of the contract.
74	Right of Cooling-off	Rights - Termination, Suspension and Withdrawal	Provider right to request the cooling-off of the contract.
75	Right of Withdrawal (client side)	Rights - Termination, Suspension and Withdrawal	Provider Right to request the withdrawal of the contract.
76	Right of Withdrawal (provider side)	Rights - Termination, Suspension and Withdrawal	User Right to request the withdrawal of the contract.
77	Warranty Validity	Level of Risk	Time Limit for requesting a reimbursement or a substitution of the service.
78	Loss of Right Penalty	Sanctions	Penalty applied to the provider in case of denial of user rights.
79	Involuntary Suspension Penalty	Sanctions	Penalty applied to the provider in case of temporal and involuntary suspension of the service.
80	Termination Penalty	Sanctions - Termination, Suspension and Withdrawal	Penalty applied to the use in case of early termination of the contract.
81	Received Endorsement	Trust	Declaration of the provider about an approval given by a third-party.
82	Professional Body Membership	Trust	Declaration of the provider about its subscription to a certified professional body.
83	Third-party Collaboration	Trust	Declaration of the provider about cooperation with other certified third-parties.
84	Certification	Trust - Compliance with Laws and Standards	Confirmation from a certification body of specific characteristics owned by the service.
85	Compliance with the Law	Compliance with Laws and Standards	Compliance of the service with specific laws.
86	Compliance with standard	Compliance with Laws and Standards	Compliance, of the service object of the contract, to a specific standard.
87	Jurisdiction	Compliance with Laws and Standards	Nation/Region with laws to which the service is compliant.
88	Method of Refund Request	Termination, Suspension and Withdrawal	Mode for requesting the reimbursement of a performed payment.
89	Termination Method	Termination, Suspension and Withdrawal	Mode for requesting the termination of the service object of the contract.
90	Termination Time	Termination, Suspension and Withdrawal	Time limit for requesting the termination of the service object of the contract.
91	Cooling-off Method	Termination, Suspension and Withdrawal	Mode for the communication of the contract resolution.
92	Cooling-off Date	Termination, Suspension and Withdrawal	Time limit of time for the contract resolution.
93	Suspension Time (provider side)	Termination, Suspension and Withdrawal	Time limit for the provider for the communication to the user of the temporary suspension of the service.
94	Suspension Method (provider side)	Termination, Suspension and Withdrawal	Mode used by the provider to communicate the temporary suspension of the service.
95	Versioning	Technical aspects	The version of the service, object of the contract.
96	Physical location	Technical aspects	The phisical location of the machines involved in service provisioning.
97	User Behaviour Obbligations	Obligations and responsibilities	Conditions to be maintained by the user during the service provisioning.
98	Banned User Activities	Obligations and responsibilities	Actions which the user can not perform during the service provisioning.

Appendix 2 - Business Process Management

This appendix provides a quick overview of Business Process Management (BPM), which is particularly relevant for eGovernment applications. Traditionally, information systems, also in the eGovernment area, used data-driven approaches; however, over the last few years it has become clear that processes are equally important. BPM addresses the topic of process support in a broad perspective, and is fueled by technological developments (e.g., service oriented architectures) triggering standardization efforts (e.g., languages as BPMN and WS-BPEL). After introducing in Section A2.1 basic concepts, we describe in Section A.2.2 the Business Process Modeling notation for business process modelling business process modeling, and in Section A2.3 the architecture of a business process management system.

A2.1 Basic Concepts

Business Process Management (BPM) is based on the observation that each product/service that an organization provides is the outcome of a number of processes and activities. This also is true for public administrations providing services to citizens and enterprises. Business processes are the key instrument for organizing these activities and for understanding and improving their interrelationships.

A business process (or an administrative process) consists of a set of activities that are performed in coordination in an organizational and technical environment. These activities jointly realize a business goal business goal. Each business process is enacted by a single organization, but it may interact with business processes performed by other organizations [Weske, 2007]. Therefore BPM includes concepts, methods and techniques to support the design, administration, configuration, enactment and analysis of business processes. The basis is the explicit representation of business processes with their activities and the execution constraints between them. To these purposes, different models and languages, more or less formal, have been defined over the years; in this appendix, we quickly outline the Business Process Modeling Notation (BPMN).

A business process management system (BPMS) is a software system that is driven by explicit process representations to coordinate the enactment of business processes. A business process model consists of a set of activity models and execution constraints between them. A business process instance represents a concrete case in the operational business of an organization (e.g., the management of the certificate of Massimo Mecella), consisting of activity instances. Each business process model acts as a blueprint for a set of business process instances, and each activity model acts as a blueprint for a set of activity instances [Weske, 2007]. Therefore, business process models are the main artifacts for implementing business processes in a BPMS, which makes sure that all business process instances are executed as specified in the respective business process models.

Typically, the ordering of the activities is controlled by the BPMS as a centralized software component, very similarly to how a conductor centrally controls the musicians in an orchestra: therefore business processes are also referred to as process orchestrations. Very often multiple organizations interact through their respective business processes (e.g., a buyer, a re-seller and a shipping agency), through the sending/receiving of messages and/or the transport of physical objects (e.g., ordered products). In such cases, the interactions of a set of business processes are specified in a process choreography, which indicates the absence of a central agent controlling the activities of the involved processes; the interaction is only achieved through the exchange of messages agreed (in the common choreography) before starting the interaction.

A2.2 BPMN

The Business Process Modeling Notation (BPMN) is an OMG standard for business process modeling, and provides a graphical notation for specifying business processes in a Business Process Diagram (BPD). The objective of BPMN is to support business process management for both technical users and business users by providing a notation that is intuitive to business users, yet is able to represent complex process semantics. The BPMN specification also provides a mapping between the graphics of the notation to the underlying constructs of execution languages, particularly Business Process Execution Language (BPEL, a.k.a. WS-BPEL).

BPMN is constrained to support only the concepts of modeling that are applicable to business processes. This means that other types of modeling done by organizations for non-business purposes are out of scope of BPMN. For example, the modeling of organizational structures and data models are out of the scope of BPMN. In addition, while BPMN shows the flow of data (messages), and the association of data artifacts to activities, it is not a data flow diagram.

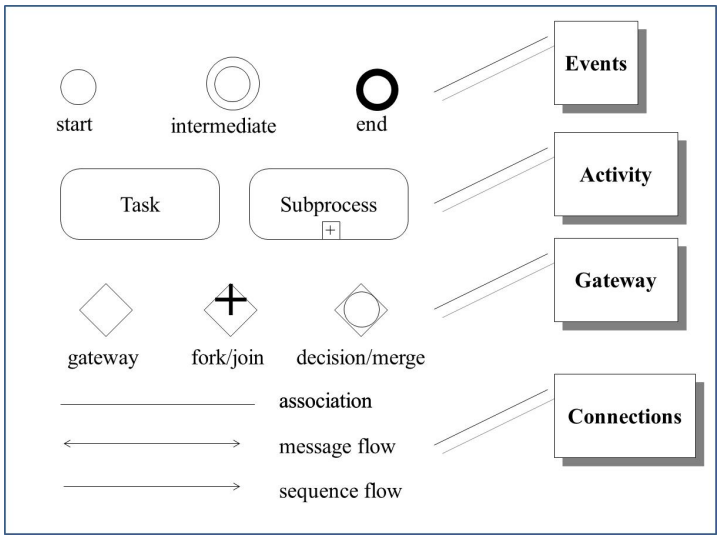

Fig A2.1 BPMN flow and connecting objects

The modeling in BPMN is made by simple diagrams with a small set of graphical elements. It should make it easy for business users as well as developers to understand the flow and the process. The four basic categories of elements are (cfr. Figures A2.1 and A2.2).

- events, activities, gateways;
- sequence flow, message flow, association;
- pool, lane;
- data object, group, annotation.

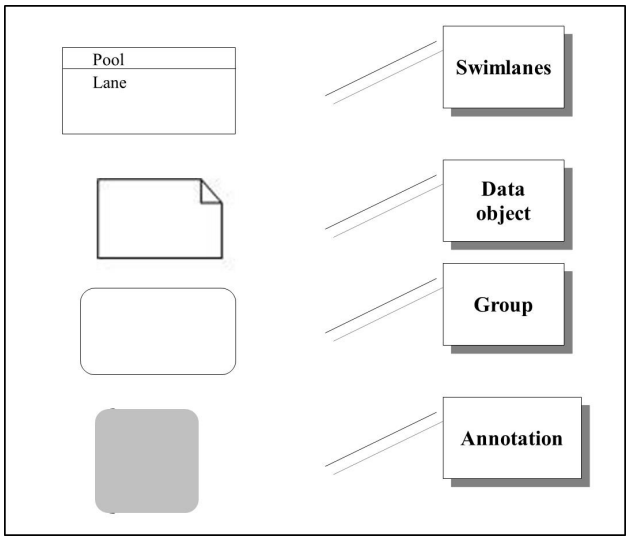

Fig A2.2 BPMN swimlanes and artifacts

These four categories of elements give the opportunity to make a simple business process diagram (BPD). It is also allowed in a BPD to make his own type of a flow object or an artifact to make the diagram more understandable.

A2.3 BPMN flow and connecting objects

Flow objects are the main describing elements within BPMN, and consist of three core elements:

Event - An event is represented with a circle and denotes something that happens (rather than activities which are something that is done). Icons within the circle denote the type of event (e.g., envelope for a message, clock for time). Events are also classified as catching (i.e., they might catch an incoming message t start the process) or throwing (i.e., they might throw a message at the end of the process). A start event start event acts as a trigger for the process, indicated by a single narrow border; and can onl be catch, so it is shown with an open (outline) icon. An end event end event represents the result of a process; indicated by a single thick or bold border; and can only throw, so it is shown with a solid icon. An intermediate event intermediate event represents something that happens between the start and end events; it is indicated by a tramline border, and can throw or catch (using solid or open icons as appropriate).

Activity - An activity is represented with a rounded-corner rectangle and describes the kind of work which must be done. A task represents a single unit of work that is not or cannot be broken down to a further level of business process detail without diagramming the steps in a procedure (not the purpose of BPMN). A sub-process sub-process is used to hide or reveal additional levels of business process detail - when collapsed a sub-process is indicated by a plus sign against the bottom line of the rectangle; when expanded the rounded rectangle expands to show all flow objects, connecting objects, and artefacts. It has its own self-contained start and end events, and sequence flows from the parent process must not cross the boundary. Finally a transaction transaction is a form of sub-process in which all contained activities must be treated as a whole, i.e., they must all be completed to meet an objective, and if any one of them fails, they must all be compensated (undone). Transactions are differentiated from expanded sub-processes by being surrounded by a tramline border.

Gateway - A gateway is represented with a diamond shape and will determine forking and merging of paths depending on the conditions expressed.

Flow objects are connected to each other using connecting objects connecting object, which consist of three types, namely sequences, messages, and associations:

Sequence Flow - A sequence flow is represented with a solid line and arrowhead and shows in which order the activities will be performed. The sequence flow may also have a symbol at its start, a small diamond indicates one of a number of conditional flows from an activity, while a diagonal slash indicates the default flow from a decision or activity with conditional flows.

Message Flow - A message flow is represented with a dashed line, an open circle at the start, and an open arrowhead at the end. It tells what messages flow across organizational boundaries (i.e., between pools). A message flow can never be used to connect activities or events within the same pool.

Association - An association is represented with a dotted line. It is used to associate an artifact or text to a flow object, and can indicate some directionality using an open arrowhead (toward the artifact to represent a result, from the artifact to represent an input, and both to indicate it is read and updated). No directionality would be used when the artifact or text is associated with a sequence or message flow (as that flow already shows the direction).

A2.4 BPMN swimlanes and artifacts

Swim-lanes are a visual mechanism o organizing and categorizing activities, based on cross functional flowcharting, and in BPMN consist of two types:

Pool - A pool represents major participants in a process, typically separating different organizations. A pool contains one or more lanes lane (like a real swimming pool). A pool can be open (i.e., showing internal detail) when it is depicted as a large rectangle showing one or more lanes, or collapsed (i.e., hiding internal detail) when it is depicted as an empty rectangle stretching the width or height of the diagram.

Lane - It is used to organize and categorize activities within a pool according to function or role and depicted as a rectangle stretching the width or height of the pool. A lane contains the flow objects, connecting objects and artifacts.

Artifacts - artifacts allow developers to bring some more information into the mo\-del/dia\-gram. In this way the model/diagram becomes more readable. There are three pre-defined artifacts and they are:

Data Objects - A data object shows the reader which data is required or produced in an activity.

Group - A group is represented with a rounded-corner rectangle and dashed lines. The Group is used to group different activities but does not affect the flow in the diagram.

Annotation. An annotation is used to give the reader of the model/diagram an understandable impression.

A2.5 Types of processes in BPMN

Business process modeling is used to communicate a wide variety of information to a wide variety of audiences.

BPMN is designed to cover this wide range of usage and allows modeling of end-to-end business processes to allow the viewer of the diagram to be able to easily differentiate between sections of a BPMN Diagram. There are three basic types of sub-models within an end-to-end BPMN model: Private (internal) business processes, Abstract (public) processes, and Collaboration (global) processes:

Private (internal) business processes. They are those internal to a specific organization and are the type of processes that have been generally called workflow or business processes. If swim lanes are used, then a private business process will be contained within a single pool. The sequence flow of the process is therefore contained within the pool and cannot cross the boundaries of the pool. Message flow can cross the pool boundary to show the interactions that exist between separate private business processes.

Abstract (public) processes. They represent the interactions between a private business process and another process or participant. Only those activities that communicate outside the private business process are included in the abstract process. All other internal activities of the private business process are not shown in the abstract process. Thus, the abstract process shows to the outside world the sequence of messages that are required to interact with that business process. Abstract processes are contained within a pool and can be modeled separately or within a larger BPMN diagram to show the message flow between the abstract process activities and other entities. If the abstract process is in the same diagram as its corresponding private business process, then the activities that are common to both processes can be associated.

Collaboration (global) processes - They depict the interactions between two or more business entities. These interactions are defined as a sequence of activities that represent the message exchange patterns between the entities involved. Collaboration processes may be contained within a pool and the different participant business interactions are shown as lanes within the pool. In this situation, each lane would represent two participants and a direction of travel between them. They may also be shown as two or more abstract processes interacting through message flow (as described in the previous section). These processes can be modeled separately or within a larger BPMN diagram to show the associations between the collaboration process activities and other entities. If the collaboration process is in the same diagram as one of its corresponding private business processes, then the activities that are common to both processes can be associated.

Appendix 3 – Questionnaire for value perception

The following questionnaires are designed to measure the value of services, in terms of the customer's perceived business outcomes, and described in terms of the combination of service utility and service warranty, i.e., how the service is delivered and its fineness for use, in terms of availability, capacity, continuity and security. We focus on the relations between service value and service quality, user benefit, user satisfaction, perceived sacrifice, and user behavior intention. We do not refer to a specific service, but to experience with service providers in general.

User benefit:

Confidence benefit:

Are you provided by enough knowledge of service provider/call center?

- 1 (very poor)
- 2 (poor)
- 3 (average)
- 4 (good)
- 5 (excellent)

Are you feeling uncertain about the service and service provider/call center?

- 1 (very poor)
- 2 (poor)
- 3 (average)
- 4 (good)
- 5 (excellent)

Are you feeling confident that the service will be performed correctly?

- 1 (very poor)
- 2 (poor)
- 3 (average)
- 4 (good)
- 5 (excellent)

Treatment benefit:

Do you get preferential treatment and extra attention from the service provider/call center?

- 1 (very poor)
- 2 (poor)
- 3 (average)
- 4 (good)
- 5 excellent

Do you get special service that is not available to other customers?

- 1 (very poor)
- 2 (poor)
- 3 (average)
- 4 (good)
- 5 excellent

Security:

Are you privacy protected by the provider?

- 1 (very poor)
- 2 (poor)
- 3 (average)
- 4 (good)
- 5 excellent

Are you safe in your transactions with the provider?

- 1 (very poor)
- 2 (poor)
- 3 (average)
- 4 (good)

- 5 excellent

Service quality:

Do you get the service accurately as it is promised?

- 1 (very poor)
- 2 (poor)
- 3 (average)
- 4 (good)
- 5 excellent

Do you get what you have ordered?

- 1 (very poor)
- 2 (poor)
- 3 (average)
- 4 (good)
- 5 excellent

Is the service delivered by the time promised?

- 1 (very poor)
- 2 (poor)
- 3 (average)
- 4 (good)
- 5 (excellent)

The service providers/call centers are competent (i.e., knowledgeable and skillful).

- 1 (very poor)
- 2 (poor)
- 3 (average)
- 4 (good)
- 5 (excellent)

The service providers/call centers are approachable and easy to contact.

- 1 (very poor)
- 2 (poor)
- 3 (average)
- 4 (good)
- 5 (excellent)

The service providers/call centers are courteous, polite, and respectful.

- 1 (very poor)
- 2 (poor)
- 3 (average)
- 4 (good)
- 5 (excellent)

The service providers/call centers listen to me and speak in a language that you can understand.

- 1 (very poor)
- 2 (poor)
- 3 (average)
- 4 (good)
- 5 (excellent)

The service providers/call centers make the effort to understand my needs.

- 1 (very poor)
- 2 (poor)
- 3 (average)
- 4 (good)
- 5 (excellent)

How do you rank the service?

- 1 (very poor)
- 2 (poor)
- 3 (average)
- 4 (good)
- 5 (excellent)

Information quality

Is the information conceived by the service accurate?

- 1 (very poor)
- 2 (poor)
- 3 (average)
- 4 (good)
- 5 (excellent)

Is the information conceived by the service complete?

- 1 (very poor)
- 2 (poor)
- 3 (average)
- 4 (good)
- 5 (excellent)

Is the information conceived by the service up-to-date?

- 1 (very poor)
- 2 (poor)
- 3 (average)
- 4 (good)
- 5 (excellent)

Perceived sacrifice:

How to think the price of the service?

- 1. Very cheap
- 2. Cheap
- 3. Average
- 4. Expensive
- 5. Unaffordable

What do you think the total amount of time you spend on obtaining the service?

- 1. Very quick
- 2. Quick
- 3. Average
- 4. Too much
- 5. Beyond my limitation

What do you think the amount of time you spend on accessing the service?

- 1. Very quick
- 2. Quick
- 3. Average
- 4. Too much
- 5. Beyond my limitation

What is the amount of time you spend on receiving the service?

- 1. Very quick
- 2. Quick
- 3. Average
- 4. Too much
- 5. Beyond my limitation

What is the amount of time you spend on completing the service?

- 1. Very quick
- 2. Quick

- 3. Average
- 4. Too much
- 5. Beyond my limitation

User satisfaction:

Are you feeling happy with the service?

- 1. Not at all
- 2. Poorly
- 3. Average
- 4. Fairly
- 5. Very much

Is the provider willing and ready to respond to your need?

- 1. Not at all
- 2. Poorly
- 3. Average
- 4. Fairly

5. Very much

- When you have a problem, does the provider show a sincere interest in solving it?

- 1. Not at all
- 2. Poorly
- 3. Average
- 4. Fairly
- 5. Very much

Are your enquiries answered promptly?

- 1. Not at all
- 2. Poorly
- 3. Average
- 4. Fairly
- 5. Very much

Behavioral intentions:

How likely you will repurchase the service in the future?

- 1. Not at all
- 2. Not sure
- 3. Average
- 4. Maybe
- Very likely

How likely you will recommend the service to others?

- 1. Not at all
- 2. Not sure
- 3. Average
- 4. Maybe
- Very likely

How likely that you will make the same choice if you will do it again?

- 1. Not at all
- 2. Not sure
- 3. Average
- 4. Maybe
- Very likely

How likely you will say positive things about the service to others?

- 1. Not at all
- 2. Not sure
- 3. Average
- 4. Maybe
- Very likely

Service value:

How do you consider the value you received from the service compared to the time, effort and money you have spent?

- 1. Very low
- 2. Low
- 3. Average
- 4. High
- 5. Very high

How do you consider the value of the service?

- 1. Very low
- 2. Low
- 3. Average
- 4. High
- 5. Very high