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Abstract

The number of survey about customer satisfaction on public services has increased in the last years. However, in the evaluation of the public services hardly this perspective has been taken into account. This dissertation aims at analysing the customer perspective through the value for customer concept. Most models presented in literature assume that in the evaluation of the public services only two stakeholders have to be considered. In the model here presented three stakeholders have been considered, namely public authority, users, and supplier. This means that the concept of customer satisfaction has to be evaluated with reference to both, citizens and public authority. A conceptual model is suggested which outlines the antecedents of the customer satisfaction and the gaps regarding citizen satisfaction and public authority expectations. The validity of such a model has been tested through a series of case studies concerning waste collection services in the Great Britain and Italy. Finally, a multi agent based model has been developed to simulate the interactions among the stakeholders of the public services.

Keywords:

Customer satisfaction, value for customer, waste services, public services, agent models, gap model

Il numero delle indagini di customer satisfaction è andato aumentando negli ultimi anni, malgrado i risultati di queste abbiano trovato raramente applicazione. Questa dissertazione si propone di analizzare la prospettiva dell'utente attraverso il concetto di valore per il cliente. La maggior parte dei modelli presentati in letteratura considera, anche per i servizi publici, solo due attori principali, mentre nel modello qui presentato ne sono stati identificati e considerati tre: l'autorità pubblica, gli utenti e il fornitore. Questo implica che anche il concetto di customer satisfaction debba essere valutato facendo riferimento sia ai cittadini, sia all'autorità pubblica. Per questo nel presente lavoro viene proposto un modello concettuale che esplicita il gap esistente tra la il servizio atteso dai cittadini e quello auspicato e ricercato dalle autorità pubbliche e le motivazioni dello stesso. La validità del modello proposto è stata testata attraverso diversi casi studio riguardanti i servizi di raccolta dei rifiuti in Italia e in Inghilterra. Un modello di simulazione ad agenti è stato sviluappato per simulare le interazioni tra i principali portatori di interesse identificati.

1. Introduction

I. Research Background

During last half century the relevance of services has been growing in all parts of the world. It has been increasing economically in the developed economies, but it is becoming a key factor also in most developing countries. Moreover, services have contributed to improve citizens' quality life. A large part of the service sector, as health care, education, police and defense, infrastructure, water delivery, waste collection as well as administrative services, has a strong impact on taxation. In fact, the high level of taxation in western countries is mainly spent by the state in order to provide such services (Openspending, 2008), although users often cover the cost of the services, at least partially. Due to the high relevance of such services they have been often considered to be "public". For this reason most of them have been in the past kept under the full control of the government. However, in many services the public sector has opened to competition from private providers. For instance banks can be till to day private or public depending on the country.

The growth of the service sector has been accompanied by a growing request for more accountability to citizens and customers. Such trend has started with a mix of reforms in Great Britain and in some municipal governments in U.S.A. in the eighties, and has been later reproduced by many countries. The main idea of public service provision was defined New Public Management, (Dunsire, 1995) later NPM. A concept itself has evolved during the time, several definitions has been proposed (e. g. Borins, 1995; Buschor, 1994; Hood, 1995). According to that NPM paradigm, there was a need for more contestability to citizens and customers and for a more market-oriented approach in the delivery of public services, mainly with reference to local public services. The theoretical underpinnings of these reforms were that competition would result in improved outcomes, such as greater efficiency and higher quality of service, a clearer focus on customers and better value for money (Lavery, 1999; Warner and Hedbon, 2001). In order to make this approach effective, it has been coupled with the adoption of performance contracts instead of regulator contracts (Behn and Kant, 1999). After three decades it is possible to recognize some evolution of NPM towards a different style of managing public services (Denhardt and Denhardt, 2007). Such a different style may encompass several common characteristics of the NPM underlined in literature (Gruening, 2001). In particular, NPM may include a shift towards greater competition (e, g: Painter,

1991, Chaundy and Uttley, 1993), an increased stress on private-sector styles of management, separating politics and administration (Jenkins et al. 1998), an improved financial management, the adoption of privatization (Dunleavy, 1986; Veljanovski, 1987; Vickers and Yarrow, 1988; Marsh, 1991), and contracting out (e.g. Hartley and Huby, 1985). Jackson (1985) stressed the relevance for NPM of discipline and frugality in the use of resources, often due to legal, budget and spending constraints (Jackson, 1985), while Carter and Greer (1993) emphasized an increased use of measurable standards of performance to improve the accountability and to help reaching previously discussed aims. Finally several authors have put a greater emphasis on output controls and the use of information technology (among others, Pitt and Smith, 1984; Plant et al., 1998; Bellamy and Taylor, 1992; Muid, 1992).

Under rising pressure to be more accountable to their constituents, public managers at all levels have turned to measure citizen satisfaction with public services to gauge performance (Swindell and Kelly 2000). Furthermore, citizen assessments of service quality have increasingly become important factors in key public decision-making processes (Glaser and Bardo 1994; Watson et al., 1991). Thompson (1997) clearly emphasises this trend: "The new public managers define economy and efficiency entirely in terms of customer satisfaction. Indeed, they are preoccupied with the problem of identifying customers, assessing their wants, developing products to satisfy those wants, and, where possible, ensuring accountability by having customers fund providers on a fee-for-service basis. This definition of efficiency is, of course, the gospel taught in every management school on earth" (p. 5).

As a matter of fact, satisfaction measures are increasingly used in evaluating services and informing managerial decision making, including setting budget allocations, changing staff or operating procedures, and altering services (Kelly, 2005). However, researchers have outlined that the relationship between administrative service performance and citizen satisfaction has been assumed, but it has not been yet demonstrated in the application of market models to public service delivery (Kelly, 2005). Conversely, public-sector managers have shown more confidence in internal performance measures, as a reflection of actual service quality, than in external measures of citizen satisfaction with service quality, perhaps because they are concerned about the extent to which citizens have sufficient information to effectively evaluate the service quality (Nye and Zelikow, 1997; Berman, 1997; Bok, 2001). In other words, managers in public sector prefer to define their responsibilities as a result of the "knowledge from the profession" more than as a result of customer opinions.

In the private sector there is little space for any trade-off between the technical knowledge and customer opinions. As private sector is mainly profit oriented, customers' opinion has undoubtedly the highest priority while technical knowledge exists to serve them. On the other hand, since public services are not necessarily and not only profit oriented, the main aim is to pursue the collective interest for such services, and this could be at odds with customer opinions. For instance, a car driver receiving a fine for exceeding speeds limit, is receiving a service from the police, but would waste likely express dissatisfaction for the service received. Is such gap between public authority and users generalizable also to other kind of public services out of the limit case of police controls and people behaving against the law?

This leads to a first research question that will be investigate in this dissertation:

QR1 Does a gap concerning the quality of the service exist in public services between the expectations of citizens and that of public managers?

Expectations in marketing literature have been considered as one of the main antecedents of customer satisfaction (Parasuraman et al., 1985). In such case, the concept of expectation comprehends every part of the service provision which affect the customer. It means that it can include technical parameters as well part of the process of the service provision, or outcomes obtained through the usage of the service, or even the price to be paid for the usage of it.

If the existence of the gap is confirmed it becomes necessary to understand which role customer satisfaction can play in public services. Should we care more about customer satisfaction or about technical parameters chosen by managers? The most clear analysis of this issue, to our best knowledge, that clearly states pro, cons and needing of customer satisfaction in public services has been made by Kelly (2005). Drawing on results provided by literature, this author argues that public managers have to care about all stakeholders. Thus, they should improve in terms of both technical parameters and customer satisfaction. However, the author does not hide that such goals could often be conflicting. According to Kelly (2005) in such cases the role of politicians should be "the very same they have been making for centuries: to choose". If the managers are provided just with subjective values to choose between customer request and technical performance the dilemma about using, or not, customer satisfaction as measure to evaluate the service remains mainly unsolved.

Managerial implications of such a statement should underline that managers have to

improve technical performance, have to improve customer satisfaction, and eventually have to try to understand/influence customer expectations in order to reduce the gap with them. Customer satisfaction approach has been widely recognized as a good proxy for service quality (Parasuraman et al., 1985). In particular, Parasuraman et al. (1985; 1988) have been considered customer satisfaction as a measurable gap between expectation and perception about the service. The authors have considering such gap as the results of other four gaps mainly internal to the service process, and similar approach have been later proposed (Lewis and Klein, 1987; Brown and Swartz, 1989, Luk and Layton, 2002). Moreover, a specific tool (SERVQUAL) was developed by Parasuraman et al. (1988) in order to measure customer satisfaction in a theoretically full spectrum of services.

While such tool has been adopted also for the measurement of several public services (Wisniewski, 2001; Donnelly, 2006) even with some adaptation (Asubonteng et al., 1996; Babakus and Mangold, 1992; Bhat and Malik, 2010), the relevance of customer satisfaction in public service could be questioned, and being essentially different than in private services. First, some concern has been raised about the "mixture of different aspects of service provision" (Stipak, 1979a, 51). Not secondarily, other studies claim that citizen perceptions of service quantity and quality have no link with quantity and quality of the service provided (Brown and Coulter, 1983). Last, legislation has a relevant impact on service provision (Stewart and Walsh, 1992) and then, if a gap of expectation exist between users and public authority, it could implies some constraint on customer satisfaction. However, the increasingly more central position of the citizen in public services is claimed to have to arise (Denhardt and Denhardt, 2007).

A society which pays more attention to customer needs and expectations, cannot just consider customer satisfaction as taking periodically a measure of it, but it should be included in an operative framework where the citizens' point of view becomes a starting point from where plan and develop public policies.

Thus, a second question research should be investigated:

QR2 How customer satisfaction can be part of a fair evaluation in public service?

To sum up what is above mentioned, customer satisfaction concept is already considered in the literature about public service, and several tools developed for services in general, have been applied also to public services. However, such import of existing tools has been done without the major adaptation that the peculiarities of the sector could have required. In

particular, few attentions have been done to consider the triangular relations among users, suppliers and public authorities. The present piece of work aims to fill the gap reconsidering satisfaction and value for the customer under this perspective.

II. Structure of the Study

In order to investigate the research questions, two main directions can be taken. On one hand the development of conceptual models which already exist in literature as well specific revisions adapted for the public services, on the other hand through empirical data collected through real case studies in public sector. In particular, customer satisfaction model (mainly Parasuraman et al., 1985) and value for customer models (Woodall, 2003) could be adapted in order to fit public service characteristics. It should be noticed that it is not in the aim of the study to consider the opportunistic behaviours that public authority could have when deciding about public policies. The purpose of the models to be realized is to consider public authority for their role to manage in the public interests. At the same time, empirical data and case study analysis could be useful to test the assumptions done for the test of the conceptual model. Moreover, real case studies can be used in order to build an example of framework of evaluation for public service which eventually considers the customer point of view coherently with the conceptual models and the best practises recognized. Such framework of evaluation can be simulated through a multi agent based toolkit.

The present piece of work presents an extensive literature review of several streams of research on which the research has been grounded. In particular, the second chapter contains the state of art about the concept of services and public services in particular. It also reports the review about stakeholder's theory. Moreover, the service concept together with two main version of quality applicable to services in order to consider customer's perspective, namely the value for customer and the customer satisfaction. Last, the characteristics of the tool proposed, a multi agent based simulator, are considered.

In the third chapter, it has been outlined the case study proposed to investigate the research questions. The general characteristics of the waste collection system are presented with specific references to the technical processes involved and the legislation under which the providers investigated have to work.

In the fourth chapter, the conceptual framework is outlined with the methodologies adopted for the research. It is motivated the reason for the choice of a qualitative research, and for the selection of the case study.

Fifth chapter proposes the main outputs of the present research. In particular it contains: a revision of the gap model (Parasuraman et al., 1985) customized for the public services and that consider explicitly the existence of a triadic relation among the main stakeholders; a presentation of the case studies investigated with the help of the gap model revisited; it also propose a selection of parameters in order apply the value for customer concept at waste management services; a test of the gaps recognized through the theoretical model is done in order to verify empirically the existence of the gaps.

In sixth chapter is proposed a simulation tool based on the results of the theoretical model and investigations earlier presented.

In seventh chapter a discussion of the results obtained through the research and managerial implications are outlined.

In last chapter the conclusion are given, and limitations as well further possible steps for the research are considered.

Appendix contains a tutorial about the software developed, as well some key pictures which explain more than words could do, the need for evaluation which are not strictly limited to a few of technical parameters.

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2. Theoretical background and literature review

I. The concept of service

Although the existence of services is as old as the man is (i.e. sacerdotal, kings, knights, doctors have been providing more "services" than goods) attempts to distinguish what services are by what they are not, are relatively recent.

According to Jiao et al. (2003) service is understood in literature along two possible streams: as an output of a system or as an activity. The first is also the main stream of research. Accordingly to that, in last decades the services have been defined through the identification of the main peculiarities which characterize it and make it something which is not goods. According to Parker (1960) the two most important characteristics of services are intangibility and perishability, Regan (1963) add inseparability and ubiquity but neither define or explain what such characteristics mean or imply. Such definitions have been later consolidated in the work of Sasser et al., (1978). In their pioneering service operations textbook they used the terms of intangibility, simultaneity, heterogeneity, and perishability. Such definition has been kept almost unchanged during the years till our days (Zeithaml et al., 1985; Edgett and Parkingson, 1993; Ladhari, 2009). For precision, it is right to clarify that currently the word simultaneity is not used anymore, but it has been changed for "inseparability". However, what researchers mean with both words is just the same. Later in the present work only the last will be adopted.

More in detail, the meanings of such peculiarities can be described as:

- **Intangibility:** Services lack the palpable or tactile quality of goods. Services are more or less intangible processes whereas goods are tangible things. Laroche et al. (2001) divide intangibility to three dimensions: physical intangibility or inaccessibility to senses; difficulties in precisely defining and describing the service; mental intangibility, which refers to the difficulties of a customer to mentally grasp the service which is mentally intangible for most people who do not have sufficient knowledge of their internal workings. It should be noted that service literature usually speaks of physical intangibility when referring to intangibility, and so does this paper unless specifically stated

otherwise. Intangibility means that a customer cannot easily evaluate a service beforehand, as opposed to goods. In terms of evaluation, customers have problems in evaluating a service offering prior to purchase (Edgett and Parkinson; 1993). This often means that the customers might perceive an higher risk of purchasing in services than in goods (Laroche et al., 2001). Service are said to be at lower level in search qualities compared to goods (Bowen & Ford, 2002). It's because there is a few or nothing to show, compare or objectively test prior to purchase (Lovelock and Gummesson, 2004). The goal of marketing efforts should therefore be to make the offering more tangible to customer, as opposed to approach commonly used in goods (Edgett & Parkinson, 1993). Possible ways to do this are use of visual cues (like consistent staff appearance), image and reputation creation, use of guarantees, and branding (Edgett & Parkinson, 1993; Laroche et al., 2001). Although, Vargo and Lusch (2004) argue that branding does not increase the tangibility. Rather, branding in their view conveys the intangible benefits related to the brand. Each of these gives the customer something tangible with which to associate the service as well interactions customer-provider which are tangibles, at least in the sense they can be observed by senses. (Edgett and Parkinson; 1993). Allowing the customers to observe or monitor the service process may also decrease risk associated with tangibility. For example, UPS lets its customers to track their shipment in the Internet (Laroche et al., 2001) and McDonalds offers a clear view to their kitchen (and its cleanliness). Another way to increase mental tangibility could be providing the customers with "objective" product reviews and references from satisfied clients and free trials to the service (Laroche et al., 2004).

The fact services are distinguished by goods through intangibility has been partially contested for several reasons. For instance, services often have tangible results (Vargo and Lusch; 2004). Moreover, the inability to evaluate the service before the consumption can be true for goods too, and some services can be evaluated before purchase (Lovelock and Gummesson; 2004), e.g. a customer can turn away at the door from a restaurant if he/she does not like the attitude of the employees, the atmosphere of the place, etc. Customers could also have troubles in assessing the monetary value of the service

transaction both prior and after purchase (Edgett & Parkinson, 1993). Customers may only be able to compare services along their prices – and base their expectations and judgements of perceived quality on the price. Price, thus, can become an important standard. Advertisement is affected as well by the intangibility of services. It is more difficult to communicate to the potential customers the firm's willingness and ability to provide a service and its value for the customer (Edgett & Parkinson, 1993). In order to reduce the gap, service advertisement could try to create vivid mental images of service benefits, use narratives focusing on subjective human experiences and service episodes (e.g. insurance commercials of unusual claims), and depiction of service processes.

Last, the same researchers, indicate that service customers rely more on word-of-mouth when they are purchasing services than when they are purchasing goods. Moreover, they also require more information about services than about goods.

- **Heterogeneity:** Heterogeneity is the result of service typically being co-produced by service company employees and customers, many of whom have never worked together (Schneider and White, 2004). Moreover, each customer subjectively evaluates the outcome of service meaning that a similar and consistent service performance from the company may result in different evaluations from different customers and even from the same customer on another service encounter (Ancarani and Mascali, 2011). On the contrary, mass manufacturer produce homogenous goods. There is therefore a relative inability to standardize service outcomes in comparison to goods. As services are more difficult to standardize, customers tend to expect more inconsistent delivery from service companies and thus they have one more reasons to perceive purchasing services to be more risky than for goods. This is especially true in labour intensive services (Edgett & Parkinson, 1993). In particular, some researchers have been assessing the heterogeneity stems largely from the fact that it is inherently related to labour-intensive services (Vargo and Lusch, 2004; Lovelock and Gummesson, 2004). For automated services this difference does not necessarily hold. There are many services where automation by machines or IT

has enabled homogenous (or standardized) service output, although the customer experiences and expectations may still vary from customer to customer. However, this variation applies to goods as well. Vargo and Lusch (2004) further argue that customers actually would prefer to receive a (service) product that is customized (i.e. heterogeneous) to their individual needs, instead of a standardized one (i.e. homogeneous). They also state that heterogeneity concept as a negative aspect mostly relates to manufacturing output and whether it meets the specifications – however, the quality and value perceived by the customer might depend on entirely different issues.

- **Inseparability of production and consumption:** Services are simultaneously produced and consumed contrasted to the sequential nature of production, purchase, and consumption that characterizes goods (Carmen and Langeard, 1980; Gronroos 1978; Regan, 1963; Upah, 1980).

  In other words, in goods the production and distribution are separated from consumption, in both time and space, whereas in services these happen simultaneously and are inseparable. Vargo and Lusch's (2004) argument against inseparability is based on the idea that goods render services, or value, to customers when they use the goods or adapt them to their needs – hence, the separation is not possible. However, Stauss (2005) argues that even if the idea of goods as means to render value is accepted, goods and services are still produced in very different ways and that customer's use of a good does not pose any problems to its production. Lovelock & Gummesson (2004), in turn, argue that there are many services that indeed are produced separately and do not involve the customer directly – hence the production and consumption need not be simultaneous. Examples of services delivered in the absence of the customer include freight transport, routine cleaning, and equipment maintenance. They are of the opinion that inseparability does have important implications for marketing and operations of services that truly are inseparable – but that it is not a distinctive characteristic to all services.

  The main effect of inseparability in marketing is that the company must market the service successfully to the customer before he/she has any experience with it. Another effect is that the service personnel often act both as producers and

marketers for the service, making customer contact people key personnel for the service company (Edgett & Parkinson, 1993). The inseparability could bring also benefits in form of immediate and continuous feedback from customers (Edgett & Parkinson, 1993). Marketing services should also strive to educate customers to participate in the process according to the company's wishes (Grönroos, 2000; Johns, 1999). Consider any fast food restaurant that expects the customers to clear their own tables, there usually is a sign saying Thank you! on the places where the trays should be taken to. In Subways there are clear step-by-step instructions on how to order their baguettes.

- **Perishability:** Services cannot be stored or inventoried as compared to goods. Therefore services cannot be saved, stored for reuse on a later date, resold, or returned. This implies that unused service capacity is wasted. If a seat on a flight is left unoccupied that specific seat on the flight cannot be sold again. Inventory problems exist in goods as well but in services carrying costs are related to idle production capacity.

  Main result from perishability for service marketing is that it should aim for smoothing demand as production capacity is wasted if not used. Means to do this are using peak and off-peak period pricing & price incentives, charging different rates for different types of customers, developing non-peak demand & demarketing peak times, and creating reservation systems (Edgett & Parkinson, 1993; Fitzsimmons & Fitzsimmons, 2004, p. 24; Lovelock & Gummesson, 2004). Vargo and Lusch (2004), which criticize the fact there are four main characteristics which really distinguish services by goods, state that also many goods are perishable, foodstuff rots, cars rust, etc. Moreover, they see that services can be inventoried *prior* to production, like hotel rooms, flight seats, university lecturers but services are not inventoried *after* production. Further, the effect of services need not perish in an instant either. For example, consider a university course and the knowledge students (hopefully) accumulate during it. Lovelock and Gummesson (2004) see perishability to be a multifaceted issue that encompasses productive capacity, the producer's output, the performance experienced by the customers and the out they obtain from the service. Productive capacity is perishable in both goods and services and wasted if not used. In

services with wide demand fluctuation this could be a big problem. In manufacturing inventories could help but carry a cost.

Despite the fact such way to distinguish services by goods is still heavily used, other limitations have been already outlined. At the beginning of the research about services Rathmell (1966) has recognized that there is not a solution of continuity between goods and services but it as a continuum, with pure goods and services at the extremes, but most of them falling in between (fig. 1). However, the fact that when service marketing become an hot topic, marketing was already well rooted in goods, made researchers were paying more attention to catch differences between service and goods, than to describe services "per se" (Fisk, Brown, and Bitner, 1993). All these four characteristics previously listed can try to mark the difference between the service and goods but they do not explain really what a service is. On such a stream of research, Ishikawa (1985) identify as service all activities which do not concretize itself on the production of nothing of hardware, he also underline as the role of service for industries and economy in general is fundamental. Moreover, according to Shostack (1977), service is a "intangible good" which can't be stored. In order to provide the service there is a very complex system within which customer participation in the provision is required.

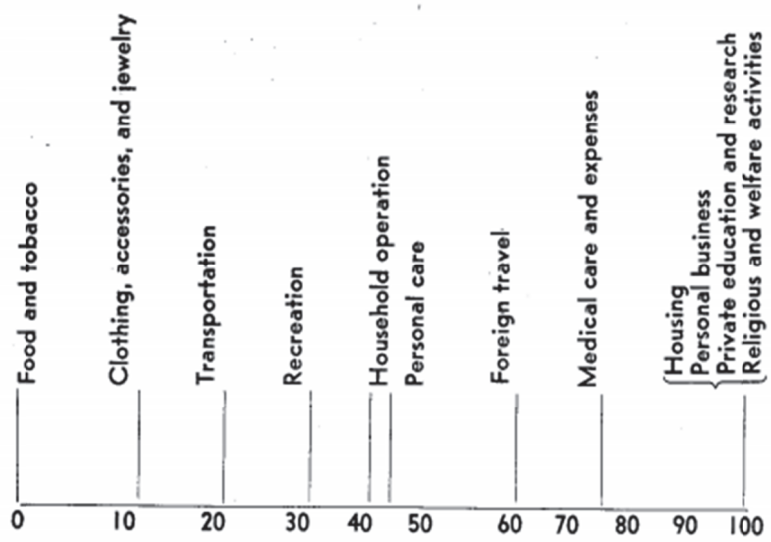

Figure 1 Per cent of major classes of personal consumption expenditures allocated to services – Rathmell (1966).

Thus, only a relatively smaller stream of research tried to better explain what a service is per se, instead of through the supposed differences with goods. Such stream is smaller mainly

because the higher complexity implied in the definitions than for lack of consensus in the approach. The first relevant attempt in this sense has been done by Judd (1964) whom points out the lack of a positive definition of service but he still not provide one. Nevertheless, he gives a constructive contribute proposing a first negative definition of services: *"service is a market transaction by an enterprise or entrepreneur where the object of the market transaction is other than the transfer of ownership of a tangible commodity*". This is a broad concept considered valid to describe all kinds of services even now, a half century later (Lovelock & Gummesson, 2004). Solomon et al. (1985) noted that "service marketing refers to the marketing of activities and processes rather than objects". Normann (2001) outlines the relevance of the customer as an active part of a service provision, introducing the concept of "moment of truth". Rosander (1989) claims that human factor is a key issue of services, as the intangible elements (courtesy, trustworthy, front line's responsibility) are determinant in order to obtain customer satisfaction. In such perspective, the common denominator of most service definitions is "activities" or "processes." This activity or process, in turn, implies applying something and doing something for the benefit of some entity. Thus, it is possible to posit that it is individual and organizational resources, especially specialized skills and knowledge (i.e., competences) that are being applied. Accordingly, services have been defined as *the application of specialized competences (skills and knowledge), through deeds, processes, and performances for the benefit of another entity or the entity itself (self-service)* (Vargo and Lusch 2004; Gronroos 2000, for a similar conceptualization).

Further researches have been aiming to fill the gap with a positive definition of service, however their results has not yet considered satisfactory due to the high differences among services, as well as their variable correlation with goods.

II. Peculiarities of Public Services

Even more complex and problematic is the definition of what a specifically public service is and what is not. There is no shared definition of what a public service is and what a private service is instead. Although public service and private are usually used as mutually exclusive concept, there is no absolute and the judgment of what is public varies across countries and time. Moreover, even the definitions that exist in literature largely vary. These looks to reflect the background of whom propose more than a shared approach.

For how much a service provider can be considered private it has to work under the laws and the rules established by the government, and for such reason it can be considered to provide a service which is at least partially public (Bozeman, 1987). Americans have been distinguishing what is public by what is private preeminently by three criteria: the ownership, the source of financial resources, and the model of social control (polyarchy versus market) (Perry and Rainey, 1988). Nevertheless, such criteria are not perfectly correlated and thus the public or private nature can be still considered ambiguous. It can be claimed that especially American scholars tends to consider public services with a narrow perspective, the services which satisfy almost fully the previous criteria (for instance Wright, 2007), on contrary Europeans tends to a wider perspective about what public services are. For instance the article 1 of the Italian law 146/1990, consider as essential public services, any service which guarantees the constitutional personal rights, as are health care, security, freedom of circulation, pensions, instruction, communication, despite the fact some of these, as communication has been fully privatized and the others can be provided by private companies and without a participation in the cost through the general taxation.

According to a more recent opinion the notion of public service should depend on the rules which regulate the provision instead of by some internal characteristics of the service itself (Arcangeli, 2000; Mele, 1993). In general, it is possible to posit that an activity is a public service depending on a social, economic, political and legislative process that exist in a exact context (Ancarani, 2003). Later in the work the services have been considered as public, according to the higher weight of public rules on their provision.

Until few years ago, the most important alternative for delivering public services, has been constituted either by public utilities or by public service agencies. The services have been funded through the public balance, the infrastructures and the plants have been acquired as public properties, monopolies have been protected against competition and main decisions have been defined by means of administrative procedures. Currently, the government is keeping the role of rule maker while is opting to left the management of the provision to other actors.

Such trend has started with a mix of reforms in Great Britain and in some municipal governments in U.S.A. in the eighties, and later reproduced with success by many countries. It was defined New Public Management (Dunsire, 1995) since the beginning. However, the concept itself has been evolving and during the time, and it affected its several characteristics

have been built over the time (e. g. Borins, 1995; Buschor, 1994; Hood, 1995). According to that new paradigm, there was a need for more contestability to citizens and customers and for a more market-oriented approach in the delivery of public services, mainly with reference to local public services. The theoretical underpinnings of these reforms were that competition would result in improved outcomes, such as greater efficiency and higher quality of service, a clearer focus on customers and better value for money (Lavery, 1999; Warner and Hedbon, 2001). In order to make this approach effective, it has been coupled with the adoption of performance contracts instead of regulator contracts (Behn and Kant, 1999). Actually, there exist some criticisms about NPM (e.g. Dunleavy et al., 2005), and some issues to be solved have been aroused (e.g. Hood and Peters, 2004; Groot and Budding, 2008). For instance Maor (1999) claims that while NPM was intended to improve public service quality by ‘‘depoliticizing’’ public management through the assignment of more direct responsibility for public service provision, in the application politicians increasingly intervened in hiring and firing managers, to avoid what would otherwise have been a loss of control over the implementation. It should be underlined that even in case of a privatization the politic control could not necessarily decrease due to the political power during a contracting out phase. Several researchers confirmed that process controls over bureaucracies were in many cases retained and augmented and that increased formality and regulation (Hoggett, 1996; Hood et al. 1999; Jones and Thompson 1999; Light 1993). Moreover, after three decades more than a paradigm change it is possible to recognize just some some evolution of NPM in terms of incremental change. In particular what is recently called as New Public Service is just the application of NPM to services in terms of an increase attention to citizens as user of the public service (Denhardt and Denhardt, 2007). Such a different style encompass than the characteristics of the NPM underlined in literature (Gruening, 2001).

In the light of the present paper the most relevant and common characteristics noticed by all observers or most of them (Gruening, 2001) are:

- a shift towards greater competitions (e, g: Painter, 1991, Chaundy and Uttley, 1993);
- an increased stress on private-sector styles of management, separating politics and administration (Jenkins et al. 1998), improving financial management, and often adopting privatization (Dunleavy, 1986; Veljanovski, 1987; Vickers and Yarrow, 1988; Marsh, 1991) and contracting out (e.g. Hartley and Huby, 1985);

- a greater stress on discipline and frugality in the use of resources, often due to legal, budget and spending constraints (Jackson, 1985);
- a shift towards disaggregation; more emphasis on visible "hands-on" management;
- an increased use of measurable standards of performance to improve the accountability and to help reaching previously discussed aims (Carter and Greer, 1993) ;
- a greater emphasis on output controls;
- more use of information technology (e.g. Pitt and Smith, 1984; Plant et al., 1998; Bellamy and Taylor, 1992; Muid, 1992);
- an increased possibility for public markets to be based on pricing and charging in the new public service (Heald, 1990).

Under rising pressure to be more accountable to their constituents, public managers at all levels have turned to measures citizen satisfaction with public services to gauge performance (Swindell and Kelly 2000). Furthermore, citizen assessments of service quality have increasingly become important factors in key public decision-making processes (Glaser and Bardo 1994; Watson et al., 1991). Thompson (1997) is even stronger in his statement about new public management and managers: "The new public managers define economy and efficiency entirely in terms of customer satisfaction. Indeed, they are preoccupied with the problem of identifying customers, assessing their wants, developing products to satisfy those wants, and, where possible, ensuring accountability by having customers fund providers on a fee-for-service basis. This definition of efficiency is, of course, the gospel taught in every management school on earth" (p. 5).

As a matter of fact, satisfaction measures are increasingly used in evaluating services and informing managerial decision making, including setting budget allocations, changing staff or operating procedures, and altering services (Kelly, 2005). However, researchers have outlined that the relationship between administrative service performance and citizen satisfaction has been assumed, but it has not been yet demonstrated in the application of market models to public service delivery (Kelly, 2005). Conversely, public-sector managers have shown more confidence in internal performance measures, as a reflection of actual service quality, than in

external measures of citizen satisfaction with service quality, perhaps because they are concerned about the extent to which citizens have sufficient information to effectively evaluate the service quality (Nye and Zelikow 1997; Berman 1997; Bok 2001). In other words, managers in public sector prefer to define their responsibilities as a result of the "knowledge from the profession" more than as a result of customer opinions.

With such background a question arise: should we care more about customer satisfaction or about technical parameters chosen by managers? The most clear work to the date, at our best knowledge, that states pro, contra and needing of customer satisfaction in public services has been made by Kelly (2005). The researcher arguments, grounding on results provided by literature, that public managers have to care about all stakeholders. Thus, they should improve in both technical parameters and customer satisfaction. However, the author does not hide such aims could often contrast each other. According to Kelly (2005) in such cases the role of politicians should be "the very same they have been making for centuries: to choose". If the managers are provided just with subjective values to choose between customer request and technical performance the dilemma about using, or not, customer satisfaction as measure to evaluate the service remains mainly unsolved.

Managerial implication of such a statement should imply that managers have to improve technical performance, have to improve customer satisfaction, and eventually have to try to understand/influence customer expectations in order to reduce the gap with them. However, this last aim has been contented by other researchers as such manipulation could not be correct for a public administrator as the outcome could be negative for customers (Brown, 2007).

The relevance of the customer satisfaction for the service performance evaluation requires a preliminary careful analysis of who the main players of the service are. In general terms, such an issue had been addressed by the stakeholders' theory.

III. Public services: stakeholders

According to stakeholders' theory, the stakeholders of an organisation can be defined as "any group of individual who can affect or is affected by the achievement of the organization's objective" (Freeman, 1984).

In literature many authors have used the stakeholder concept (Freeman, 1984; Mitchell et al. 1997). Salience of the stakeholder was defined by Mitchell et al. (1997) as the degree to which managers give priority to competing stakeholder claims. Such a salience increases according with the weight of the three main attributes which characterize the stakeholders' influence on the organisation, namely the coercive, utilitarian or normative power to influence the organization, the legitimacy of the relation with the organization, the urgency of the stakeholders claim on the organization (Neville et al. 2004).

According to the stakeholder salience approach (Mitchell et al., 1997; Neville et al., 2004), there is a positive relationship between the number and the strength of stakeholder attributes (power, legitimacy, urgency) and the perceived stakeholder salience.

In Figure 2 four subgroups of stakeholders have been identified, depending on the power and the interest that they have on the service. In particular, on one side when managers identify a stakeholder with low interest and low power they could assume not important to focus on them. On the other side, when a stakeholder has a relevant power and interest on the service, it acts as a key player for the service. Kamann (2007) pointed out that public bodies have several potential key-players who may turn, from either dominant or discretionary stakeholders, to definitive stakeholders when one or more of them get attributes (power, urgency) not owned before.

This change in stakeholder's role takes place in the public sector either when the atomistic stakeholders organize themselves to actually influence the purchasing strategies by public bodies, or, as is the case in many standardised public services, when there is a major change in the social feeling that definitively asks for quality. In this respect, in recent years, the power and the urgency attributes of the direct customers of the public services have increased substantially with reference to their capability to effectively claim for their rights (Denhardt and Denhardt, 2007).

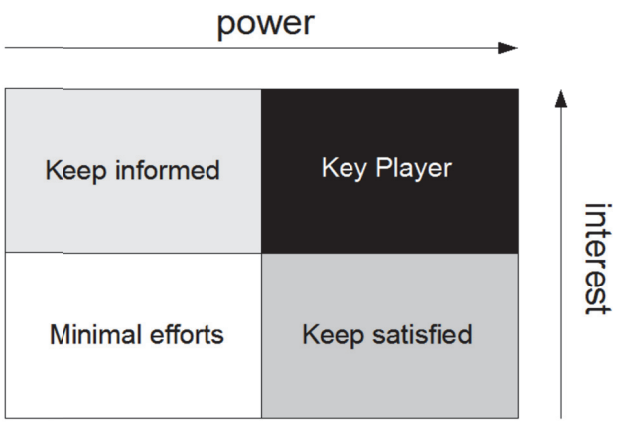

Figure 2 Stakeholder's relevance (Kamann, 2007)

Using the same scheme to analyse public services, beside the direct customers, the Local Authority, who entrusts the supplier with the local service provision, is identifiable as a key player because generally it has a deep power and a high interest. The claim for power by customers is a recent trend in public sector, as it modifies substantially the impact of the citizens on public service provision and, in terms of stakeholder theory; it can be interpreted as a status change from being an informed player to a key player.

Hence, with particular reference to the public services, the key players in public services are the buyer (e.g. Local Authority), the user (citizen), and the supplier (organisation external to buyer, public or private) (Skelcher 1992, Ancarani 2009). Such players interact in formal and informal ways as reported in Figure 3, where the main relationships are outlined (Ancarani and Mascali, 2010).

Citizens have usually a very limited power on local government about specific issues, their power keeps in the periodic evaluation they do on their administration through their vote during elections. However, such evaluation regards the perceived work of politicians as a whole, and any negative or positive effect coming from any specific service can be easily overridden by other issues. The supplier is chosen by the local government. Thus, is the government who choose the terms on which will be based the contract to the customers, the level of the service provided, the requirements it has to fulfil. Between the supplier and the citizen the relations are based on the contact due to the service itself and its payment, as well on a service chart which mainly has the role to inform the customers about which are their rights, which is the minimum level of service has been agreed, how they could complain in case it is not respected and how they could be reimbursed in such case (especially in case

such reimburse is considered in the service chart.

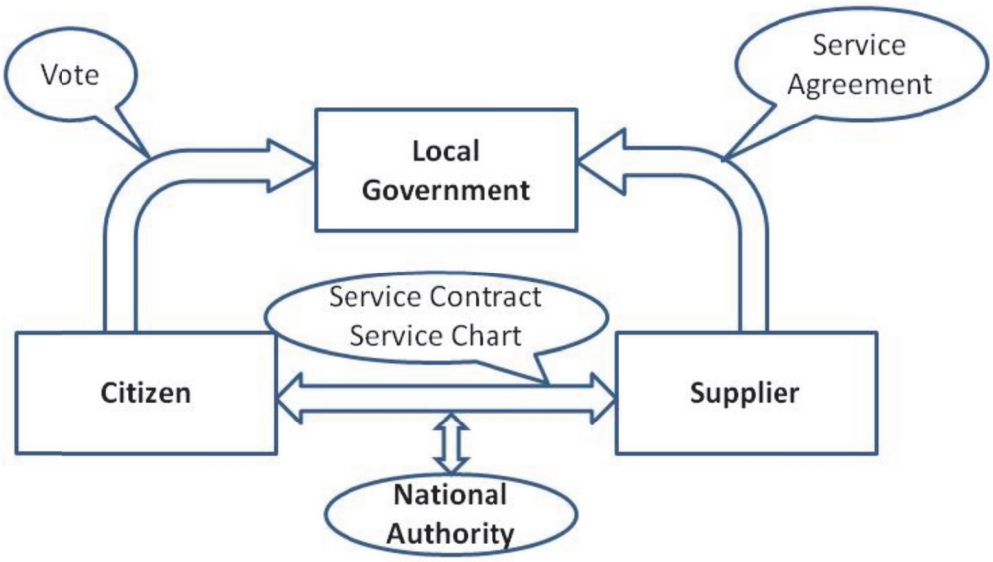

Figure 3 The triangulation (Ancarani and Mascali, 2010)

It should be clarified that identifying the existence of three main stakeholders does not imply that other stakeholders do not exist. For example supplier's competitors, media, group of interests. Moreover, the same stakeholders identified could be distinguished in an indefinite number of subgroups. For the purposes of the present work, some of these subgroups have been specified in order to be able to distinguish among the different roles each stakeholder could have. In particular, although the service provider has been cited always in terms of "supplier", the grade of separation between the public authority and the provider itself could largely vary among different cases. The current trend of privatization asks for an increasingly higher separation between the two different roles, however, we cannot say a priori that in all environments and cases public services are not directly managed by any public entity. Moreover, the service could be provided by a company co-owned by private investors and public entities. In the light of the present paper, supplier is going to be considered for its role, disregarding the kind of ownership, when is not differently specified.

In the case of customer, it has been already distinguished between the public authority whom buy the service and the citizens whom are user of the services. However, more distinctions can be made for each one of them. In particular, public authority acts mainly through two different ways. On one hand, the public authority, through politicians, influence

the service provision setting constraints and laws according to which the service should be provided. On the other hand, the role of public authority is to choose who should provide the service, together with the specific characteristics of the service in order to consider local peculiarities Figure 4.

Regarding the citizens, they can generically be considered the users of the public services. However, not all citizens necessarily use all the services constantly during their life (e.g.in health care sector), and in some cases they could never try some of them during a full life (for instance not all citizens try the prison services). Moreover being user for the public services do not necessarily means to pay for it, as their cost could be partially or fully covered through taxation.

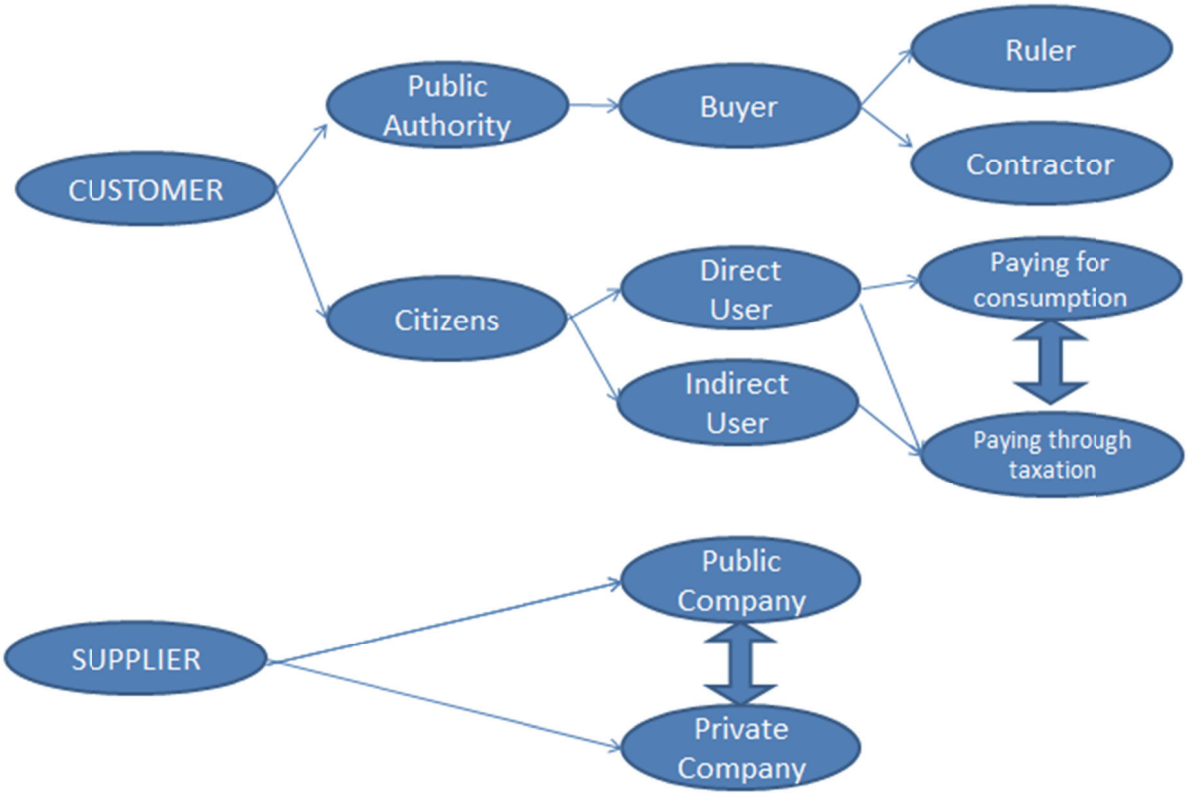

Figure 4 Customers and Suppliers, different roles.

The definition of user needs is a question for policy, while the way in which they are satisfied is the public organisation's own responsibility (Dewhurst et al., 1999). Local Authorities define the requirements of the service suppliers, looking for a equilibrium between political choices, long term aims (environment, budget, etc.) and users' needs. In this respect, the key points are how to identify such needs and how to translate them into technical

specifications to be included in contracts with the service providers (supplier).

When the “customers” of the service are so much different in their role, as public bodies and citizens are, the concept of service quality as well the concept of service improvement become both inherently political and contestable.

The performance of public service providers is judged by multiple constituencies. Each of them uses different criteria to judge the standard of public services and may apply different weights to the same criterion. It follows that there is no fixed and universally applicable set of criteria for evaluating whether improvement occurred. Nevertheless, public services have also tangible elements that are likely to be valued by all constituencies, even if the valuations differ between groups or over time (Boyne, 2003). Tangibles could be the basis for service improvement. Preliminary criteria to this aim can be derived from the literature on the conceptualization and measurement of organizational performances in the public sector (Ammons, 2001; Carter et al., 1992). Among such criteria can be considered quantity and quality of outputs, efficiency, equity, outcomes, value for money, and customer satisfaction. It is evident that some of the criteria overlap and that the buyer and the customer can't use the same dimensions. While the buyer can evaluate technical parameters, the final user applies its satisfaction as a proxy of some or all of the above.

The above literature review suggests the following hypothesis:

Hp1 *The evaluation of a public service done by public authorities and citizens could differ.*

Hp2 *Any evaluation about the service should consider both the perspectives of public authorities and citizens.*

With specific reference to public services, these reforms entailed the separation between the public authority and the supplier (a public, private, or public-private organization) to which the service provision is entrusted. This separation between buyer and supplier requires that the service characteristics can be clearly specified in a form which can be used as part of the contract and against which performance can be monitored.

This shift to a more contract-based system gives service manager freedom to manage the operational delivery of services, within the policy and resources framework established by the political authorities.

In turn, the need for monitoring the provision of a public service calls for the identification of the monitoring body and of the main actors or stakeholders (Freeman, 1984; Mitchell et al. 1997) involved which affect the service performance.

According to this approach, even if traditionally the service performance has been evaluated in the dyadic exchange between a buyer and a supplier, in public services it is necessary to consider at least three main stakeholders: two customers (users and public authority) and one supplier. This doesn't exclude that several other stakeholders could coexist, (i.e. indirect customers, financial bodies, regulators, etc.), but the relevance of the impact of those others depends on specific conditions.

The triangular interactions showed in Figure 3 have been widely recognised in literature (Skelcher 1992; Ancarani, 2009). However, what is quite new is the framework proposed in the present paper, as it takes into account the existence of more actors and their different perceptions in order to identify the quality of the service provided.

The definition of user needs is a question for policy, while the way in which they are satisfied is the public organisation’s own responsibility (Dewhurst et al., 1999). Local Authorities define the requirements of the service suppliers, looking for a equilibrium between political choices, long term (environment, budget, etc.) and users' needs. In this respect, the key points are how to identify such needs and how to translate them into technical specifications to be included in contracts with the service providers (supplier).

This identification is complex due to the several aspects of the service that need to be considered. Moreover, there could be a gap between the performance requested by the Local Authority and the performance expected by customers/citizens.

Each stakeholder evaluates the service quality from a different point of view, using different tools and policy to handle the service provider. When a particular perspective is applied the perception of quality itself changes. Moreover, the public bodies have a deep influence on the managers choices, especially because they take care of the public interest and several times pay at least partially for the service provision. Hence, user has usually a reduced power in public services comparing to private market. The previous statement is even more true when the activity of delivering the service strongly involves general interests (e.g. environment, finance, health, etc.) and when the user does not pay at all or pay just a portion of the cost to use the service (Donnelly, 2006).

IV. Public services: the public authority

The state has at least the role to control the public service, especially when it is provided under the condition of a natural monopoly. In such situation it is important to adopt technical and economical tools in order to control the power position of the monopolistic provider and stress it to a progressive improvement of the service provided to the customers.

Such role is necessary in both cases: when the service is outsourced to a private provider as well when the provision is under direct control of the public entity.

To develop an efficient system of regulations is strongly important for the standardizable public services, regardless the way in which the services are managed. The current legislation is trying to guarantee that while an increment of efficiency and efficacy in public service occurs all customers get benefits of it. It implies a regulatory system able to enhance the interest of all the stakeholders, the providers as well the customers.

Politicians have the role to decide which are the priorities and the aims to be fulfilled through a public service. These priorities will regard a conjoint of nations, a single one, or just a regional or a local level depending where they have been decided. While local rules have to respect the national one, in many cases public services have to be managed on local basis, for several reasons. For instance hospitals and school have to be distributed on the territory in order to be reachable by all the population, while water provision is strongly affected by local environment which can strongly change from a place to another one even inside the same country. However, an authority of control can be assigned to check that the services are provided respecting all the rules, on a higher level than the managed one. For instance a national authority exists to check how effectively waste collection services are provided inside Italy or UK countries. Such Authorities usually have a sort of autonomy but their power can largely vary on single case base. They can have the role to regulate economically and financially sector of public interest, to set prices for the service, to guarantee the financial stability of the providers, to specify and verify the quality of the provision and the technology used, in some cases they can also affect the industrial configuration of the sector considered (Ancarani, 2000). As a result of the New Public Management, such kind of control has been spread also in Italy. In several cases they have also the role to set up a price limit for the services which should be respected by local bodies when a service is contracted out or provided.

Among such techniques, it has been used often the method of price cap, which make the tariffs depend on general inflation reduced by the increased productivity.

Regarding the local administration the trend has been for an increased interest on improving managerial control, budget systems, efficiency and effectiveness as well making auto evaluations.

V. Public service: the customer

The recognition of the citizens as a relevant stakeholder in public services led managers of the public service providers to increase their interest in listening to user requests, which mostly were increasingly referred to the rationalization of public expenditure, to the improvement of the performance in service provision, and to the accountability with respect to organization outcome (Carter and Greer, 1993).

However, citizens requests, are far to be easily identifiable. The main problem is that any identification of request by citizens risk suffering a bias determined by the asymmetry of information and knowledge between them and providers and local authorities. Moreover, citizens are usually characterized by a wide variety of their expectations, often determining conflicting interests among themselves (e.g. Rose, 1990; Donnelly et al., 2006). It implies users should be considered not as an homogenous body, but as a complex entity with different segments which have different needs, expectations, willingness and possibility to collaborate.

Among the complexities typical of the public sector resumed by Donnelly et al. (2006) have to be noticed, in the light of the present work, the user's ignorance of actual service supplied, paralleled by their limited knowledge of the service process, and the ambiguity of the customers themselves mostly due to their directly conflicting interests.

Moreover, while in private markets an higher use of the service provided by a company is usually considered an aim by the company owners and managers, in public sectors there are more considerations to be taken into account. First, as public authorities should not be profit oriented they are more likely to pay attention on misusage of natural resources, environmental effects of their behavior than private companies. Moreover, as public services are often paid through general taxation, at least partially, an increment of their usage could have negative

effects on the public balance and could require for an higher taxation. Due to this financial as well environmental constraints, increment in consumptions are often considered an undesirable effect to be limited or avoided at all. Most of the above mentioned aspects are rarely expected in the commercial sector. For instance, an excess of medical analysis while would not improve the citizens life would require a higher taxation. In water or electric supply an excess of consumption is often punished by increased costs when higher consumptions among families occur in order to promote sustainable behavior among citizens, while for a private seller usually higher usage of its service are welcome and rewarded to the user through discounts and better fares.

Actually, besides these considerations, there are several other aspects that stress the need for forming the public service provision. In particular, it has also to be noticed that is decreasing the willingness by citizens to pay for insuring public service provision to the collectivity (it means that they are not more available to pay a tax disregarding whether they consume the service or not) although, are increasingly requesting customized services demonstrating their willingness to pay for those (e.g: Rose, 1990). It implies that service provisions have been progressively restyled in order to measure how much its citizen consume, and the role of citizens have progressively turned from tax-payer to direct payer for several public services. Moreover, in last decades the citizens are increasingly requesting customized services, demonstrating their willingness to pay for these. Such a trend, has been promoting the differentiation of services on two different levels. On one side, a standard service for all citizens who ask for it, on the other a customized service, usually with an higher quality, for the customers who have the possibility and the willingness to pay for it.

A fundamental aspect to represent the citizen in the public context is the complexity. While in the private the customer chooses among the market alternatives and buys the good or the service he have chosen on his personal basis, in the case of a public services the relations between the citizen and who supply the service can be far more complex. In table 1 a scheme of relations among stakeholders is resumed (see also figure 5).

In table 2 the main roles that a citizen can assume in a public service provision are outlined. The different role a citizen assume in a service can have strong impact on their level of collaboration, on their expectations about the service, as well on the quality evaluations made by them (Donnelly et al., 2006). In some cases it can be difficult to identify what is the role of a citizen to a service as it can change over the time, as well he can assume different

and roles even in a same specific situation.

Later in this work, we are going to use more often the term “citizen” than any other as just it includes all the relations, not only with the suppliers, but also with the public authority.

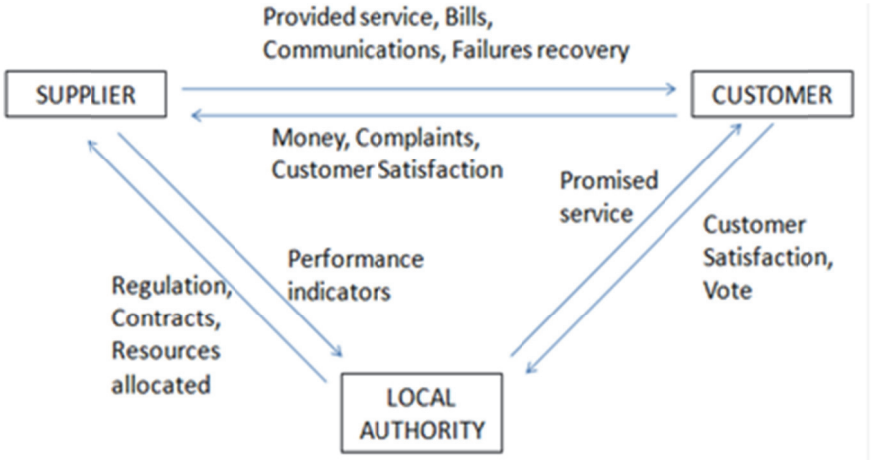

Figure 5 Triangulation of the relation in a public service furniture

Table 1 Resume of the relations among the main stakeholders

Stakeholder (from/to)	**Supplier**	**Customer**	**Public Authority**
Supplier	• Provide the service	• Service provision • Communications • Bills	• Give Reports
Customer	• Pay the bill • Collaborate with the service provision	• Use the service	• Give the vote • Transmit the complaints
Public Authority	• Control the service • Establish the rules • Put pressure for a change	• Make penalties • Promote collaboration	• Decide the rules under which service have to be provided

Table 2 Kind of relations between the citizen and the service

Citizen role	Service
Customer	According to the customer role, a citizen is a customer when he receives a service, upon his request as well against his own willingness, directly as well indirectly.
User	The citizen is a user of the service when he is a direct customer of it. He can receive the service upon his request as well against his own willingness. For example a citizen whom goes to an hospital to cure a flu is a direct user of the health care of the service. However, also the citizens who is forced to go to an hospital because of his schizophrenia is a customer as well an user of the service, while is not asking for any service, but is forced to receive it.
Beneficiary	The citizen could receive benefits from a service also in not direct ways. For example police service protects and defends citizens from robbers while checking the roads. It do not imply all citizen have necessarily any interaction with police man, but still all citizens around should be more safe due to the police presence. In public service is common also the case in which a problem in the service provision affect the citizens who are not user of the service. For example, a prompt health care could diminish the risk of contagious on sane people.
Administrated	The citizen can be considered as administrated, when he receives a service against his willingness, or for which he would have chosen a different provider, or a different kind of provision than the chosen one by the public authority.
Payer	A citizen could directly pay for the service he is using. In some cases the fee could be fixed, and/or cover only partially the cost.
Tax Payer	A citizen could indirectly pay for the service, through the taxation. In this case, it is also possible that what he pays through taxation is higher, or lower, than his real usage of the service.

VI. Service Quality

The quality measurement issue is nothing recent. One century ago Bells Laboratories developed statistical processes for quality control. Next step has been, a couple of decades later, the quality control in goods produced by Japanese manufacturing with a special emphasis to eliminate variation in the item's quality. Such consideration for creating items perfectly working instead of fixing these after production started in the USA only in the seventies (Cole, 1979; Adam, 1991).

The interest for quality in services has been growth together with the growth of service industries. Such wide category which includes the hotels, b&b, hostels, hospitals, and health care services in general, personal services, business services, consultancy, legal services, educational, associations, auto repair, parking, as well as many others currently has an higher impact on GDP than manufacturing. In the private service sector the needing for quality has been motivated with the needing of gain a competitive advantage over the competitors, as well for an increased profitability (Deshpandé et al., 1993; Narver and Slater, 1990; Schneider, 1991). As public sector usually do not know competition and often it is considered it does not look for profitability, the attention for the service quality has started some years later than in private sector. In particular, in the so called new public management customers are asking a value at least equivalent to the money they spend for the service provision. The value of the service is a balancing act between cost and quality, in some way dependent on the nature of the contract, stakeholders aspirations and resources available. Thus, quality evaluation has a primary relevance in order to improve the service, or at least improve its accountability. However, in case of services, there are several well-known limitations, for example a lower tangibility than goods (Bateson 1977; Berry, 1980; Lovelock, 1981; Shostak, 1977), to have a clear measure of quality. Even to posit a single universally acceptable definition quality looks to be a difficult problem (Kasper et al., 1999). Currently, the quality definitions have been based on three different approaches.

A first approach is the so called philosophical approach. It considers quality as a synonymous of innate excellence (Oliver, 1997). However, such concept implies that people can recognize it when they see, but they are not able to define quality further. Although some researcher have supporter such an approach, it cannot be used for practice purposes as it considers quality immeasurable (Schnider and White, 2004).

A second more practical approach has been considering quality as a matter of measurable technical performances. According to such an approach, quality is objective. In particular, this technical quality considers to which extent a product (or a service) fulfils some technical standards (Oliver, 1997; Kasper et al., 1999). Thus, more a service respect the service peculiarities above listed, especially intangibility and heterogeneity, less will be feasible adopt any technical quality measurement.

Last way to consider quality has been through the customer perspective. It implies the most relativistic point of view about quality. As it means that quality is based on subjective measures and individual perceptions. It implies that customers could positively evaluate a service which is not good according to technical criteria. However, such user based view has been appealing because it fits particularly well with the service intangibility as well the heterogeneity across the time and people (Schneider and White, 2004). Moreover, setting specific goals for particular aspects of a service might lowering the quality in the other areas where service have not been set. Thus, the results of such goals could be not necessarily positive. On the contrary, a quality judgement made by the customer has become the main approach to assessing quality in service literature especially for marketing scholars. For such reasons technical quality has been more adopted to measure the quality of the *what* of the service, while the user based approach has been applied to measure the how of the service (Schneider and White, 2004).

Currently, quality in public sector has been evaluated importing methodologies and tools from private services without any specific adjustment. In particular, at least to our best knowledge, it misses in literature an evaluation methodology which considers both the technical quality and the quality according to the customer. With the grew of relevance in the last decade of the public services sector, and with the new public management trend, quality issue in this sector has become anyway more and more relevant in both scientific debate and practitioner daylife. Moreover, it is now fully recognized that the quality of public services (effectiveness, sustainability taken together) has a significant impact on the living standard of citizens (Kirkpatrick & Lucio, 1995).

The quality of services has been interpreted as the level of service supplied, but no final word has been said on the criteria to be applied in the evaluation. As citizens are receiving more attention and public policies are focusing on them, evaluation criteria should not be based just on technical parameters and then on service performance, as generally happens, but

should somehow take into account the customer's perspective in terms of perception of service quality (Carter & Greer, 1993; Lavery, 1999; Warner and Hedbon, 2001).

During the last years in public services, the attention for the quality has been translated in an increased orientation toward a private-sector style of management, with a trend toward separating politics and management (Jenkins et al., 1998), toward privatization (Vickers and Yarrow, 1988) and contracting out (Hartley and Huby, 1985). This implies that the service provider (supplier) is increasingly separated from the public authority (buyer) which entrusts it with service provision. This trend is mainly due to economic reasons, while it does not directly determine an improvement in customer perceptions of the service quality.

However, such changes imply also a change on the quality concept on which services are based. When public authority has a full control of the service provided the philosophical quality can be applied, as there is no need to further define what quality implies for the service, and it is possible to posit that the public authority at least should adjust the service over the time to generically increase the quality, through both technical parameters and customer satisfaction. When public authority outsource the service to a third part supplier, the needing for a contract imply that some parameters have to be chosen among what is measurable which implies that quality is reduced to technical quality concept. The service provider has to supply service according to the rules and constraints contracted with the public authority. However, that service is judged by the final users according to their expectations and perceptions, the already cited quality according to the user. Unfortunately, user expectations are often mismatched in the agreement between supplier and public authority (Kelly, 2005) because the two actors tend to evaluate differently the quality of service. In particular, when comparing public authority and users, the aims are different, as well as the relations with the service provider and with the service itself. It means that even if some investigations about customer satisfaction are currently done, the road to consider technical quality as well quality according to the customer in order to build a philosophical quality is still far away to be over. Even if the importance assigned by the literature to the study of public services has increased in the last years, this trend of research still lacks a model of service quality able to take into account the specific attributes of those services. In particular, since the interaction between the customer and the supplier has been considered as a dyadic relationship, an analysis of the impact of the interactions with other stakeholders involved in public services is still missing.

Thus, the service quality should be evaluated as technical parameters by the buyer and as satisfaction by the user. At the same time, it may be envisaged that the buyer should use the user satisfaction as a technical parameter among the others.

In particular, has been hypothesized that *complexities and differences among different places would make difficult to compare different services through benchmarking if only a few of parameters have been adopted (Hp3).*

VII. Value for Customer

According to the above reported considerations, the quality concept definition in public services should not be constrained within the customer satisfaction concept. In order to have a comprehensive assessment of the service quality level, it may be necessary to investigate the problem in terms of the broader concept of value for the customer. That could take into account both short and long term customer needs (Bolton, 1998; Bolton and Drew, 1991).

The concept of value for the customer has been explored and developed by several researches. However, this concept is broad and complex enough that there is no final answer universally accepted to define what it is and what it is not (Woodall, 2003).

Frondizi (1971) suggested an idea of the value as comprehensive of the intrinsic value, related to the relevant characteristics of the object, and the extrinsic value, due to the possibility of use or exchange of the object. According to this approach, value is dependent on customer preferences; quality is dependent just on the item's characteristics.

Fekete (1987) argued that value is objective and could be analysed and measured with certainty and exactness, but there is no consensus on this. Smith (1987) contested that a truth value exists, claiming that value is just contingent. Moreover, evaluation differs not just among people but also the same person could evaluate the same object differently at different times. Zeithaml, (1988) argued that value is the result of comparing the perceptions of what is received to what is given. Thus, environmental, social and cultural factors, as well utilitarian and economic reasons, could influence these perceptions and then the value for the customer.

Shillito and De Marle (1992) considered that value is dichotomous, centered in people and the objects they desire. This suggests that value can perhaps be conceptualized and can be comprehended through the conjoint appreciation of economic and abstract/philosophical

perspectives that, together, recognize the existence of value-oriented properties. Such properties are associated with both the object and the subject, and are manifest at the point of interaction between the two. Sacrifice and the market are also key factors. The model identifies four distinct interpretations of value (exchange, intrinsic, use and utilitarian), any or all of which may be recognized and/or expressed individually or collectively by the consumer. All values are subject to the influence of both the user's value system and environmental contingency.

Sweeney and Soutar (2001) proposed four distinct value dimensions (emotional, social, quality/performance and price/value for money). They showed that multiple value dimensions explain consumer choice better than single value does for money items.

Holbrook (2006) proposed a typology of customer value composed of extrinsic value versus intrinsic value, and self- oriented value versus other-oriented value.

Smith and Colgate (2007) developed a framework aimed at identifying four major types of value (functional/instrumental, experiential/hedonic, symbolic/expressive and cost/sacrifice) that can be created by organisations and five major sources of value (information, products, interactions, purchase or consumption environment and ownership/possession) that are associated with central value-chain processes.

Resuming, it is possible to posit that recent researches have been considering the value mainly as contingent property strictly related to the each user, time, conditions (Smith, 1987; Shillito and De Marle, 1992; Walter & Lancaster, 1999; Ravald & Gronroos, 1999; Sweeney and Soutar, 2001; Holbrook, 2006; Smith and Colgate, 2007) with the exception of the role of the price, which has been considered by some researchers inversely related to the value (Zeithaml, 1998; Monroe, 1991). However, it does not matter a lower price as much a perception of it (Sanchez Fernandez and Iniesta Bonillo, 2007). Thus, for most researchers the concept of value is indissolubly linked with the customer. Following such stream Woodall (2003) paid his attention on defining the *value for customer* (VC).

Through a comprehensive analysis of the literature, he explored the concept of value for customer considering five primary forms of it:

- net VC, in terms of balance of benefits and sacrifices: it implies that the customer makes some judgement on the usefulness of a product by computing or comparing benefits and sacrifices; some authors ascribe it to a ratio or to the dividing of benefits

by sacrifices (e.g. Heskett et al.,1997); other writers consider the computation to be a matter of subtracting sacrifices from benefits (e.g. Lai, 1995);

- derived VC, in terms of use/experience outcomes: it is suggestive of the notion of use value (e.g. Sheth et al., 1991); all are substantially informed by the linking of consumption experiences to social (Kahle, 1983) and human (Rokeach, 1973) values; VC here is conceptualised as the benefits derived from consumption-related experience and is presented such that independence of, or at least prevalence over, any sense of associated sacrifice is implied;
- marketing VC, in terms of perceived product attributes: this view of VC perhaps favours a supplier-oriented perspective (e.g. Treacy and Wiersema, 1995);
- sale VC, in terms of reduction in sacrifice or cost: It is oriented to a demand-side value interpretation (Zeithaml, 1988), or as one of a number of potential product attributes (Dodds, 1999); this value means low relative price within a competitive environment (market), and can be viewed, in part, as being analogous to exchange value; it is associated with reduction of sacrifice more than it is with increase in monetary gain, and here 'best' value is delivered by the lowest-priced alternative; neither use nor the balancing of benefits and sacrifices nor the nature of product attributes impacts substantially upon this particular interpretation of VC;
- rational VC, in terms of assessment of fairness in the benefit – sacrifice relative comparison: it combines the notions of exchange value with intrinsic value and it is essentially utilitarian in nature; this might be a more-or-less objective perception of a tolerable price band (Liljander and Strandvik, 1992), and/or a market price (Anderson and Narus, 1995), and/or a maximum or reservation price (Anderson and Narus, 1995).

The net VC often has been recognized as an overall view of VC delivered to the customer, and thus as a comprehensive and useful measurement for a good or a service. Anyway, the net VC implies a strictly rational comparison between costs and benefits. In reality, however, customers are not behaving in a strictly rational way. VC is accumulated through a largely nonrational process during all experience phases in the consumption of a product or service. Thus, the temporal and cumulative aspects of VC need to be taken into account. Perception of value is formed through all the experiences a customer has throughout

a product's or service's life cycle.

These experiences start with presales, so an ex ante VC is identifiable in this phase. It is the pre-purchase value. It considers desired and expected value. Moreover, it implies that customers have conceptions about VC also when they are just deciding to purchase, or not.

The experience continues through ordering and receiving, so a transaction VC exists and it is strictly related with the purchasing experience.

The next step in the life cycle is the process of learning, using, and supporting, to which an ex post VC is related. Thus, this VC is received during use or consumption.

Finally the end arrives with the disposing. In this phase the customer could evaluate to buy again the product, or re-agree with the service provider for a longer period of contract. An after- use VC could be outlined in this last part of the life cycle.

Thus, on the basis of the above literature, we formulate the following hypothesis:

Hp4 *Value for customer concept is a broad concept, which is useful to explain the different component of value in a public service through its different forms.*

In Table 3 has been analysed the evolution, during the last half- century, of the concept of value in marketing research. Particularly noticeable are older studies that identify the value as an objective property (Fekete, 1987), or at least researchers noted a distinction between a subjective value and an objective quality (Frondizi, 1971). Later, the studies showed that private firms paid more attention to subjective value than to objective quality improvement (Ravald & Gronroos, 1996). Most recent studies focus on the customer and thus on his/her perceptions (Holbrook, 2006). Technical parameters lose importance also when they are easy to evaluate. In the customer centric perspective, subjective measurements of value ex-ante, or satisfaction (ex-post) gain the main relevance. In such a perspective, even the price is substituted by perceived costs; but it is a parameter generally easily measured (Sanchez Fernandez and Iniesta Bonillo, 2007).

Although the value of the service has been considered as balancing act between cost and quality (among the others Zeithaml, 1998), the quality in service has been hardly measured due to several well-known limitations, for example a lower tangibility than goods (Bateson 1977; Berry, 1980; Lovelock, 1981; Shostak, 1977).

Table 3 Subjective Value-Objective Quality in marketing literature

Authors	Users judge subjectively	Properties objective
Howard & Sheth (1969)		Buyer decisions are rational and systematic.
Frondizi (1971)	Value, intrinsic and extrinsic is subjective.	Quality is objective.
Fekete (1987)		Value is objective.
Smith (1987)	Value depends on personal behaviour, environment and can easily change.	A truth value does not exist.
Zeithaml (1988)	Value depends on perception and it is the result of a trade off.	Low price increases the value.
Monroe (1991)	Value as ratio between benefits and sacrifice perceived.	Reduction in cost is more relevant than increased benefits.
Shillito & De Marle (1992)	People perceive value subjectively and are motivated to obtain what satisfy their needs. Value depends on needs; it has transience with satisfaction and time.	
Ravald & Gronroos (1999)	Value added should be customer oriented.	Clear definition of value of services is only in literature on pricing.
Walter & Lancaster (1999)	Value depends on user's goals.	
Sweeney & Soutar (2001)	Value can be analysed as function of four main dimensions that cover the two main component of value: hedonic and utilitarian.	Price affects the value.
Holbrook (2006)	Customer value is an interactive relativistic preference experience	
Sanchez Fernandez & Iniesta Bonillo (2007)	Values are the implicit criteria employed by an individual in making a preference judgment. Even price is an elusive construct.	Value depends on attributes of a product.

VIII. Customer Satisfaction

In order to overcome the difficulties of direct measures of service quality, the customer satisfaction approach has been proposed by several researchers. Although the service quality concept and the customer satisfaction are usually recognized as conceptually distinct, it is also recognized empirically that both somehow are overlapping constructs (Schneider and White, 2004). In particular, in early research these concepts were still considerate separately (Bolton and Drew, 1991). Specifically, service quality judgments were considered as global evaluation, while satisfaction referred to specific experiences. However, later developments have largely confirmed that a positive quality judgment led to satisfaction (Kasper et al., 1999; Loveman, 1998; Heskett et al., 1997; Woodside et al., 1989; Reidenbach and Sandifer-Smallwood, 1990; Parasuraman et al., 1994; Storbacka et al., 1994).

However, researches about customer satisfaction concept have started with services, as it has been developed within marketing product literature, and it was mainly regarding the evaluation of goods. In particular, in seventies Anderson (1973) recognized dissatisfaction as the "degree of disparity between expectations and perceived product performance" p.38. Researches about antecedent of satisfaction have been started during the same period,

A decade later, such an approach has been confirmed to be usable also in services (Churchill e Surprenant, 1982). A more famous approach, has been proposed by Gronroos (1982), who built a model according to which customers evaluate service quality through a comparisons between their perceptions and the expectations they have about the service in line with Anderson (1973) statement about services. In the same period, other researcher recognized the service quality as the measure of how well the service delivered matches customer expectations (Lewis and Boom, 1983). In particular, according to them to offer quality means that a firm is sufficiently aligned with the expectation of its customers.

However, satisfaction can be an ambiguous concept. It depends on several physical and psychological factors interrelated each other, which can change from customer to customer. Customer satisfaction issue has been interpreted through two main approaches. Gronroos considered that it is mainly influenced by three main dimensions, namely technical quality, functional quality (1984) and corporate image (2001).

The relevance of customer satisfaction in private service is undoubted. In a competitive market, where firms have to compete for getting new customers as well keeping the existing, customer satisfaction represent a key element in marketing strategies (Gitman e McDaniel, 2005). Moreover, researchers have posited that there is a direct link between profits and the satisfaction of customers' needs and wishes (Churchill e Surprenant, 1982). For a firm is essential to keep the base of customers through their satisfaction (Berry e Parasuraman, 1991).

Another approach, has been to develop a gap model through which has been outlined the main antecedents of the customer satisfaction gap. In particular, Parasuraman et al. (1985) suggest to analyse the relationships between customer and provider by means of a conceptual model identifying the customer satisfaction (Gap 5) as a function of other four gaps. While gap 5 is still considered as in the discrepancy paradigm (Anderson, 1973; Gronroos, 1982), the four new gaps have been considered as key antecedents of gap5 itself. They should represent the main constraints to the attempt about provide a service well evaluated by customers.

The new gaps are (Figure 6):

- Gap 1: Customer Expectations vs Management perception. Managers could be not able to understand the customer expectations or to forecast with enough time in advance in order to make plans coherent with the future customer expectations.
- Gap 2: Management perception vs Service Quality specification. Managers could be not able to translate with efficacy their perceptions about customer expectations in specific parameters about the service, or action that have to been taken in order to improve it.
- Gap 3: Service quality specification vs service delivering. Despite of the plan according to which the service should be provided, the service truly provided to customer could be different. The difficulties in standardize employees behavior could misalign these with the plan. Moreover, several constraints or occasional troubles could misalign the service provided with the service planned by managers.
- Gap 4: Service delivering vs external communication. Media and communication to customers can influence the customer expectation. Moreover, also the perception about the service could be modified as customer could better recognize some hidden characteristics after this is communicated to them by someone.

The researchers also outline that the customer expectations are also influenced by three main factors :

- Word of mouth,
- Previous Experiences,
- Personal Needs

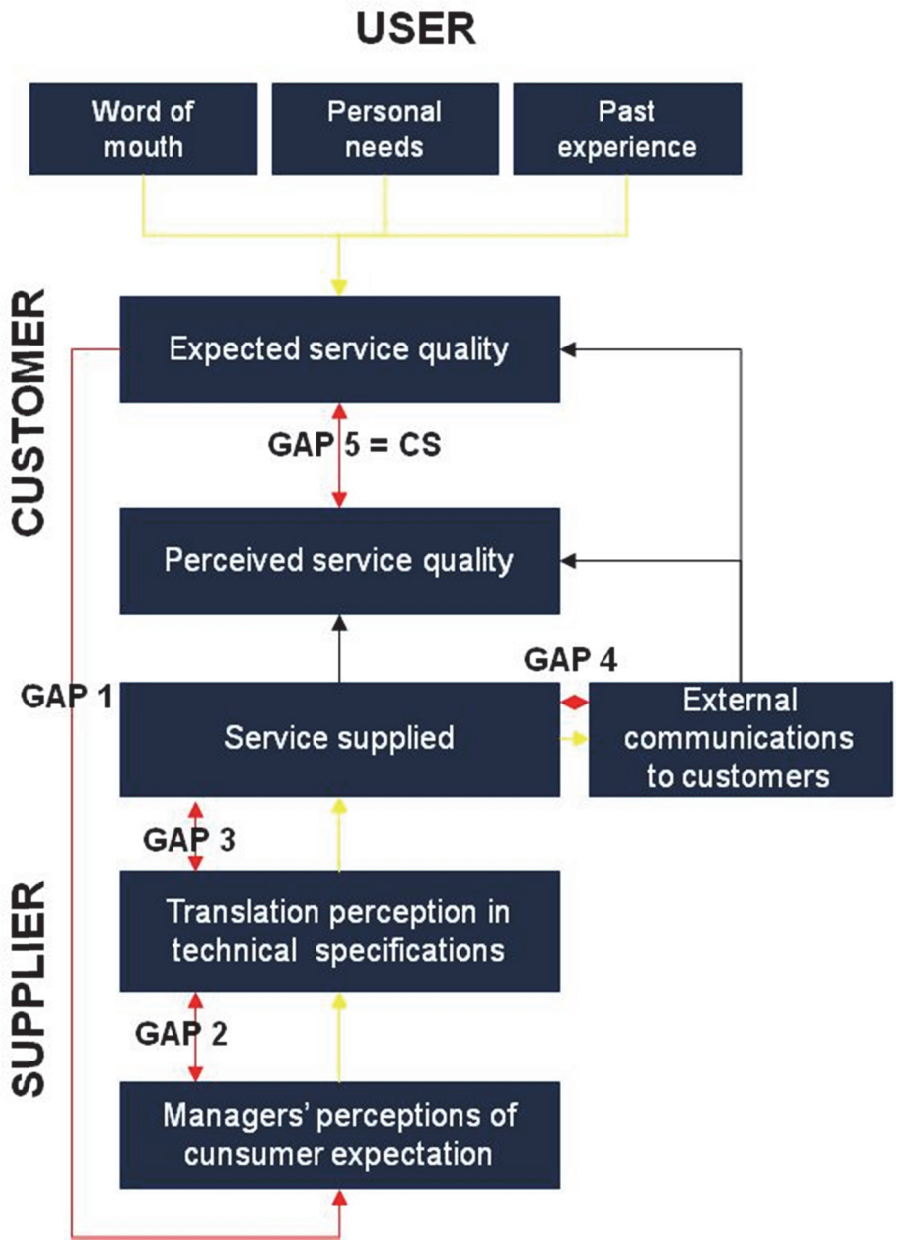

Figure 6 Gap Model (Parasuraman, et al., 1985)

The model has received a lot of attention over the years and it has been cited several thousands of time by researchers in these decades. However, the model has not been changed or substantially modified over the years. To our best knowledge only minor issues have been aroused over the conceptual gap model, the main one by Luk and Layton (2002). According to them, as employees have an high relevance on customer satisfaction. Thus, employees' impact should be explicitly considered in the gap model through two more gaps (Figure 7):

- Gap6: Customer expectations vs employee's perception;
- Gap7: Employee's perception vs manager's perception.

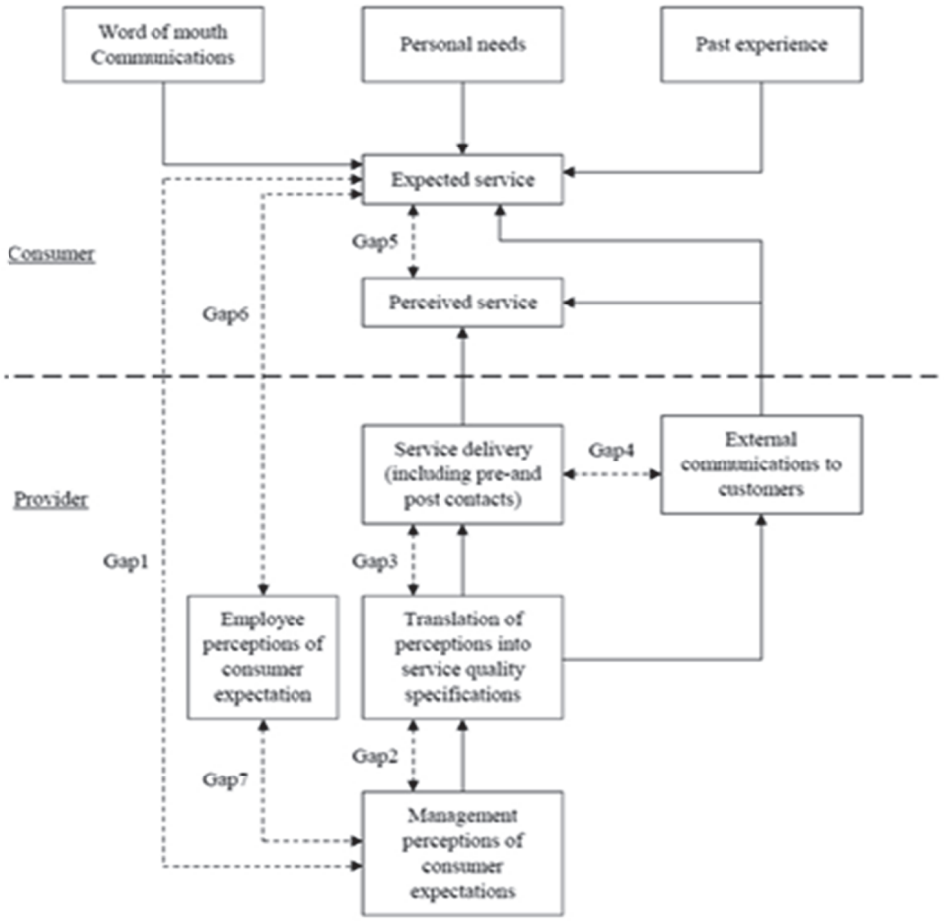

Figure 7 Gap Model Revised by Luk and Layton (2002)

Moreover, Parasuraman et al. (1985) in their work proposed ten different dimensions according which, according to them, should be key determinant for the service quality:

- Tangibles

- Reliability
- Responsiveness
- Competence
- Access
- Courtesy
- Communication
- Credibility
- Security
- Understanding the customer

During the following years, the same group of researchers (Zeithaml et al., 1988) have been explored the model improving the attention to some variables useful in order to expand the dimensions useful to get an estimate of each single gap (Figure 8):

- Gap1: it is related with the amount of marketing research (-), amount and quality of vertical communication (-) and the number of management level (+).
- Gap2: it is related with the managerial efforts in order to increase the service quality (-), the existence of specific aims about service quality(-), the existence of a standard about the work to be done (-), and the trust about the feasibility of having customer satisfied (-).
- Gap3: it is related with the teamwork of employees (-), with the correctness of the work assigned to them (-), with the coherence of technogical support provided to employees (-), with the power of control on employees (-), with the entity of role's conflict perceived by employees (+), with the the entity of role's ambiguity perceived by employees (+).
- Gap4: it is related with the extension of horizontal communication (-) as well with the existence of promises too much optimistic or unfeasible (+).

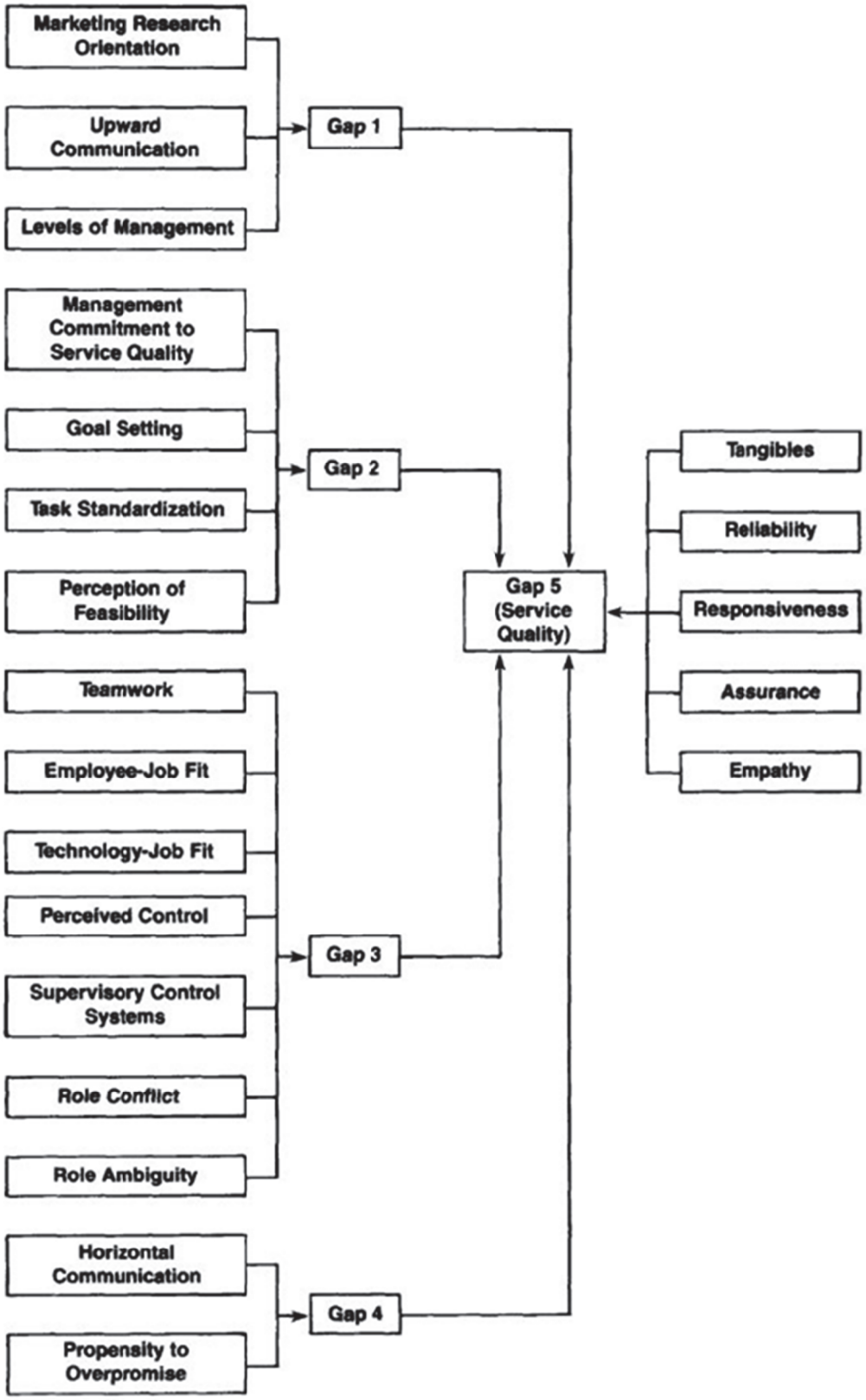

Figure 8 Service Quality (Parasuraman et al., 1988; Zeithaml et al., 1988)

Other authors have been adopted a gap approach in order to measure service quality (Lewis and Klein, 1987; Brown and Swartz, 1989) and confirmed the correlation between perceived quality and satisfaction (Gotlieb et al., 1994). Moreover, in the original paper about the gap model, Parasuraman et al. (1985) at the end of their work outlined the need of more research efforts about the subject. In particular, researchers and practitioners could improve knowledge about the service quality through:

- developing a standard tool to measure customer satisfaction,
- developing a method for measuring the other four gaps presents in the model qualitatively in order to understand which gaps are more relevant and how reduce these,
- developing a method for measuring the other four gaps presents in the model quantitatively in order to test the validity of the model,
- segmenting the customers according to their expectations, any tool to measure customer satisfaction should consider it,
- focusing on the antecedents of customer expectations due to the relevant managerial implications.

In a later work, Parasuraman et al. (1988) answered to the first need identified: a standard tool to measure customer satisfaction. Through a double stage process of investigations which involved four big American companies, they have been identified that last seven dimensions previously cited could be resumed under Assurance and Empathy. Moreover, they have been identified a 22 item scale (SERVQUAL) useful to measure customer satisfaction in a broad spectrum of services. Accoring to such a methodology customer satisfaction can be measured through a survey, mainly based on these 22 items. The questionnaire is structured through a double group of questions which measure separately customer expectations and customer perceptions about the service. All 22 items have been selected in order to consider the five final dimensions, which namely are: Tangibles, Reliability, Responsiveness, Assurance and Empathy.

The formalized equation used in order to measure Customer Satisfaction trough the SERVQUAL is:

$$\mathrm{CS} = w_k \sum_{j=1}^{Ik} \left(P_{kij} - A_{kij}\right) \Big/ I_k .$$

CS is then the results of the sum for each dimension (k) of the differences between the perceived quality (P) and the expected quality (A). Each dimension has a different weight (w_k) according to the weight that these dimensions have in the customer expectations, while I_k indicates the number of observations collected for each dimension.

The usage of a preselected number and kind of question should help the elaboration and the practical realization of a survey. However, some question could not fit some specific service, and the rigid application on a service is not necessarily an optimal option. The researchers themselves, considered the model as a skeleton to be eventually adapted for specific context/services. Moreover, they considered SERVQUAL specifically useful for periodic investigations about customer satisfaction, in order to track trends over the time. Other researchers have been considering that a questionnaire about satisfaction should be more oriented to the process in order to get results more usable for improving the service (D'Ambra e Gallo, 2006).

The model was largely adopted as well criticized by several authors, but in its core aspects it has not changed to date (Cronin and Taylor, 1992; Teas, 1993; Dabholkar et al., 2000).

Other models were proposed in the eighties and early nineties (among others, Rust and Oliver, 1994), all these focused on the customer perceptions as the major driver of customer's behaviour, so that the latter may considered an appropriate indirect measure of service quality. Some models tried to improve the applicability of the previous models (Brogowicz et al., 1990; Cronin and Taylor, 1992; Teas, 1993; Spreng and Mackoy, 1996; Oh, 1999; Frost and Kumar, 2000). Some researcher recognized that there is no universal set of factors that are relevant across all industries (Babakus and Boller, 1992; Cronin and Taylor; 1992). Thus, some other models focused on the evaluation of different attributes (Haywood-Farmer, 1988; Mattsson, 1992; Philip and Hazlett, 1997; Sweeney et al.1997), while some were characterised either by a focus on a specific service (Knutson et al., 1990; Stevens et al., 1995; Dabholkar, 1996; Soteriou and Stavrinides, 2000) or by an attention on how information technology has an impact on service quality (Berkley and Gupta, 1994; Broderick and Vachirapornpuk, 2002; Zhu et al., 2002; Santos, 2003; Parasuraman et al. 2005; Herington and Weaven, 2009). Finally, some models explored the conceptual issues related to service quality in order to improve the understanding of the quality concept and its antecedents (Dabholkar et al., 2000).

In particular, Cronin and Taylor (1992) posit that the perceived service is already affected by the expectations, and thus is not necessary to get measures of both, but the first it is enough. Thus the model is slightly changed and renamed in SERVPERF. Customer satisfacion is in this case measured as

$$CS = w_k \sum_{j=1}^{Ik} P_{kij} \Big/ I_k$$

Pitt et al. (1995) claim that dimensions of service quality are not always well distincted in SERVQUAL. Buttle (1996) adds that the five dimension are not univerally valide. Van Dyke et al. (1997) context the possibility to just consider satisfaction as a difference between perceptions and expectation as these are the results of complex interrelation and the approximation got through just difference between these would be far away from getting a true value.

Moreover, the gap model was a fundamental background for research, to study the dyadic relations between customer and provider, between employee and provider, and between buyer and provider (Dion et al., 1998). The different applications, as the original model, focused on one dyadic relation per time (manager- customer, employer-customers, etc.).

In effect, all aspects of customer–provider conduct, including service quality, convenience, and content of application, however, it leaves little leverage for universal measures of service quality and satisfaction (Athanassopoulos, 2000).

Apart from measurement issues, the real value of quality emanates from its decision-making implications service quality can be used as a vehicle of strategic marketing.

Although SERVQUAL can be used also to assess an overall service quality based on the average measure of the five dimensions, it is not generally sufficient to identify which are the specific issues which compromise the quality, and more effort should be done during an investigation to identify them (Parasuraman et al., 1988). The original model of gaps (Parasuraman et al., 1985) instead still gives a relevant perspective in order to recognize where to look for the main downfall in case of dissatisfaction as it returns an accurate representation of the relations between two stakeholders. Nevertheless, it does not consider several mutual interactions, as it is in the case of public services.

At our best knowledge, there is a lack of attention toward a comprehensive model helpful for different kind of service, setting and situation that takes into account the main stakeholders involved in service provision. Hence, it is relevant to investigate how the customers of the public services integrate their service perceptions to obtain a comprehensive evaluation of the service quality taking into account the impact of the interaction with both the supplier and the public body.

Thus, on the basis of the above literature, we formulate the following hypothesis:

Hp5 *Gap model should be revised in order to consider the three main stakeholders in a public service.*

IX. Multi agent based models

The number of interconnected processes carried out, the number of subjects involved in the provision of the services, and the different perspectives by the two customers in terms of value make the evaluation process a very complex system. Thus, a tool that adds to calculability, typical of mathematical models, the flexibility, typical of descriptive models, would be requested.

The above mentioned characteristics are typical of the multi agent-systems (MAS), which have been increasingly applied to simulate complex systems through simple rules, regulating the interactions among a number of agents acting in a common environment.

MAS simulations are suited not only to reflect interactions among different agents. They allow one to start off with the descriptive power of verbal argumentation and to determine the implications of different hypotheses. From this perspective, MAS can provide an orderly formal framework and an explanatory apparatus (May and Mc Clean, 2007). Other features of MAS simulations are (Foster, 2006): modularity, great flexibility, large expressiveness, and the possibility to execute them in a parallelized way, possibility to be combined well with other kinds of models. For instance, is possible to apply rules already knew through continuous models, as in case weather, environmental, or climate simulations would be combined with models of human response to the respective external conditions.

In the economic sciences, MAS make it possible to overcome limitations of the theoretical concepts (Aaron, 1994), by relaxing idealized assumptions that are empirically not well supported. They also offer a possibility to go beyond the representative agent models of macroeconomics (Kirman, 1992), and to establish a natural link between the micro- and macro-level description, considering heterogeneity, spatio-temporal variability, and fluctuations, which are known to change the dynamics and outcome of the system sometimes dramatically (Helbing and Balietti, 2010).

Morever, the agent-based models allow testing the "what-if" conditions and are highly reliable. They can be adapted and improved by adding details without a full restyling of the model. Moreover, each actor can be designed having different behaviour and options to interact with environment and/or with other actors (Ferber, 1999; Weiss, 1999).

The multi -agent- based simulations differs from other approaches due to its peculiar characteristics of the following:

- Autonomy: Agents are aware of their environment operating without human intervention to some extent in order to fulfil their objectives (Woodridge and Jennings,1995).
- Social ability: An agent can interact with other agents or humans (Moyaux et al., 2006).
- Reactivity: An agent can interact with its environment, perceiving some or all of its characteristics depending on the choices of implementation; an agent could also deal with the changes in the environment modifying its behaviour (Parunak, 1999).
- Pro-activeness: Agents do not simply respond to changes in their environment, but can take action under proactively (Giannakis and Louis, 2010).

Such peculiarities have been applied successfully to test and prove laws in different contexts. In particular, these models have been used to: recognize how a group of behaviors from individuals can have an impact as a whole (e.g. Deadman, 1999).

The most known example is the simulation of the behavior of a group of ants. It is based on a few simple rules:

- Ants walk randomly looking for food when they do not feel any pheromone around;
- Ants release pheromone when they carry any food; and

- Ants follow the tracks of pheromone when they recognize any.

Three simple rules that are enough to create a simulation in which ant behavior replicate exactly the real world, showing how ants create perfect lines, and demonstrating that no additional senses or quality are needed by ants than just releasing pheromone when they carry food and recognizing pheromone.

From this example several advantages and limits in the usage of a multi- agent system can be outlined. First of all, the main provision of these models is that they are made to be simulated. It means that they can be tested and the validity of the theoretical assumption can be verified through a comparison among simulated results and true results in the same conditions. Unfortunately, the last consideration contains also the main contra of such models. The advantages of a MAS could be limited if is not possible to compare the results of a simulation with a real contest. Nevertheless, the simulation tool motivates the researcher to identify with the highest clarity the scheme of the relations among the actors involved, and the possibility of an unlimited number of simulations gives strong help in the research of stable and detailed relationships.

Moreover, the inherent distributed nature of agent-based technology, as the system is distributed to different agents, helps to deal with a higher level of complexity than with conventional information technology (Akkermans et al., 2003). This is enhanced by the fact that each of the agents has specific rules in dealing with this complexity in combination with easiness of development in a short time frame (Lu and Wang, 2007). With this approach, a nonhomogeneous service provides a multidimensional concept of value for customers and implies different customer perceptions and behaviours which should be taken into account.

MAS can been developed for a number of different reasons, among these: explanation of phenomena, guiding data collection, revealing dynamical analogies, discovering new questions, illuminating core uncertainties, demonstrating tradeoffs, training practitioners, and last but not least decision support, particularly in crisis situations. (Epstein, 2008). Its versatility has made possible to adopt the method of agent-based modeling to a number of different problem especially in social sciences:

- social influence and opinion formation (Mas et al., 2010; Nardini et al., 2008),
- social networks (Szabo and Fath, 2007; Carrington et al., 2005; Holme and Ghoshal, 2006),

- social cooperation (Axelrod, 1997; Bowles and Gintis, 2004),
- social norms (Helbing et al., 2010; Rauhut and Junker, 2009),
- social conflict (Cederman, 2003; 1997),
- coalition formation (Sichman, 1998),
- collective intelligence (Bonabeau et al., 2000),
- agglomeration and segregation (Mansuri et al., 2002; Osullivan et al., 2003),
- evacuation of people in scenarios where poisonous gas spreads in the environment (Epstein, 2009).

However, several models have been developed also to reply to question research in the economic area:

- financial markets (Hommes, 2006; Raberto et al., 2001),
- competition and cooperation between firms (Zhang, 2005),
- micro-economic models (Kaihara, 2003),
- macro-economic models (Lebaron et al., 2008; Testfatsion, 2002),
- organization and managerial decisions (Harrison et al., 2007),
- systemic risks in socio-economic systems (Delli Gatti, 2008; Aoki and Yoshikawa, 2006),

The flexibility and usefulness of MAS tools has been recognized also in many other fields of research pretty different from each other, from the diffusion of viruses (e. g. Linarda et al., 2009), to the simulation of battlefield and military sector (e.g. Safak et al., 2008, Cioffi-Revilla and Mark Rouleau, 2010).

The theorical approach proposed through the agency theory has been implemented through a number of different software tools. There is a multitude of tools available in literature to develop a multi- agent system, the most famous are Netlogo, Swarm, and Repast (see Railsback et al., 2006). Most of these, are strictly related to the academician use, due to the fact their use has been mainly adopted to the date for research purposes. Thus, there is no commercial software available, but most of it is freely developed and distributed through university institutions. Among all the software available one of the most used is Swarm, originally developed by the Sante Fe Institute of Complexities, although now is not any more linked with the institution. It represents an important mile stone in the multi agent based software. It has been born as a library tool in order to develop simulation through the

language Objective C (some years later also a Java version has been released). It has been largely used because it is well supported (Terna et al., 2006). An Italian initiative has been to develop the JAS tool, which has been fully programmed through data language and it is able to simulate models through discrete time steps. It is clearly inspired by Swarm, with a special focus on the fact all the project has been developed in Java while the interface give a full range of possibilities to interact with parameters and check how the experiment is being executed (Terna, 2006). However, in last years the program has not been upgraded and currently is not supported any more.

A third tool largely known by academician interested in agent based is NetLogo. It has been developed by the researchers of Northwestern University (Sklar, 2007). The main characteristics which have promoted its usage by academicians in different areas of research are the simplicity of the language adopted as well the easiness of the development tool included (Railsback and Grimm, 2012). In particular, the language used by Netlogo is Logo, a Lips dialect, which results easy to be learned even by people with few skills in programming. However the easiness of usage is paid in terms of flexibility, and limits on the complexity of the model to be simulated. On the opposite side, Swarm and Repast are considered to be more advanced tools, with fewer limitations but they also require higher informatics skills in order to set up the agents.

A more recent and innovative project is MASON, acronym for "Multi-Agent Simulator Of Neighborhoods". This tool for the development and simulation of multi agent models based on discrete time frames has been fully developed in Java, by the Evolutionary Computation Laboratory (ECLab) in collaboration with the Centre for Social Complexity at the George Mason University (Luke et al., 2005).

It has been particularly used when a high number of agents would have been required. It has been specifically developed by its authors in order to make feasible the simulation of a complex system with a number of agents, even in terms of speed of simulation. According to Railsback (2006) MASON is the fastest simulation tool among the prevously listed, to process the same environment and agent relations could be even 10 times faster than in NetLogo, 30 times faster than the Swarm version developed in Objective C and 50 times in case of SwarmJava.

Moreover, it is based on a open source project, and developed in a multi language platform, which allows simulations and replications of results in every kind of system. The architecture through which is based allow a modular system, which allows to interact, even dynamically during the simulation with any external layers or tool (Luke et al., 2004).

However, Railsback (2006) do not suggest to use a tool for every kind of simulation rather it helps the researcher to choose according his needs and skills (Table 4).

Table 4 Comparing different simulation toolkit

Toolkit	Mason	NetLogo	Swarm	JAS
MultiAgent	Yes	Yes	No	No
Java Based	Yes	Yes	No	Yes
Model in Java	Yes	No	No	Yes
Currently updated	Yes	Yes	Yes	No
Graphic Tool	Yes	Yes	Partially	Partially
Possibility to expand through external tool libraries	Yes	No	Yes	No
Open Code	Yes	No	Yes	Yes

More noticeable characteristics of MASON are:

- relatively small program;
- model can be simulated with or without a graphic support, it is also possible to remove or restore the graphic tool in every moment during the simulation (it is useful due to the fact graph tools could slow the simulation process);
- it uses *checkpoint* through which it is possible to stop a simulation in every moment and restart from that point later;
- it is possible to easily load other *framework* if they have been developed in Java;
- it can recreate same results over different platforms;

- graphic tools are bidimensional and tridimensional, the researcher can choose what is better according to his needs;
- easiness of implementation about external tools, some through automatic procedures, with such a tools it is possible for example to plot graphs results of simulation, create PNG image as well videos in Quicktime;
- code is *open-source.*

During this work the java based tool Mason (Luke, 2004) has been chosen in one of its last version (15) mainly because of its capability to simulate an unlimited number of agents with different behaviours and for the facilities provided that allow monitoring of the evolution of the parameters over the time. One more reason has been the possibility to modify the source code in order to adapt to any needs, as well the possibility to use on the same time different graphic tools to the evidence the ongoing simulation and its results. Moreover, such a tool is still updated and supported.

Such kind of model could be used also in order to test how different user behaviours could influence the service supplied and the evaluations made by the local authority when an aggregated VC model is applied.

This leads to formulate the following hypothesis:

Hp6 *A simulation tool is useful to take into account customer satisfaction and value for customer in a evaluation of a public service.*

3. Case study: Waste Collection Services

I. General characteristics of waste collection services

Historically, the amount of waste generated by human population was easily manageable mainly due to the low population densities, coupled with the fact there was very low usage of materials neither recyclable neither biodegradable. Thus, with the change from nomadic population to sedentary the increased stress for the environment was still limited. This does not mean there was no waste collection and disposal system. A waste management system has has been reported to exist at least from 2000BC (Melosi, 1981). Moreover, two thousands and five hundred years ago there was already at least a municipal dump in the Western world and the first rule against throwing garbage in the streets have been already issued by the Greeks. However, the hygienic measures have not been always sufficiently considered in that age. For instance, in fourteenth-century Black Death in Europe may be partly attributed to the practice of littering of organic wastes in the unpaved streets and roadways in the cities (Tchobanoglous et. al. 1978). Later in the history, the industrial revolution has been important in shaping the early evolution of waste management. Industry attracted urban populations, and crowded urban centres generated waste in large quantities. Moreover, epidemic diseases that struck cities prompted rising public concern about the quality of the living environment. The sanitation problems associated with this waste created the need for institutional waste management.

Before the industrial revolution, waste has been disposed in a number of different ways, human and animal wastes were often applied to the land as fertilizer. In some cases, waste was used as fuel for indoor burners and destroyed in fireplaces or outdoor bonfires. Food waste was often fed to animals, particularly swine. Similar practices prevailed in colonial America, although available nearby for use as dumping sites. Waste was collected on behalf of individual property owners, and discarded onto the land, either uncovered or buried. Waste was also deposited in open bodies of water, such as ponds, bogs, lakes, rivers and the ocean. With the industrial revolution it grew the necessity for an improved waste management. The first organized incineration of collected refuse occurred in Nottingham, England in 1874 (Melosi 1988, Kimball 1992). In 1898, the nation's first municipal recycling center was been established in New York City by Waring (Melosi, 1981). He also conducted researches into

alternative methods of refuse disposal to avoid ocean dumping and land application, which were the prevailing practice of his time. During the same period, waste management was alternatively managed by municipalities and through contracting out, without that any specific trend in preference of one of these system could be recognizable (Melosi, 1981). For example, the contract system was implemented in New York City for street sweeping in 1890, after a long period of municipal control. Moreover, Waring transformed it from an inefficient political patronage mill into a prototype public works department that ran with military, if not businesslike, efficiency (Hancock, 1995). On the other hand, during the same period in Chicago, the contract system was severely criticized as corrupt and inefficient, and the municipal system prevailed. Contemporary practitioners were claiming a more relevant role of engineers and technician over the public administration in order to solve issues arised on municipal refuse collection and disposal. From the beginning of the century and during the next twenty five years several changes were made on disposal in the USA. Reduction strategy increased its relevance; incineration was lightly reduced, as well dumping in the water, farmer use largely decreased, in favor of more landfilling as well multiple methods (Melosi, 1981). By 1930, refuse management had been transformed into an institutionally organized, technology focused, municipally operated service, employing mechanical street sweepers, covered trucks for waste collection, scales for the recording of waste collected and disposed, barges for the transportation of refuse by river, machinery for the burial of waste, and engineered drainage for the removal of water from waste-disposal sites (Melosi, 2000, Montville, 2001). In 1934, the first sanitary landfill in America has been opened and adopted speedily among 100 different cities across USA during just ten years (Tchobanoglous et al., 1977, Melosi, 2000) and becoming in the 1960s the dominant means of disposing of municipal refuse, since it was viewed as economical and at the same time offering a sanitary method to reclaim land for the ever-growing cities (Tarr, 1996).

In short, the period 1920 to the date saw a dramatic increase in the rate of generation of municipal refuse, as rising American affluence and urbanism accompanied higher levels of consumption and its attendant waste (Thogersen, 1996; Mertins et al., 1999). On the same time preferred disposal methods have been changing over the time depending on legislation, perceived concerning about risks, the not-in-my-backyard (NIMBY) syndrome (Melosi, 2000), as well technical evolution of disposal methods (Louis, 2004).

While in the USA is reaching 750kg per capita per year (EPA, 2008; OECD, 2008a,b) the OECD area 580 kg per inhabitant (OECD, 2008b), India contributes with 170kg per inhabitant and China with 320kg. Recent estimates suggest that the municipal solid waste (MSW) alone generated globally more than 2 billion tonnes per year.

With the perspective of even higher amounts of waste in the next future, governments are increasingly more concerned about waste management practices and different alternatives have been tested or studied.

In particular, the first strategy promoted by governments is to reduce waste at source, through the imposition of rigorous standards and increased disposal costs. With such a strategy it is supposed that products should use less material, for example with the reduction of the packaging, as well with less waste during the manufacturing process. It also means encouraging consumers to avoid using disposable products (such as disposable cutlery or nappies, and designing products that use less material to achieve the same purpose (for example, lightweighting of beverage cans).

A second step in the strategy is to promote the reusing. For instance, glass bottles could be cleaned and reused. For instance in Germany, almost every supermarket has an automatic machine which payback for used bottles. It also includes reuse of second-hand products, repairing broken items instead of buying new and promoting products that are reusable (such as cotton instead of plastic shopping bags).

One more step is finding other beneficial uses for waste, as composting. It means that organic waste is separately collected to be, at the end of the process, recycled as fertilizer. There are several ways to compost, it is possible to do it at home, in case of houses with some garden, saving all collection costs, as can be organized a large scale composting, where mechanical biological treatment is applied through a multi-step process. Treating organic waste strongly reduces gas emission after landfill.

Disposing of waste in a landfill involves burying the waste, and this remains a common practice in most countries. Landfills were often established in abandoned or unused quarries, mining voids or borrow pits. A properly designed and well-managed landfill can be a hygienic and relatively inexpensive method of disposing of waste materials (Batarseh et al., 2010). Older, poorly designed or poorly managed landfills can create a number of adverse environmental impacts such as wind-blown litter, attraction of vermin, and generation

of liquid leachate. Another common byproduct of landfills is gas (mostly composed of methane and carbon dioxide), which is produced as organic waste breaks down anaerobically. This gas can create odour problems, kill surface vegetation, and is a greenhouse gas.

Landfill is to be considered the last option for those wastes which cannot be treated by alternative measures and for the residues of incineration. With the usage of the previous strategies the amount of waste disposed through landfill without recovering energy should be kept at the minimum (DoE, 1995). The amount of MSW disposed at landfills widely varies around the world. It is accounted for 3% in Japan, 18% in Germany, 36% in France, 54% in Italy and the USA, and 64% in the UK. Although such percentage could look very high in some countries, there has been a significant reduction in the amount of waste landfilled, for example in 1995, Italy landfilled 93% of MSW, and the UK 83%. It has been due to European legislation which imposed a change in the waste management, as well as the increased perceived unsustainability on a waste management based on landfilling.

Design characteristics of a modern landfill include methods to contain leachate such as clay or plastic lining material. Deposited waste is normally compacted to increase its density and stability, and covered to prevent attracting vermin. Many landfills also have landfill gas extraction systems installed to extract the landfill gas (Tsai, 2007). Gas is pumped out of the landfill using perforated pipes and flared off or burnt in a gas engine to generate electricity. Recent estimates indicate that gas from landfill is recovered for beneficial use at approximately 550 of the 1,654 landfills center in the US. While gas is flared at some landfills and some are too small for economical energy recovery, the United States Environmental Protection Agency estimates that energy could be recovered at an additional 500 landfills (EPA, 2011).

A current alternative is incinerator in which solid organic wastes are subjected to combustion so as to convert them into residue and gaseous products. This method is useful for disposal of residue of both solid waste management and solid residue from waste water management. This process reduces the volumes of solid waste to 20 to 30 percent of the original volume. Incineration and other high temperature waste treatment systems are sometimes described as "thermal treatment". Incinerators convert waste materials into heat, gas, steam and ash.

Incineration is carried out both on a small scale by individuals and on a large scale by industry. It is used to dispose of solid, liquid and gaseous waste. It is recognized as a practical method of disposing of certain hazardous waste materials (such as biological medical waste). Incineration is a controversial method of waste disposal, due to issues such as emission of gaseous pollutants.

Incineration is common in countries such as Japan where land is more scarce, as these facilities generally do not require as much area as landfills. Waste-to-energy(WtE) or energy-from-waste (EfW) are broad terms for facilities that burn waste in a furnace or boiler to generate heat, steam or electricity. Combustion in an incinerator is not always perfect and there have been concerns about pollutants in gaseous emissions from incinerator stacks. Particular concern has focused on some very persistent organics such as dioxins, furans, PAHs which may be created which may have serious environmental consequences.

Although the most obvious solution is to minimise the amount of waste that is being created and thus minimise the cost of collection and disposal, this requires long term strategic planning and large scale reorganisation with associated financial costs. Another obvious alternative is the re-use of materials before they enter the waste stream. However, it is not always possible to find ways of re-using existing materials (Romanski, 1996). In any other case waste municipalities are called to decide a planned strategy. For the operation of waste management systems, waste generation related planning data have an essential influence on:

- recycling rates,
- environment pollution,
- customer collaboration,
- personnel and truck utilisation (Matsuto and Tanaka,1993),
- operational costs (Grossman et al.,1974) with respect to collection and transportation,
- monitoring of systems (e.g., assessing effects of waste prevention action, recycling activities, etc. (OECD, 2003)).

However, MSW management is not only a technical problem, but is strongly influenced by political, legal, socio-cultural, environmental and economic factors, as well as constrained by as available resources (Kum et al., 2005). It implies that the waste management service can differ as well the policies on which they are based can differ. For these reasons a background about public policy regarding waste service is presented about two different countries, Italy

and Uk. Both legislations are based on a common European background which establishes a common framework for the handling of waste.

Directive 1600/2002/EC (OJ L 242, 10.9.2002, p. 1) calls for a development of measures regarding waste prevention and management, including the setting of targets.

Directive 2006/12/EC of the European Parliament (OJ L 114, 27.4.2006, p. 9.) puts in place the essential requirements for the management of waste major principles such as an obligation to handle waste in a way that does not have a negative impact on the environment or human health, an encouragement to apply the waste hierarchy and, in accordance with the polluter-pays principle, a requirement that the costs of disposing of waste must be borne by the holder of waste, by previous holders or by the producers of the product from which the waste came.

Directive 2008/98/EC (OJ L312, 22.11.2008, p. 10) confirms the priority to apply the waste hierarchy. In order to promote the design of products which reduce their environmental impacts and their generation of waste, States could apply producer responsibility, under the condition it do not affect the market, is technically feasible and economically viable. In order to achieve high quality recycling by 2015 all States should collect separately at least paper, metal, plastic and glass, by 2020 separate collection should be at least 50% of the total waste in term of weight. Moreover, recycling and other material recovery, including backfilling operations using waste to substitute other materials, of non-hazardous construction and demolition waste shall be increased to a minimum of 70 % by weight. These targets could be reviewed and increased within 2014. The same directive states that disposal should be done without risk to water, air, soil, plants or animals; without causing a nuisance through noise or odours; and without adversely affecting the countryside or places of special interest. Member States should develop specific waste management plan, taking into account “best available techniques” as well the possibility to set up minimum standards for providers and necessary measures to prohibit the abandonment, dumping or uncontrolled management of waste for example through penalties. However, the directive do not specify in any way which are these “best techniques” currently available, neither which could be the minimum standard or how set them. About the penalties is just said nothing more specific than these shall be effective, proportionate and dissuasive.

However, the directive also posits that Member States shall ensure that relevant stakeholders and authorities and the general public have the opportunity to participate in the

elaboration of the waste management plans and waste prevention program, and have access to them once elaborated. In particular, they shall place the plans and program on a publicly available website. Nevertheless, at least in the countries analyzed by us (Uk and Italy) the general public cannot directly participate in the elaboration of waste management, at least regarding the national level, however their ideas can be promoted through groups and associations.

UK legislation is applying the last European Directive through a working progress statutory instrument (EPEW, 2011). It mainly confirms the European directive, adding the need of periodic inspections of waste facilities and also specifies several limitations to the landfill usage and some request for sea deposits. Without making it compulsory, the act also promote, as a possibility to include in the waste management plan a specific consideration of the geographical level and geographical area to which the plan is related; the organisational aspects related to waste management including a description of the allocation of responsibilities between public and private actors carrying out waste management; the evaluation of the usefulness and suitability of the use of economic and other instruments in tackling various waste problems, taking into account the need to maintain the smooth functioning of the internal market; the use of awareness campaigns and information provision directed at the general public or at a specific set of consumers; the historical contaminated waste disposal sites and measures for their rehabilitation. Moreover the statutory instruments posits that after a proposal about waste management plan is prepared consultation bodies should receive a copy, as well people who in the authority's opinion are, or are likely to be, affected by the program or plan, or have an interest in the program or plan. The opinion of the consultation bodies and public consultees should be welcome, and all explicitly considered before any decisions.

Previous documents, in particular the Environmental Protection Act (DoE, 1990a) has been starting to create the framework within which local authorities, contractors and individuals within the industry are supposed to be stimulated to recycle more waste, by providing a system of recycling credits to be paid for each ton of material removed from the disposal path. The UK Government White paper 'This Common Inheritance' (DoE, 1990b) indicated the Government's commitment to reduce the nation's dependence on landfill.

Since April 1996 the Environment Agency has responsibility for the regulation and monitoring of the municipal solid waste industry, encouraging the initiation of regional waste

facilities, and providing long-term policies. This body has inherited the regulatory powers of the former waste regulation authorities which were part of County Councils, and is thus a key development in the continuing shifting balance of the municipal sector, taking practical discretionary power away from local government who remain only responsible for waste collection and disposal through contracts with the private sector (Read et al., 1997).

Government research had identified two main failures in the operation of the solid waste market, first there was no direct incentive through the pricing system to reduce or recycle waste, and second the prices of the different waste management options did not accurately reflect their environmental impacts (Pearce and Turner, 1993). The UK Government has actively attempted to partially correct these failures through the introduction of the Recycling Credit Scheme, whereby local authorities are paid subsidies on the basis of verified weight of recycled material which is removed from the disposal chain. Moreover, a more recent attempt to has been made through the introduction of the landfill tax to raise the cost of landfill to a level which accounts more fully for its environmental impacts (Jones, 1996).

While UK government has starting to worry about the limits of landfill Coopers and Lybrand (Coopers and Lybrand, 1993) wrote about a possible levy on controlled waste which was landfilled, as part of a series of studies on economic instruments. It came to the preliminary conclusion that a landfill tax could be feasible. However, it also concluded that in the short term there would be little change in the quantity of waste being landfilled, though in the long term there would be an increased incentive to incinerate waste. The study expected recycling to be relatively unattractive even at a levy of £20 per ton, whilst the levy posed the threat of encouraging fly tipping and other forms of illegal disposal.

In 1996 landfill tax has been placed on every ton of waste which goes to landfill for disposal, at £7 for active wastes and at £2 for inert. This increased the landfilling costs considerably and encouraged the adoption of alternative strategies as they become more economically competitive against an ever more expensive landfill route. Predictions from Coopers and Lybrand (1993) suggested that a £10 levy per ton would stimulate an increase in recycling from 2 to 4%, whilst incineration levels would rise by 5% from 7 to 12%.

Thus, the tax can became a benefit to both the environment and to UK industry more in terms as a catalyzer for the good reasons to recycle than for a strictly economic advantage.

As in the UK, in Italy has been created a National Observatory about Waste, (art. 26 D.Lgs. 22/97). Similarly to the Environment Agency, this institution has been created in order

to guarantee the implementation of the rules about waste reduction, health risks, as well the economic costs and efficiency of waste management.

In particular, it is regulated by the national law n.309, 18/4/2000, according to which the Observatory has to:

- vigilate on waste management, packaging, and waste of packaging;
- to elaborate and keep update constantly criteria as well specific aim to guide the actions, also through a list of best practices or possible schemes of actions;
- to express an opinion on the general program for waste reduction (as in the art.42, D.L. 29/97) to the Ministry of Environment and Ministry of and Industry, Commerce and Artisan;
- to verify costs of waste collection and disposal;
- to verify the service quality;
- to prepare an annual report on waste management, to be transmitted to the Ministry of Environment and Ministry of and Industry, Commerce and Artisan, and Ministry of Health Care.

The main background on which National Observatory, as well all the other parts involved in waste management are is based on the law 22/97, the so called "Decreto Ronchi", which has been applied three different European directives (91/156 about waste, 91/689 about dangerous waste, and 94/62 about packaging). However, the legislation has been currently updated mainly through DL 3 april 2006, n. 152, called Unique Text for Environment (originally Testo Unico Ambientale), which contains the general legislation about all environmental issues, including the waste management. Some other relevant laws which have an impact on the arguments of the presents work are DL 3 august 2005 which sets the limits about the kind and quality of the waste which can be landfilled and the ways to control the respect of the rule itself.

DM 2 may 2006 which regards the outsourcing to consortia for the recycling of materials after their collection.

DM Environment 29 january 2007 which set specifically which are the best practices about waste disposal, and DM Environment 8 april 2008 which regards how recycling collection centers should be implemented, and work.

According to the current laws each region should have a regional waste management scheme. Moreover should exist in the local level Authorities (Autorità d'Ambito Territoriale Ottimale, later called AATO) with a specific plan (Piano d'Ambito). These ATOs have been created in order to avoid the service fragmentation through an integrated waste management.

The regional waste management schemes should fulfill these main aims:

- Decrease the amount, the volume, and the hazard of wastes,
- Develop recycling and reuse of materials,
- Develop recycling of organic waste and garden waste in order to make good quality composting,
- Obtain energy from all the remaining waste trough incineration, new incinerations have to recover also the energy produced,
- Landfill only the minimum residual waste which still has to be disposed after that all the previous steps of the process have been applied.

Moreover, these regional schemes should include rules about:

- Conditions and technical criteria about the location of waste facilities,
- The kind of waste facilities to realize in order to obtain the autonomy of each ATO,
- Divide the territory in different ATOs (Ambito Territoriale Ottimale) according to the physical, technical, demographic and political (in terms of the pre-existence of different local administration) conditions. It should also consider the existent connections through roads and railways.
- The promotion of correct waste management practices through the use of incentives,
- The prescriptions to avoid the pollution of soil and water,
- A forecast about the costs of waste collection and disposals,
- The initiatives in order to limit the waste production and increase reusing and recycling of materials, and recovery of material and energy,
- The initiatives to promote the regionalization of waste services,
- Kind and amount of municipal waste to recover or dispose, for each ATO,
- Technical parameters to be guaranteed in waste management,
- Plans for recovering areas with pollution.

Relations between AATOs and service provided are strictly limited by the law.

In particular the main prescript conditions are:

- Service provided have to have an economic equilibrium,
- Service contract can be shorter than 15 years,
- Information and data transmission have to be considered in the contract
- Penalties in case of breach of contract,
- Conditions under which is possible to close the contract before the deadline,
- Efficiency and reliability service to guarantee to the users also in terms of maintenance.
- Criteria for the determination of the tariffs for users, and its evolution over the time.

Moreover, the minimum amount of waste to be recycled has been set to 45% within the end of 2008 and 65% within the end of 2012 for each ATO. In case some ATOs do not fulfill the required amount of waste recycled, the costs for landfilling will be increased of 20%. Such cost will be covered by all the municipalities in the ATO which did not reach the aim.

In 2008 Italy has been creating a new institution for the research about environment and protection, ISPRA (Istituto Superiore per la Protezione e la Ricerca Ambientale).

Such institute has been analyzing waste management sector in Italy according to several perspectives:

- amount of waste produced,
- kind of waste produced,
- disposal technics applied,
- packaging,
- tariffs,
- costs,
- benchmarking with others European countries

Results of such analysis are valuable as they have been taken into account 80% of municipalities and 79% of inhabitants of Italy.

According to these data, on average in Italy there is a collection cost for refusal waste of 92,4€ per inhabitant and 0,23€ per kilo. Such cost decreases of 0,06€ per any kilo more than the average (Table 5). A linear regression explain the decreasing cost per kilo, when the waste

production increase with R=0,5328 which explain 28% of the decrease. Moreover, further analyses posit a correlation between the number of inhabitants and the waste management costs due to the decreasing recycling ratio (Table 6).

Last, the lower amount of recycling collected in south of Italy, due to a lower amount of waste disposed (480kg vs 536kg in the North and 645kg in the Center) and to a lower recycling ratio (16,3% vs 46% in the North, and 24,5% in the Center) has a strong impact on the cost of managing the recyclable waste. While the cost of managing refusal waste is 30 eurocents on average, the cost for managing recyclable should be much lower but this is not always true. It is in North and Center Italy where to manage recyclable there is a cost of 13 eurocents, but is not at all in South Italy where there is a total cost of 27 eurocents which is just 10% lower than average refusal cost (Table 5)..

Table 5 Waste Management Costs in Italy (2009)

Refereed to	**Typology of service**	**Cost per inhabitant €**	**Cost per Kilo €**
Italy	All Waste Management	167,5€	26,6€
Italy	Street clean services	26,6€	6,8€
Italy	Dispose refusal waste	92,4€	0,23€
Italy	Dispose recycling waste	26,7€	0,11€
Italy	Collection refusal	28,3€	0,07€
Italy	Collection Recycling	22,7€	0,09€
North Italy	Managing Recycling		0,13€
Centre Italy	Managing Recycling		0,13€
South Italy	Managing Recycling		0,27€

Table 6 Costs and number of inhabitants (2009)

Number Inhabitants	**% Recycled**	**Total Costs**
Italy	37,9	167,5
<5000	57,4	114,2
5000-10000	53,7	133,8
10000-50000	53,4	136,6
50000-150000	38,7	143,2
>150000	26,3	195,1

Thus, it interesting to hypothesize that *complexities and differences among different places would make difficult to compare different services through benchmarking if only a few of parameters are adopted(Hp3).*

According to the National Observatory parameters to be considered for the waste services are (see also Figure 9 for a general resume):

- Number of users served and inhabitants,
- Frequency of collection,
- Number of tracks used,
- Number of employees,
- Number of bins,
- Quantity of waste.

Collection services can be based on different actions:

- Road collection,
- Door to door collection,
- Services for commercials.

In case of road collection users dispose their waste through bins which are placed for more householders, which are periodically emptied by tracks. Typically there are bins of 1.100-3.200 liters each 40-60 inhabitants. It is important to avoid that user could find a full bin, as well that waste is kept in the been for more than one full day.

Waste collection timetable should to be chosen during not critical hours, for the traffic, and neither on night time, for the noise. Three workers for each track are usually employed. Esthetic impact is considered a typical contra of such methodology.

Door to Door Collection is usually applied in order to increase the ratio of waste recycled. Sometimes it is also adopted due to the lack of space for bins in the roads or for measure the amount of waste of each household in order to customize the tariffs. In such kind of collection, waste is disposed by householders during specific days at specific hours in front of their buildings. It can be implemented through plastic bags or bins which size usually vary between 35 and 360 liters. Main problem of such solution is that users have to use their spaces

in order to deposit waste till the day of collection. Moreover, in case of missed collection health, esthetic and smell issues could arise.

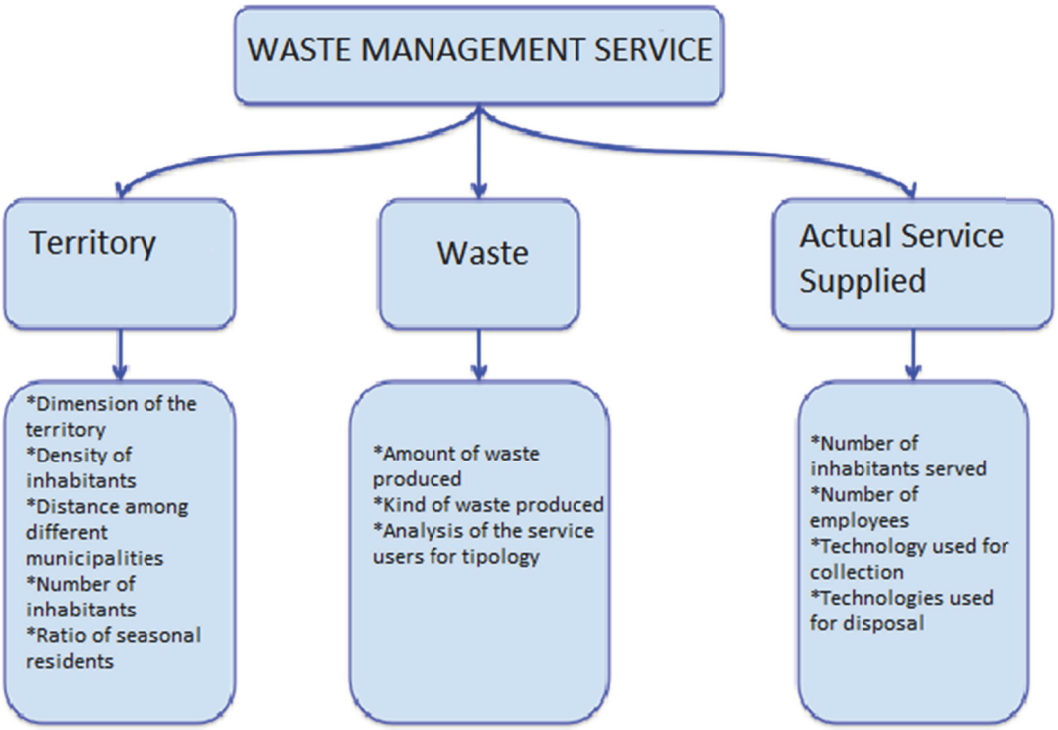

Figure 9 Elements for planning and realizing a waste collection service

For a better clearness, the waste management process has been here resumed (see also

Figure 10 and Figure 11). While users are responsible for the waste production and have the main responsibility to increase the efforts for reducing their waste, their collaboration can be useful also regarding their role on separating the waste produced. Service supplier is involved in the following phase collecting the waste from users, transporting it to some waste management center, and eventually separating again in order to obtain separate streams for optimizing the final disposal.

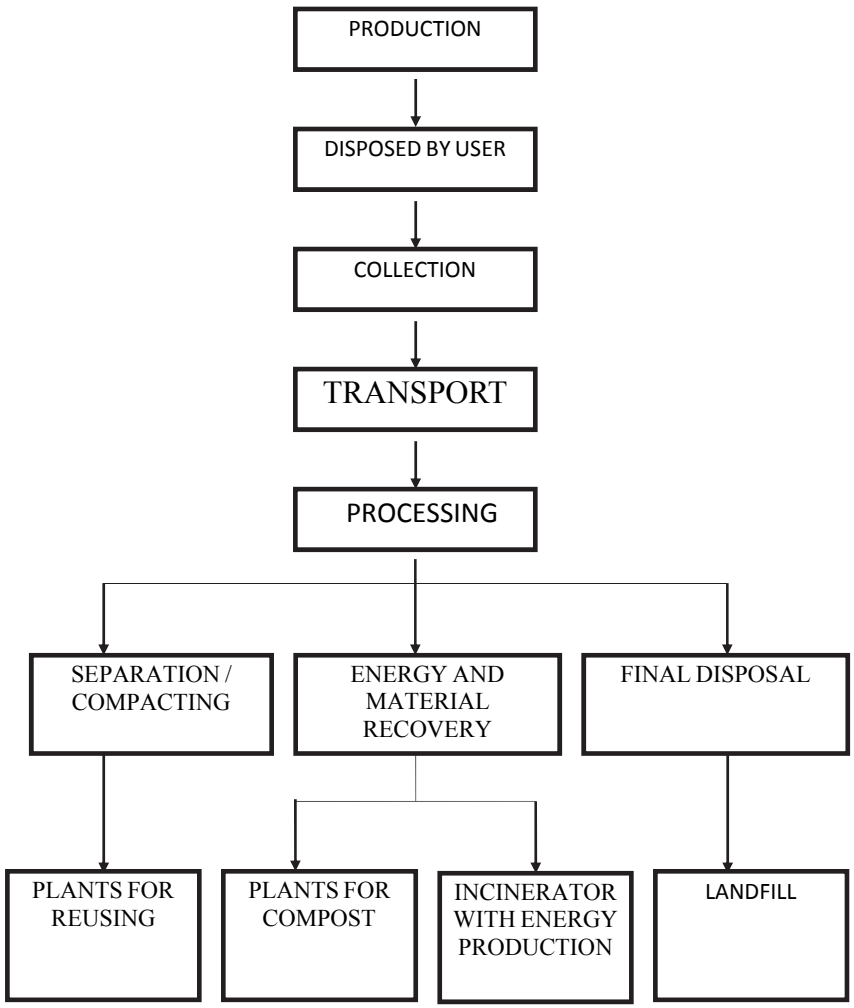

Figure 10 Scheme of a waste management service.

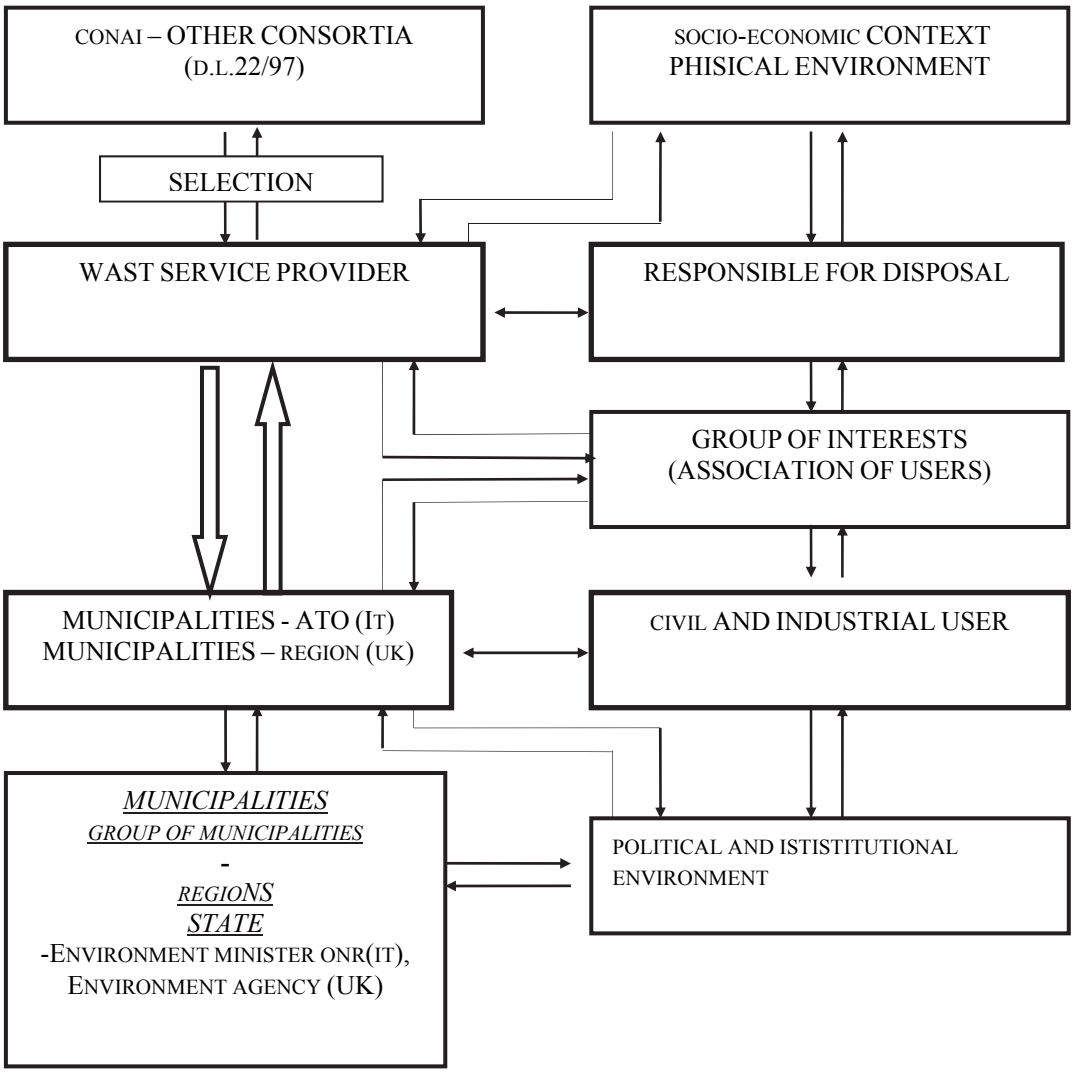

Figure 11 Scheme of actors involved in a waste management service.

4. The approach proposed

I. Research questions

Customer satisfaction in public service is relevant? Despite of frequent use of surveys in public services to check customer satisfaction, despite of the need of more and more accountability to citizens has been recognized by all constituencies in a public environment, there is no clear statement in the law about how to use customer satisfaction as measure of service quality. The usability of customer satisfaction analysis in a public context is still questioned by managers and there is no clearance about how customer satisfaction has impact or should have impact in a public service.

In order to investigate the subject a specific public service has been chosen, the municipal waste service (MWS). This sector has been chosen because it is currently experiencing relevant strategic changes. In particular, there is a strong pressure to improve its performance as well an increased request of accountability and collaboration from citizens.

The first research question aimed to clarify the existence of gap in public services between the expectations of citizens and that of public managers.

The literature review about public services have been considering several reasons for the existence of such a gap, although these motivations have been sometimes contested and not many resources have been dedicated to clarify how public managers should behave in case of a gap. Thus, part of the investigation has been dedicated in order to identify specific cases when the evaluation of public authorities and citizen strongly differ. This would confirm the:

The evaluation of a public service done by public authorities and citizens could differ (Hp1).

Moreover, the investigation have tried to identify through the interviews to managers, public authorities and citizens, the relevance of customer perspective not only for individual evaluations in terms of customer satisfaction, but also in terms of supplier results which confirm the rightness of:

Any evaluation about the service should consider both the perspectives of public authorities and citizens (Hp2).

The confirmations obtained during the research evidenced the need of considering, at least partially, the customer satisfaction as part of a fair evaluation in public service, as stated in the second research question (see also Figure 12).

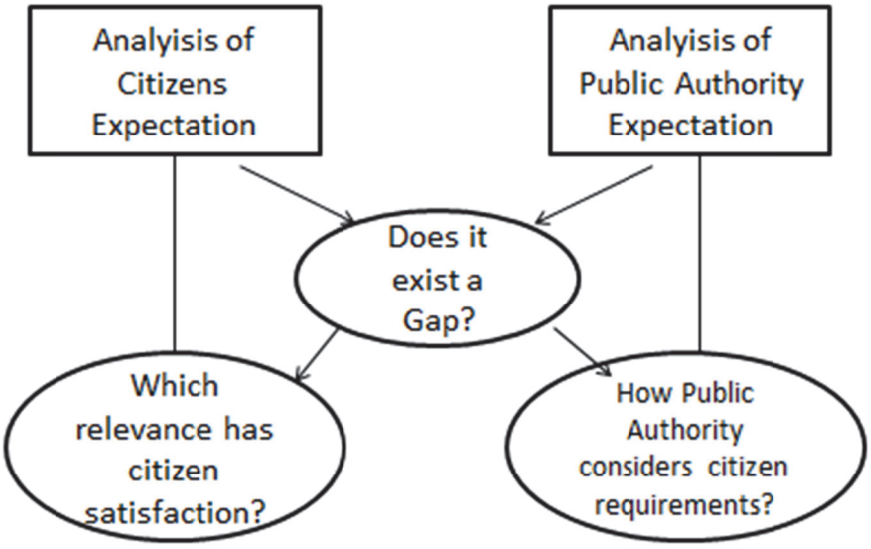

Figure 12 Research questions

The answer to such a question has been given through several approaches which are unified and find their resume in a multi agent based model. In particular, the investigation has been looking for evidences about *complexities and differences among different* case studies which *make difficult or impossible a comparison of services through a few of parameters (Hp3).* Several differences have been recognized in terms of customer expectation which can be deeply varied among places due to variables which are not always under any control of public authorities. Moreover, several constraints to the service provision have been identified which limit somehow the standardizability of such services. Although it means increased difficulties for adopting universal parameter of evaluation and universal values to be achieved for these parameters, it do not deny the possibility to develop a *Value for customer concept, useful to* evidence *the different components of value (Hp4),* in order to help public authority in considering all the dimensions and the temporal phases which affect the value of the service provided. On the same time, to test the *Gap model revised in order to consider the three main stakeholders in a public service (Hp5)* would be useful in order to set the limits according to which a customer dissatisfaction should be considered as responsibility of the supplier or a

implication of public authority's decision. In last part of the work *A simulation tool* which considers *customer satisfaction and value for customer for the evaluation of a public service (Hp6)* is proposed.

II. Conceptual Framework

The analysis has been based through case studies in order to get a wide perspective about the service, recognize the different role of each stakeholder and which are the interactions among them. Due to the lack in literature of a framework adapt to investigate the triangulation among the three main stakeholders in public services, in the first part of the research the gap model (Parasuraman et al., 1985) has been revisited in order to explicitly consider such triangulation. The main purpose of the so revisited model is to provide the necessary framework for further investigation about the possible gaps which could have an impact on users and public authority perceptions and expectations.

Later, a specific investigation about MWS has been carried out. The methodological approach of it can be resumed in its logical steps in three main phases (Figure 13). In a first phase the background of a public service has been studied, through its legal framework, the analysis of the stakeholders and of the service itself. This part of the work has been done through literature review, the recognition of the main laws involved as well the informations collected through the selected case studies. In the the second phase the level of service which should be provided has been recognized according to the laws, political aims and technical constraints. The level of the service to be provided has been used in order to apply the value for customer concept to the waste service. Moreover. the analyisy of the behaviours of the different stakeholders has been used to test the gap model revisited.

Finally, in the last phase the parameters proposed as part of the value for customer, as well the relations outlined in the gap model has been used to develop a simulation. Moreover, the results, in terms of managerial implications have been analysed.

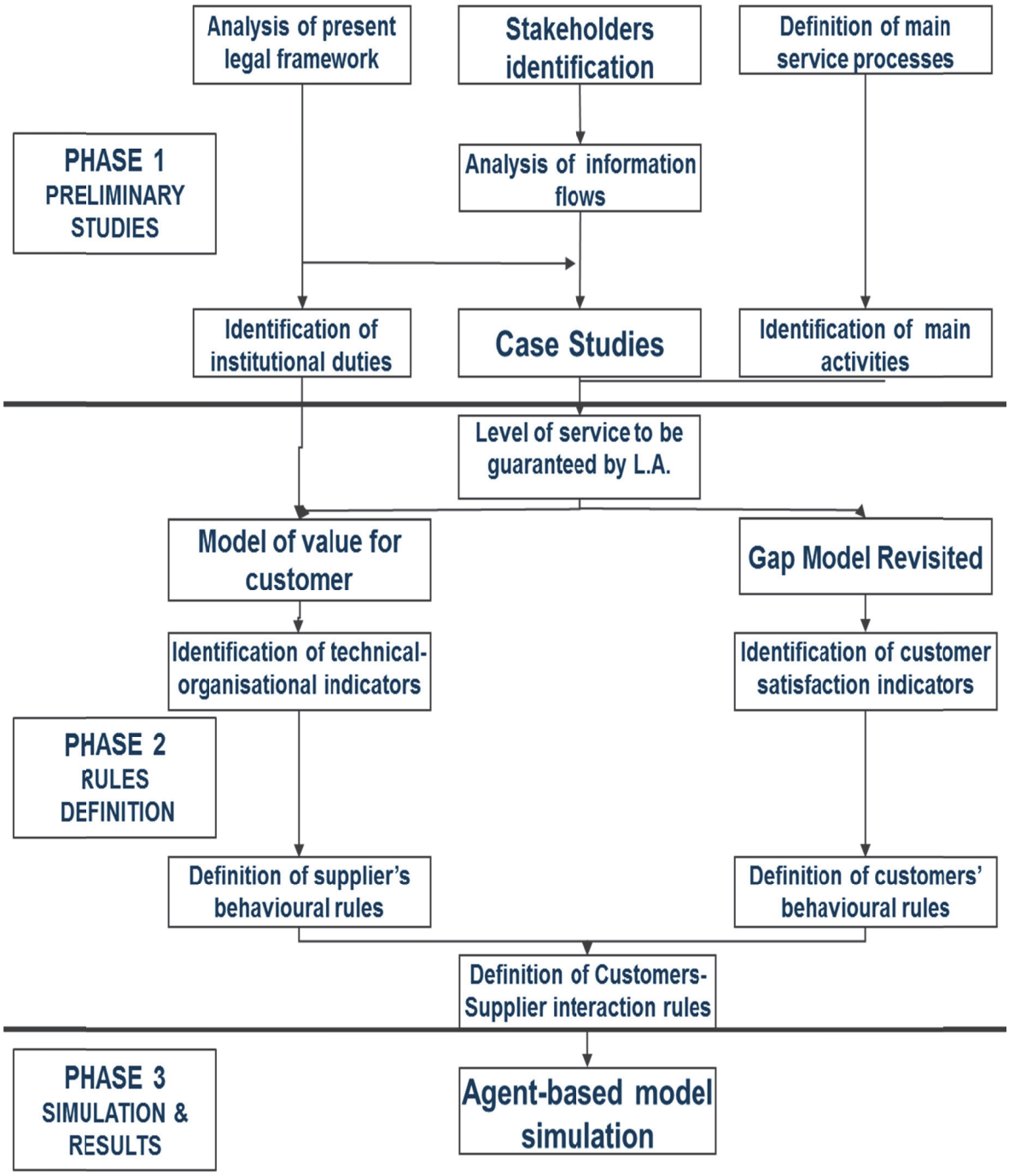

Figure 13 Conceptual methodological approach

III. The methodology applied

Case studies are generally the preferred method when questions research have a broad focus and aim to get an in depth perspective about a complex phenomenon, or decision, which is happening in real time and with little or no control on event by the investigator (Yin, 2009). The peculiarities about investigating on a real-life context imply that exist many more variables than data point, to cope with such difficulties it is important use multiple source of data and triangulation. The adoption of a case study approach in a research do not exclude to use other methodologies as archival analysis or survey in order to reply to the portion of the research which aim to reply to "what" questions (Hedrick et al., 1993).

All cases have been selected from two different EU countries, Italy (cases C,D,M) and Uk(cases E,T,U) in order to have comparable cases, which work under the same European directives and are comparable in their waste collection practices. Informants have been chosen from: personnel from the waste collection practice of the local public authority; senior executive from the service providers and resident customers. Case studies have been selected among municipalities which are involved in strategic change about waste management service in order to be able to catch fresh impressions and data from managers, but most important their practices in order to consider customer perceptions, expectation and satisfaction. The unit of analysis has been considered each Municipal Waste Service.

More specifically, the methodological approach has been done as follows (Figure 14):

i. **Revisiting Gap Model** [Customer Satisfaction Model by Parasuraman, 1985]: the first stage in the research process has been to analyse revise the gap model in order to consider the public service peculiarities. Specific gaps have been identified in order to take into account the relations among the supplier and two different kind of customers (users and public authority).

ii. **Documentation review** [collection / collation of quantitative and qualitative data]: In this stage of the process the aim has been to gain an outlook about how waste service is currently provided and which are the process on-going promoted by laws and supported by public authorities. Documents have been used also in a later part of the process, after the interviews have been done, in order to confirm results from interview and to get a wider amount of quantitative data.

i. **Interviews** [collection / collation of qualitative data]:, Through in-deep interviews the expectations of all stakeholders involved have been analyzed. Moreover, it has been investigated how the same directives and laws could find different solutions in the case studies analysed. Through the interviews, an exploratory attempt to recognize main antecedents of such differences has been done.

ii. **Data Analysis** [quantitative and qualitative data interpretation]: Data collected through interviews, survey, as well secondary source have been used to resume which are the main facts which have influence on waste service in terms of supplier decision, customer behavior and public authority request.

iii. **Value for Customer Applied** [Selection of Parameters]: Results from data analysis have been used in order propose a preliminary set of parameters which could adopted by who has the role to the evaluate the service and guarantee its quality. Such parameters have been selected in order to have measures which consider the VC according to its different dimension and to the temporal perspective.

iv. **Gap Model Tested** [Qualitative evaluation of decision's impact on Customer Satisfaction]: The Gap Model Revised has been compared with the results obtained from the case studies in order to prove the existence of the gaps.

v. **Multi Agent Simulation** [Using outcomes Value for Customer and Gap Model]: A simulation based on multi agent system has been realized. It made use of the main relations among the agents already analyzed in the cases studies. Moreover, it adopts Value for Customer results for the evaluation of the service provided.

Figure 14 Methodological approach in steps

5. The Customer Perspective in Municipal Waste Services

I. Revisiting the Gap Model

In the present chapter a revised version of the gaps model by Parasuraman et al. (1985) is proposed. In this model the public body, which acting as the buyer of the public service, has been added along with the links with the other stakeholders of the service, namely the customer(s) and the supplier. Such links identify new gaps that in what follows have been reported and commented, in terms of the effects they determine.

In the revised model the public authority is considered as buyer. Moreover, it also acts as a customer although its behaviour significantly differs in needs and past experiences with respect to the end user. Thus, following such an approach, two different measures of customer satisfaction must be defined, namely user satisfaction and buyer satisfaction.

The former does not differ substantially from the customer satisfaction in the PZB model. However, several more antecedents of satisfaction has been recognized as it user and buyer satisfaction, can have mutual influences. In particular, user satisfaction can be affected by the buyer satisfaction through external communication.

The latter is based mainly on technical aspects (hypothesising that in the contract performances required has been defined), although the users' complaints could impact on such a satisfaction, as it can determine in the long term an impact on the vote behaviour (see fig. 2).

In

Figure **15** the gaps identified in the present model are reported. As in the original gap model, Gap 1 refers to misunderstanding user's expectations. Gap 2 is related to difficulties about translating management understanding in service quality specifications. Gap 3 is due to the problems that could be meet implementing specifications. Gap 4 is the misalignment between service supplied and service showed in communications. In what follows, the gaps that have been added to the original model by Parasuraman et al. have been interpreted in terms of propositions. Each proposition aims at describing the gap and its antecedents

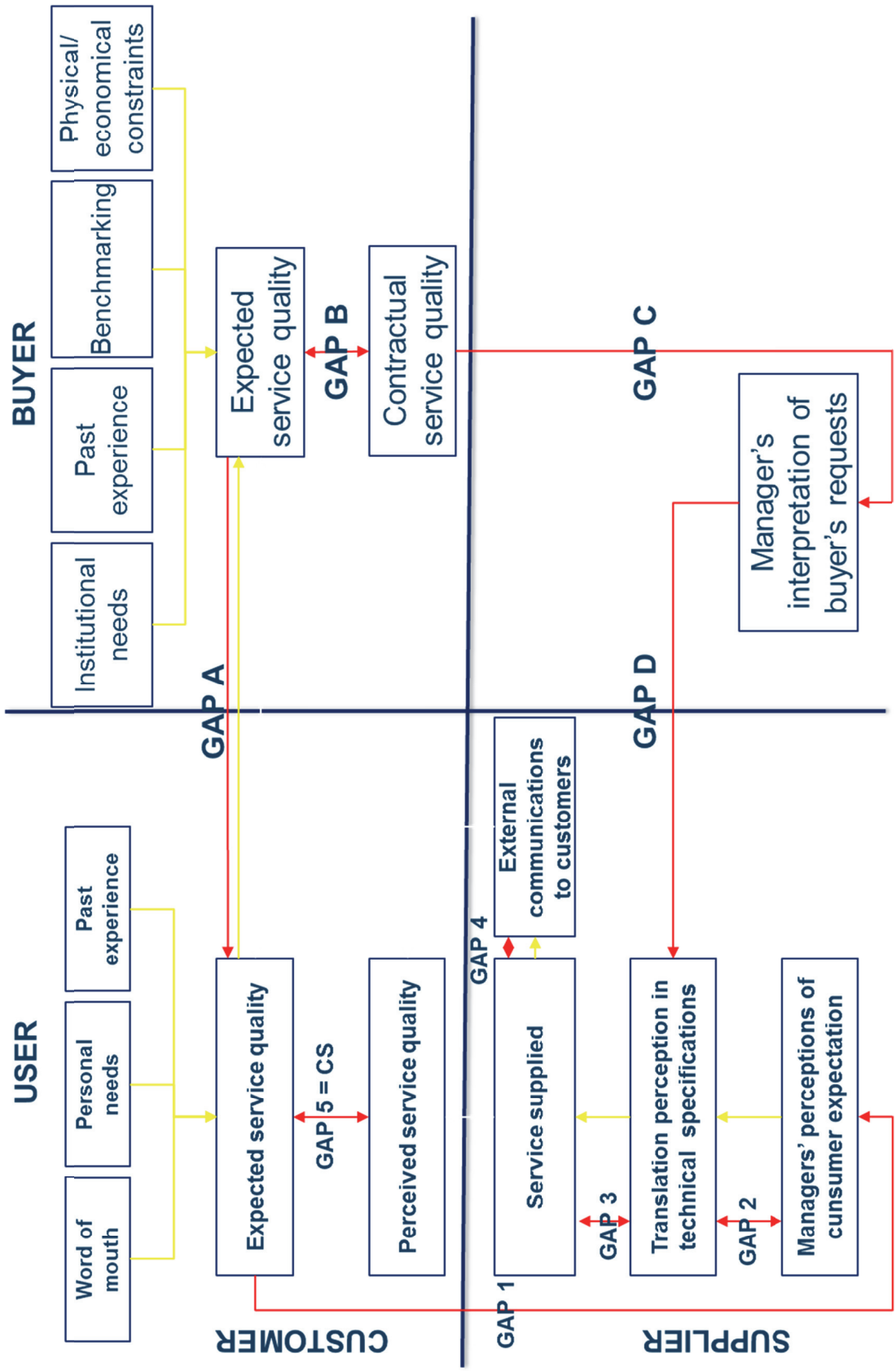

Figure 15 Gap Model Revisited

Proposition 1: *Gap1 in public services is influenced by more constraints than in the private sector.*

Although the Gap l is already considered in the original gap model (Parasuraman et al., 1985) in public sector it can be much more relevant than in private.

In the literature some of its antecedents are pointed out by Zeithaml et al. (1988). According to the former, service firm executives may not always understand what are the users expectations, what features should be implemented in order to match such expectations (Langeard et al., 1981; Parasuraman and Zeithaml, 1983). Moreover, this gap could be more relevant when the attention to the market is lower. If service organisations are more oriented to the process than to the market (Lovelock, 1981), this is even more true in non competitive sectors as the public one. Thus, the above mentioned gap (determined by a lack of knowledge, attention or sensibility to customer's expectations), may be even stressed in this context where the normative approach is predominant. Such an approach address the focus more to the process than to the customer. Despite a market orientation could improve business performance (Grinstein, 2008), since the public service markets are likely to be oligopolistic or monopolistic, the supplier could just not be motivated to pay attention to user's needs (Kay & Thompson, 1986).

Proposition 2. *User's expectations and buyer's expectations don't coincide and a gap (A) between the two might exist.*

The user and the buyer aims do not necessarily coincide. The buyer listens to the user's requests depending on political choices, which in turn depend on several constraints (financial, political, etc.) and should consider contrasting needs. As customer satisfaction is only one of the parameters to be taken into account by the buyer in its choice, the gap exists not only when politicians misunderstand the user's needs, but also when the buyer's core mission does not fit the user's requests. In other words, this gap exists when the criteria (or their weights) applied by buyer in the supplier evaluation, do not match those of the users. It is of paramount importance to take into account the existence of this gap when the supplier performances are evaluated adopting customer perceptions as the main measure of the quality. The supplier has neither control nor responsibility of this gap.

Proposition 3 *When the buyer formalizes its expectations in a contract, the incompleteness of this process will determine a gap (B).*

The relations between buyer and supplier are regulated by a written contract in which the parameters are specified as the minimum level to be guaranteed, as costs to be paid to the supplier, and in general as rules that both parts must follow. In recent years, the need for a more pro-active role by public sector organizations in market management (Filkin, 1998) has pushed toward the development of mutually rewarding relationships with external contractors, whether they were in the public, private or voluntary sectors (Erridge and Greer, 2002). Also, the success or failure of any alternative service-delivery arrangement likely depends on how well governments are able to manage the entire contract process. Effective contract management requires to mitigate specific problems that can plague the contract process. These problems arise from the dissatisfaction with prior contracting experiences, the transaction costs, the characteristics of the government's structure and operation, and the characteristics of external environment (Brown and Potoski, 2003).

The contract cannot precisely reproduce the buyer's expectations due to the difficulties to formalize some of them, due to unforeseen events, and due to the impossibility to forecast perfectly either the impact of some rules or the evolution of any fact, in the external environment.

Moreover, the contract cannot be easily modified (some time for tens of years), and future scenarios cannot be adequately forecast.

Proposition 4 *Incomplete contracts allow for opportunistic supplier's interpretation of some parts of the agreement as well as supplier's genuine misunderstanding of the buyer's requests (gap C).*

As much as the contracts are incomplete, the supplier's managers have to interpret the buyer's requests, sometimes acting opportunistically for getting advantages from unforeseen events (Hart, 2003).

If the public authority monitors the supplier, the control could reduce opportunistic behaviours and thus could likely null the gap between public's needs and supplier's manager actions.

Gap C is similar in its constituencies to the gap 3 in the original model. According to

Zeithaml et al. (1988) it is influenced by several aspects, that in what follows have been fit to the public service sector:

- supplier's skills, perceptions about inspections made by public authorities, and available tools for monitoring and inspection;
- conflict of interests;
- informal relations;

they could more likely reduce this gap when the buyer and the supplier coincide or when the top management of the supplier is appointed by the politicians.

Proposition 5 *Managers might not define the service specifications coherently with their perceptions of the buyer's request (gap D).*

A mismatch might exist between the managers' perception of the buyer's request and their effective translation in operational specifications.

This gap could be determined by several reasons. The contract's rigidity may make difficult to comply with the rule, taking also into account the rigidity of the supplier's structure. Furthermore, the supplier could prefer to act in an opportunistic way (e.g. in case of increasing costs to provide the service or a part of it). Due to the information asymmetry the possibility to control actions by the public authorities may be significantly limited.

Managers have to define the technical specifications taking into account both the contractual specifications and their perceptions of customer expectations (gaps 2 and D). Thus, the final specifications are a sort of trade-off resulting from the two pressures (taking into account also the interests of the organisation itself). Actually, more competitive is the market the higher will be the weight of the customer expectations (gap 2), while more monopolistic is the market the higher will be the impact of the contractual requests by the buyer (gap D).

Proposition 6 *CS= G5= g(Gap 1, Gap 2, Gap 3, Gap 4, Gap A, Gap B, Gap C, Gap D)*

As the model is based on Parasuraman et al. (1985), the original gaps maintain their names. Gap 5 is usually defined as the resulting customer satisfaction. It can be measured as

the difference between user's expectations and perceptions of the quality of the service provided, and it depends also on the contributions of the previous gaps.

In the present model, it is, as in the original gap model, the comprehensive result of all the previous gaps. However, in the revised version here presented, it is influenced by both user's and buyer's expectations. Moreover, in case of public services it is possible that the service provided depends much more on public decision than on customer expectations. In this case Gap A could have the biggest impact, as would be difficult to have satisfaction while buyer request strongly differ to customer expectation.

Proposition 7 *BS= Gap E = f(Gap 1, Gap 2, Gap 3, Gap B, Gap C, Gap D)*

The buyer is an institution which evaluates the service in terms of the supplier capability to respect the contract. Since the contract is based on technical parameters, the Buyer Satisfaction (BS) in public services results from the gap between the parameters reported in the contract and the actual parameters measured with reference to the service supplied. It can be considered a measure of the technical service quality (Gronroos, 1982).

The key point is the actual possibility to measure the technical parameters. When a service is contracted out, there might be a lack of control about service quality due to several reasons. First of all, the information about the state of the service could not be collected or collectable directly by the buyer. This implies the possibility of opportunistic behaviour by the supplier in providing information. Moreover, in several cases the public buyer has not the competencies to take the role of controller. This means that this gap could be reduced improving the control systems, adding skills on the buyer side, and avoiding misalignments in the information.

II. The impact of the gap model revisited on service quality measurement

Among the gaps outlined in this work and by Parasuraman et al. (1985), only few have to be considered in order to evidence the discrepancy between the three main stakeholders. A scheme of the gaps directly involved in the relationships among the three main stakeholders is sketched in Figure 16, where each of them is represented in one edge of the truncated pyramid

with triangular base.

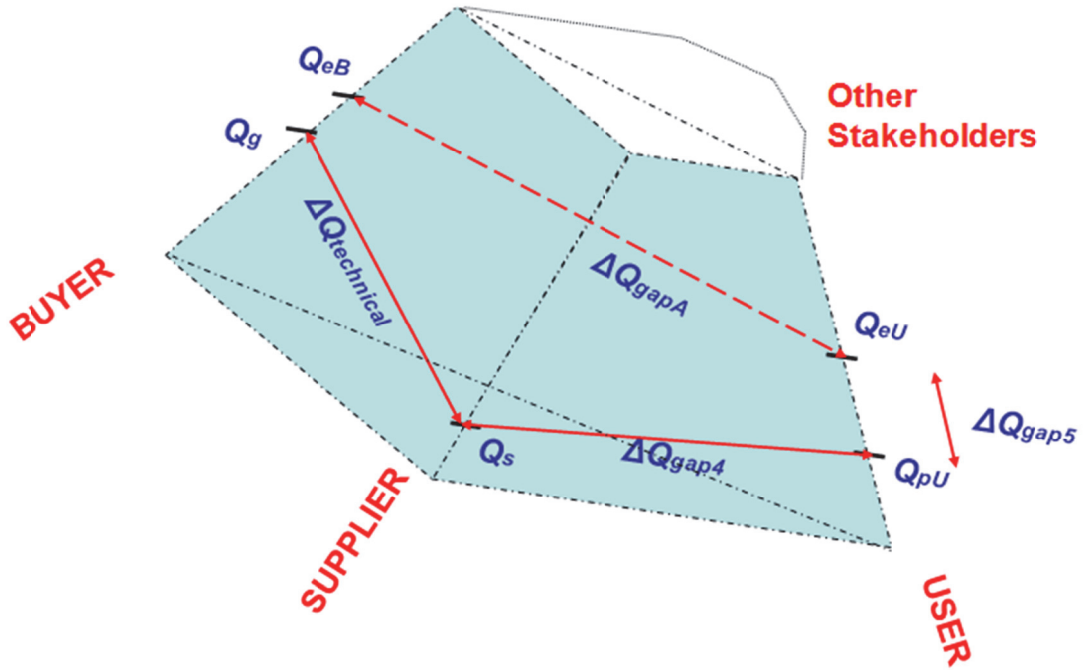

Figure 16 Quality Gap in a triangulation

At the very top of the figure there should be the service quality where ideally buyer's needs, user's expectations and quality provided by the supplier would coincide. Since this barely happens, it is important to identify which are the main sources of misalignment between the three and, in particular, which aspects could be improved in order to match them.

In the present model, in order to evaluate the service quality supplied (QS), two different perspectives should be considered, the ones by user and buyer. They are reported in two of the edges in Figure 16. They are connected and interact with the third edge where is reported the perspective by the supplier.

In the user's edge, the traditional total customer satisfaction (Qgap5) is represented, according to the disconfirmation paradigm, as the distance between the expected quality (QeU) and the perceived quality (QpU). Furthermore, again, according to the original gap model, QpU might not coincide with QS due to a lack of effective information in the communications between supplier and user (Qgap4).

When the buyer perspective is taken into account, Qg may not coincide with the expected quality (QeB) due to the contract imperfections QgapB). Moreover, in the buyer's perspective,

the technical quality (Qtechnical) can be evaluated as the difference between the contractual quality (Qg) and QS.

If we consider all together the buyer's and user's perspectives, two different quality evaluation can performed, the first expressed by Qtechnical would calculate the technical quality, while the second expressed by Qgap5 would calculate the process quality, according to the definition by Gronroos (1982).

A supplier evaluation, made by the public authority and taking into account the customer satisfaction, should consider whether a user's dissatisfaction does depend on the public body itself, misaligned with respect to the user's needs (QgapA). In Figure 16, QgapA is identified in the hidden face that lays in the back. For this reason when the public authority decide to evaluate the provider according to the customer satisfaction, its evaluation cannot be based only on Gap5. Instead, it should be measured as:

- *CustomerSatisfacionRevised= Gap5 – GapA- GapB.*

The new measure could be able to take into account that a public authority should not judge the work of the provider through customer satisfaction as it is. It depends on the impact that the choices and constraints decided by the public authority could be against the users' expectation. In such cases a provider which keeps the dissatisfaction at the level forecasted through the contract request should be already considered on the average. It can be posit that providers have still space of improvements despite contracts limits, as they can promote specific actions in order to align the user expectations with the parameters contracted by the public authority, or they could adopt specific measure not considered, but neither forbidden, in the contract in order to increase the quality of the service perceived.

In summary, for an overall measurement of quality, three aspects should be considered. First, the customer satisfaction, that could be measured with traditional tools like ServQual (Parasuraman et al., 1988). Second, the technical quality, which can be measured through the parameters reported in the agreement between buyer and supplier. Third, an effort by the public body is necessary to identify citizens' requirements, evaluating which of their requests conflict with the institutional needs and constraints identified by politicians.

The needing of such a perspective can be clarified thanks to evidences from a real case study analysed. In our researches we noticed that a technically better service (as it is the case of a door to door collection in municipal waste management services compared with a basket

collection) could provoke a significantly lower satisfaction in citizens (in this case mainly due to the higher level of collaboration required). As previously stated, in such cases the public authority should carefully evaluate the supplier, considering that its own requests already provoke a lower satisfaction. At least till the learning process by the users is over.

III. Selection of Case studies

As public services are generally constituted by tangible and intangible elements, by technical measurable parameters as much as by questionable personal valuations made by each single citizen, in order to find an answer to the several question research, we have been investigating how public authorities, suppliers and citizens currently behave about the service provision. In order to accomplish the aim, a specific public service has been chosen. The municipal waste collection service has been chosen due to the fact it has all the main complexities typical of a public service. Managers from public authority and private service providers, as well as final citizens, have been interviewed in a cross-country analysis, in order to understand how services are currently evaluated by stakeholders in different contexts and cities. The research project has been build following the guidelines about qualitative (Huberman & Miles,1994).

Waste service has been chosen among the public services, as this sector is currently involved in strategic changes due to both strong technical changes and increased attention to customers. Technical changes are due to the pressure to improve its performance in terms of quantity of waste landfilled and in general to the more sustainable waste management practices required. The attention to customers has been increased because new public management trend has been requesting more accountability to citizen and better value for money while several financial crisis are often putting pressure for cuts in the budget. Particular focus has been given to waste collection services for residential customers, due to the several direct links between public authorities, final users and provider. cases will be selected based on the following case selection criteria to reach a literal replication. Cases are selected from different EU countries in order to share the same European directives and to compare the waste collection practices. The *unit of analysis* of the research is identified as a Municipal Waste Service.

Data have been collected in two different countries of EU, namely Italy and UK. Such choice has been made for two main reasons. One is that both countries are, among the other European, that which are doing the highest effort to improve the service right in these years. The second is that although both countries share the same European directives which allow us to compare the results, they are pretty different in their context, this should enhance the generalizability of the results. Although not all municipalities are currently interested by structural changes in waste management services, the cases studies have been selected among that one who have been. This has been done in order to be able to catch fresh impressions and data from managers, and customers, as well collect data.

Key Informants have been chosen from:

- Personnel from the waste collection practice of the local public authority
- Senior executive from the service providers
- Resident customers

It also has been used secondary data provided by local authorities for this research or already published and accessible by all citizens. One more source for the research have been a survery among final customers in order to confirm the previous results coming from final customers through interviews.

One interview has been done in all municipalities where supplier and public authority role somehow overlap because the service is not outsourced or it is managed through a public-private partnership. Two interviews instead have been made in case of waste collection service outsourced to fully private company as differences in perceptions, expectation, perspectives could exist.

All the interviews have been based on open questions which were spacing from the socio-demographic characteristics of the municipality to the characteristics of the service provider, with a specific attention to the relation between the stakeholders, the attitude of the institution represented by the person interviewed to the other stakeholders. It has been asked also to give examples about actions taken in order to consider users expectations and perceptions, if any.

Moreover, it has been asked on which basis the service is judged, which are the positive and negative aspects they are able to recognize in the service provision, what could be

improved and how, and what cannot be improved and why.

All interviews were lasting around one hour. With the permission of the interviewed they have been recorded in order to keep track of the replies, the set of questions which has been prepared in advance, has been used in order to have a direction during the interview. Results from structured interviews has been analysed with the help of a revised version of the gap model (Parasuraman et al., 1985), specifically adapted in this work in order to get a deeper insight inside public services.

IV. Presentation of the Case Studies

Three case studies have been selected for each country. These cases in Uk are similar for number of inhabitants (between 120.000 and 140.000 in all cases) while they differ in Italy (C and D have less than 5.000 inhabitants while case M has almost a quarter of million).

The European directives are requiring strong effort in order to improve waste management, both in terms of waste reduction as better management for waste disposal. It has been implying major efforts for many municipalities which have been disposing the absolute majority of their waste, through landfilling. This is especially true, in country as Uk and Italy, where there was the highest amount of waste landfilled among all European Countries (OECD Environmental Data, 2004). For the reasons above reported managers interviewed from both countries were recently involved in strong changes about the waste collection service provided in their municipalities (cases D, E, T, U). In the other two case study (C, M) citizens still recognize the need for more attention to environment and sustainability, although not all of them have clear what are the possible alternatives to improve the waste services, especially in terms of feasibility.

Moreover, while most of the contracts which have been signed formerly are mainly based on service costs, (among the others: number of employees, number of trucks, frequency of collections, number of bins), a new parameter has been considered to evaluate the service provision in all municipalities where a strong change was required (cases D, E, T, U): it is the recycling rate. While previous parameters have been always used to reward the supplier and evaluate the quality of the service, the new one is now used to diminish the supplier earnings through penalties. However, such a parameter do not depends only on supplier efforts, but

also on user behaviour and public authority efforts. The service could set could set up a full set of facilities in order to give the possibility to the users to differentiate their waste, however citizens could misuse these facilities and go for the easiest way: throw away all in one bin.

In order to avoid it, public authority could help the supplier through several ways. A list of possible Actions (A1, A2, etc.) based on case studies analysed is here resumed:

- A1: Control the on-going disposal made by users, and give immediate feedback to them when they do not behave correctly.
- A2: Inform users about the specific rule of the collection in the municipality.
- A3: Clarify to the user the motivations for the specific service provided.
- A4: Allow the provider to check the waste and deny to users the collection in case of a resulting excess of contamination.
- A5: To set up fine to users in case of misuse of waste collection services.
- A6: Set up a maximum amount of residual waste (not recyclable) which would be collected in a specific time frame.
- A7: Reduce the frequency of collection.
- A8: To allow different rates for customers depending on their consumption.

In particular, A1 results to be very difficult when waste is collected through anonymous banks displaced in the roads. It is because usually each place where such kind of banks are should serve a hundred or more of inhabitants. Thus, it would be difficult to identify who are the people responsible for any wrong behaviour. On contrary, when collection service is on a door to door basis, the householder is identifiable, or at least the building from where the bag come from. All managers from municipalities involved in door to door recycling collection reported such advantage (cases D, E, T, U).

According to the user point of view, to separate waste in different bins is not necessarily an easy task. Although the difference between paper and glass should not be difficult to recognize, some people would question if a glass bottle could be disposed in the glass bank even when the label paper is still attached. More difficult the plastic matter, as several municipalities reported to be able only some kind of plastic, and that the load would be considered contaminated in case also the wrong kind of plastic has been disposed. Moreover, differences among service implemented have strong impact in the rules of the municipality. Currently there is no standard rule for collection management. For instance, in case E there

are only two different bins, and some kind of items, as glass, cannot be disposed in any one of these two bins, while food has to be disposed together with the residual waste. In case T there are five different bins, among which there is a specific place for glass as one for food. Case U is based on three different bins. It means that a user who moves from a municipality to another one, have to learn every time a different waste system, not only in terms of time for dispose the waste but also in terms of what should go where. Currently all municipalities which apply door to door collection send mail to the users in order to inform them about the changes in the system. However, more communication is sent after a problem is recognized, even on customer basis (Appendix B). In some cases, as the E, there is a good number of inhabitants which stays in the municipality for short periods of time, which do not receive any "learning package" at their arrival, although their participation to the recycle scheme is strictly required too. For this reason, although A2 looks to be practiced by managers from most of the municipalities (cases D, E, T, U) in many cases looks to exist still space for improvements.

The number of different rules among different municipalities can confuse people and create dissatisfaction. Citizens complain for the fact they cannot recycle food, as other people can, or about they can dispose their waste with less frequency and with limits in amount which do not exist in near municipalities. Although all these differences have been motivated by managers, at our best knowledge, there is rarely evidence of such motivation in the mail sent to users.

In case of A4, it is possible to posit that public and private managers have been troubled by the issue. No one of the managers interviewed has been choosing it as a first choice. However, after a starting period some of the providers (it is done in case E, App. B1), has been deciding to adopt such kind of action in order to force users for more collaboration. Other managers at least to the date of the interview have preferred to limit their action at sending some mail in case of wrong behaviour to some mail (as in case D). In all municipalities is supposed to exist a coercitive power in order to allow A5, however in all cases it is considered a last choice.

All UK managers have been considering the possibility to set up limits to the amount of waste not recyclable which each householder could dispose (A6). Although all of them recognize such action would help to increase recycling ratio, only case E applied A6. In case E there is a limit of three plastic bags per week per householder, or as most of the

householders have a biweekly collection, they can dispose six plastic bags (or 1 full bin) for each collection only a App. B2). The other municipalities did not set up such a limit in order to avoid customer complaints. Similarly, some municipalities, especially cases E and T have been deciding to reduce the collection frequency (A7) with the double effect of saving costs and increase the pressure for recycling. Manager from case U confirmed that such a strategy could be effective to increase the recycling ratio but would avoid it considering it a minor effect. Finally, the customers interviewed have been claiming they were not changing their recycling ratio because of the collection frequency, but they agreed they were just fulfilling "the other bin" when one was looking too much full, whatever was "the other bin". Previous research commissioned by public authority responsible in case E confirmed that putting limitations in terms of frequency would decrease the amount of waste in the bin for refusal waste.

Last action among the others previously mentioned, A8, is not applied in any of the case studied. However, there are several evidence founded during the research about municipalities who are applying such strategy. In these cases, the tariff, or at least its variable part, depend on the amount of waste not recyclable which is disposed by the users. Despite of the difficulties of implementation of such a strategy, and the fact there is a risk that inhabitants could dispose their waste illegally or in near municipalities which do not apply the same rules, this strategy results to be interesting because it promote an active role by all customers.

The choice to adopt it, or not, the actions previously mentioned, looks mainly based on political questions. Public authorities were explicitly concerned by the citizens reactions after any change in their policy. For instance, they claimed explicitly to move the period of their action in order to avoid electoral periods, on request of politicians, as they knew these actions would cause dissatisfaction. The reason for such dissatisfaction has been recognized dependent to the attitude of aversion to the change. However, in several cases the new service delayed to not electoral periods were not just generic "changes", these implied an higher level of collaboration by the users and thus, more efforts by them not only during the a limited period for learning the new service, also in the day by day in order to behave accordingly to an increased number of bins where separate the waste and/or a reduced frequency of collection. Thus, while none questioned the positive relation between the technical parameters previously listed and the value for customer provided to the citizens, the request for higher recycling rate asked for changes in the collection system which decreased the citizen

satisfaction. In particular, in all cases studies public authority, as well as managers and citizens, were considering an higher frequency of collection as a driver for higher satisfaction and an higher marketing VC and derived VC (cases C, D, M, U). Thus, A7 should cause dissatisfaction, however, public managers of cases E, T adopted a biweekly collection assuming to enhance recycle and reduce costs, although not all customers welcome it. Moreover, in order to increase recycling rate public managers had to implement a much more strict control on the waste disposed by customers (A1). Such controls have been implemented in the different case studies within a very wide range of alternatives (cases D, E, T, U). However, no solution has been accounted out of a trade off between increasing the number of employees/trucks and reducing frequency of collection. The first imply a higher cost of the service. If the net VC could be balanced between the increased costs and the higher service quality, in terms of customer satisfaction it is possible to posit that the strong increases in the cost of the service would cause dissatisfaction among most of the customers. Data collected support such hypothesis (all cases). On the same time, decrease the frequency of collection, and force the users to keep organic waste in their houses for several days in a row, even two weeks, could enhance dissatisfaction, especially during the period of transition. Moreover, to have very rare frequency of collection on regular basis could cause strong problems when something exceptional happens. For instance, during the research period an excess of winter snow during Christmas period have been causing in several UK areas long delays in the collection (BBC, 2011). It implied that even organic waste collected in the house during two full weeks, has been keeping for other two weeks in the road causing strong dissatisfaction over the citizens, the media attention as well the health risks. Last but not least, fortnightly collection through door to door services implies that all householders should care that at least one person per house stays at home and keep out their waste during the disposal period. It is long 12 hours and occurs only once every week (case E, T). To forget to dispose or to spend this period out of the house after two weeks of waste production, for example for a business-travel, would imply to keep organic waste for one full month at home. Missing it two times would imply one month and half. Such a problem has been explicitly recognized even by the private supplier in case D, where there is a quite high frequency of collection. In this case the manager was thinking about the need of some waste centre for each city in order to allow the user to dispose their waste out of the specified times. However, the centre has not being implemented because this is not yet asked by the public authority (in case D) to have one.

Moreover, to dispose all the waste at once would probably imply to overcome the limits on waste disposable (as in case E). For the above reasons it looks clear that while to increase the ratio of waste recycled is welcome by all public authorities, citizens satisfaction could be negatively affected by the measures adopted to enhance the recycling. Thus, it is possible to posit that *the evaluation of a public service done by public authorities and citizens could differ* confirming Hp1.

Although citizens and public manager could have different opinions about the service which should be provided, the service provider can hardly met the public request without the citizen collaboration. Most of the managers interviewed cited the fact that any deep change in the service provision was avoided when the electoral period was close (Cases E, T, U), as well the usefulness about consider specific request of some customers in order to avoid that a high level of dissatisfaction and complain could work against the implementation of the change (case D, E, T, U). All suppliers involved in the change recognized the need to explain how the new service would work, through mail in the box, through free toll phone number, stronger relations between employees and householders, or even between representative of public bodies and householders (case D). Moreover, even if no focus group has been organized in any of these case studies to decide which *kind* of waste collection service apply in the city, or neither to understand the feasibility of other was to enhance recycling ratio, in all cases involved in a change focus group or council meeting have been organized to listen citizens request and try to consider their needs if these would require just minor changes in the service organization. In most cases such measures have been explicitly considered as necessary to enhance customer collaboration and as drivers for the success of the change. Building on the previous and the last considerations, it is hardly possible to posit that customer satisfaction should overcome actual measures of service quality (as recycling ratio it is). However, the citizen perspective about the service has been claimed to be strongly relevant by all public representative interviewed. If the service has been designed by public authority it is also true that it is later implemented in order to fit, at least partially, citizens' requests. If both public representative and citizens have an impact on the service, it looks coherent to posit that *any evaluation about the service should consider both the perspectives of public authorities and citizens (Hp2).*

During all the interviews managers have been trying to show their relative quality comparing with the other services provided. Some enhancing the improvement in the

recycling ratio, others the relative low cost of the service (Table 7 and Table 8). However, rough data were not strictly comparable from case to case. For instance, to get a 36,2% (case E) of recyclable waste collected is still better ratio than 45% (case U) as in the second case food waste is separately collected, while the separate organic collection in case E, is not done because the disposal constraints, which do not depend at all on the municipality or the waste collector, would make it just a waste of money. One more complication is that the 45% of separated waste collected has been taken after a relatively recent strong change in the waste collection, thus it is just a partial measure taken during a positive trend, affected by the user need of time in order to learn how improve the behaviours regarding the waste separation and disposal. It is possible to forecast that such a ratio is still going to grow over the time. Moreover, user's request in terms of collection frequency can also have a strong impact on the waste management costs, which, for instance, are much higher in Italy where there is an higher frequency than in Uk. Similarly where the waste is collected with an higher frequency the costs are higher (case U, and Italy vs Uk case studies). Other characteristics, as the fact that some municipality set a limit on the amount of refusal waste which citizen can dispose, or more generically the amount of waste produced, also has an impact on costs although it also affect several other quality parameters for the service. Thus, it is confirmed that *complexities and differences among different places would make difficult to compare different services through benchmarking if only a few of parameters are adopted(Hp3).*

Table 7 Main characteristics of case studies analysed (1/2)

Case study	Country	Door to Door	Collection Costs//kg	Collection Costs//person	Waste Limits
C	Italy	*Not yet*	0,216€/kg	106€	no
D	Italy	*Implemented*	0,22€/kg*	100,31€*	*no*
M	Italy	*Not yet*	0,274€/kg	140€	*no*
E	UK	*Implemented*	0,07£/kg	20,44£	$3plastic\ \frac{bag}{hh * week}$
T	UK	*Implemented*	0,05£/kg	22,72£	*no*
U	UK	*Implemented*	$\simeq$ 65£	32,23£	*no*

*Cost in D is taken earlier than the implementation of door to door collection. The public authority claims it increased the cost but not too much, without further specification.
** The cost we have is per household and not per person

Table 8 Main characteristic of case studies analysed (2/2)

Case study	Ratio Recycled	Number of bins	Collection Frequency	waste kg/person	Composting	Outsourced
C	5%	5	6days/week	400	No	Fully
D	18%(45%)	4	variable	460	Yes	Almost fully
M	8,1%	5	6days/week	506	No	Internal
E	36,20%	2	biweekly		No	Not at all
T	57,37%	5	biweekly		Yes	Not at all
U	45%	3	weekly		Yes	Public private partnership

V. Value for Customer concept applied

If citizen and public authorities perspectives should be both considered for an evaluation of the, not the technical parameters stand alone, and neither the customer satisfaction could be in the right path to enough in order to evaluate the services. Conversely, the value for customer concept, through its different dimension as well as its temporal perspective could be used in order to consider both perspectives and account the differences among each other.

In

Table 9 each dimension of VC has been analysed in order to define a coherent approach to possible measurement of these. In particular, net VC has been considered as the algebraic sum of the other four VC dimension. The derived VC should consider an evaluation of the benefits perceived according to the customer perceived needs. So for the public authority it will depend on the institutional needs recognized at local and national through laws and directives.

The Marketing VC can be explicitly measured through customer satisfaction. Public authority satisfaction will be influenced by both the reach of local aims as well the citizen satisfaction. The Sale VC could be resumed in terms of cost paid by users, in terms of tariff, or by the local authority in case there is some part of the service provision costs paid through indirect taxation. Last, in order to measure Rational VC it should be needed an evaluation of the monetary value of the service provided in order to compare it with the costs paid. Measures of efficiency should be considered as part of the Rational VC.

Table 9 VC applied to a Public Service

VC part	What is measured	Measure based on…	Kind of value	How is measured
Net VC	All Benefits-All Sacrifice	Rational Measure	Omni comprehensive measure	• Algebraic sum of all other measure
Derived VC	Use/experience outcomes	Perception	Linked to social and human values	• Evaluation of the benefits provided by the service according to personal needs • Evaluation of the benefits provided by the service according to institutional needs
Marketing VC	Perceived attribute	Perception	Linked to attributes and perceptions	• Customer Satisfaction • Effect on citizens vote due to their satisfaction
Sale VC	Reduction of sacrifices or costs	Price based	Price to be paid	• Tariff for final users • Eventual cost paid by Public Authority
Rational VC	Benefit – Sacrifices in terms of costs	Price based	Price to be paid vs price expected according to the service offered	• Economic evaluation of the service • Service provided economically evaluated

Building on such concepts, a list of indicators already recognized by practitioners has been listed (Table 10). For each indicator has been identified which is the dimension of VC most affected, and which is the customer (citizen or public authority) who pays more attention or is more directly affected by the parameter.

However, such parameters look to be far away from giving a comprehensive perspective about the service quality. In particular, few of these parameters have an impact on citizen's perspective. A service evaluation based only on this parameter would be not able to really

catch the service quality. For this reason more parameters should be acknowledge in order to fairly evaluate the service. Moreover, the relations between user and the service would be fully missed by an analysis of the service based only on the previous parameters. For these reason a more detailed approach would be required. Another analysis has been taken considering the temporal version of VC (Table 11). In particular it has been analysed how the different stakeholders are related with the service during the four main different phases of a service provision. The temporal view gives the possibility to select specific parameters which could be used in order to evaluate the value for customer during each phase of the provision, accordingly to the role that each stakeholder have during each phase.

Table 10 Preliminary Proposed Indicators

Indicator	Unit of measure	Typology	VC	Customer Involved
Cost / inhabitant	Euro/ inhabitant/ year	Economic	Rational VC and Sell VC	Public authority/ Citizens only in some cases
Cost / kg waste collected	Euro/kg			Public authority
Cost / No. employees	Euro/employed			
Employees' Cost/ total costs	Euro/month			
No. inhabitants/ No. employees	Inhabitants/ employee	Efficiency	Rational VC	Public Authority
No. inhabitants/ bins	Inhabitants/ bins			
Waste collected/ No. Employees	kg/employee			
Frequency of bin collection	h/day	Efficacy	Marketing VC	Citizens
Frequency of door-to-door collection	h/day			
Recycled waste/ total waste	kg/inhabitants/ day		Derived VC Sale VC	Public Authority

Table 11 VC over the time in waste service sector

Stakeholder	Phase	Kind of action	Parameter proposed	VC dimension
Public Authority	Pre Purchase	**Decisions and choices**	• Getting feedback • Deciding provider	• **Net VC**
Public Authority	Purchase	**Signing the contract**	• Deciding parameters (Recycling ratio)	• **Net VC**
Citizen	Purchase	**Teaching a new collection system**	• Time to recognize a new user • Time to give full information about the service	• **Marketing VC**
Public Authority	Post Purchase	**Monitoring the service**	• Getting feedback • Measuring parameters	• **Net VC**
			• Waste reduction	• **Derived VC**
			• Cost reduction	• **Sale VC** • **Rational VC**
			• Waste reduction	• **Derived VC**
Citizen	Post Purchase: Learning Collaborating Emergency	**Information available**	• Quantity (N° data) • Accessibility (N° media)	• **Marketing VC**
		Support	• N° hours/week provider is available for support by phone • N° missed calls • Time to reply to emails	• **Marketing VC**
		Assistance	• % people with specific support due to disabilities • Time needed to admit a new user to the assistance	• **Marketing VC**
		Responsiveness for emergency	• N° missed bins/year • N° missed days/year • Max number days of delay for the collection	• **Derived VC**
		Tariff paid	• Tariff paid by user	• **Rational VC**
Public Authority	Post Use	**Long term improvements obtained**	• Differences in costs • Differences in recycling ratio • Differences in waste collected	• **Net VC**
Citizen	Post Use	**Usefulness of system learned**	• Similarity to a standard/collection services provided in other municipalities	• **Derived VC**

Citizens and public authority differ each other pretty much in their relation with the service over the time. The pre purchase phase is almost not existing in citizen perspective, due to the lack of choice as municipal waste collection service are monopolistic market by nature. On contrary the public authority has a strong role and responsibility during it. In particular, the public authority has the role to evaluate the different possibilities of service provision, to decide if outsource the service or provide it through internally resources, trying to understand advantages and disadvantages of each solution. It will mainly behave accordingly to institutional needs and previous experiences as discussed with more details during the test of the gap model revisited.

Although exist a phase "at the point of trade" for citizens, this is usually a "ghost" phase, as citizens do not sign any contract with the waste service provider, nor in Uk neither in Italy.

During the pre-purchase phase, the public authority has to decide to who entrust the service and according to which rules. Legislation can give some direction and sets some limits, for example Italian legislation forces administration for contracts which should last for at least 15 years. Italian law also obliges small municipalities to collaborate each other creating a new entity (AATO) which works for several municipalities at once according to territory proximity and in general to regional rules. However, most part of the contract in waste collection sector are freely chosen by stakeholders, or better said by municipalities in UK, and AATO in Italy. As far as public administration can prove their contracts are compatible with the regional and national laws they are pretty free to decide all the details about the waste service that should be provided. For this reasons there are many evidences of differences that exist among waste collection services within Europe but also within same country or region.

Thus, the pre purchasing phase, during which there is the collection of information is among the most relevant by the public authority perspective. It is the public authority who has the responsibility to choose how the service should be provided, if outsource it, to whom and the rules that should be stated in the contract as well the service guaranteed through the service chart which will be provided to the users. The relevance of this phase is due also to the fact that an eventual outsourcing could have very long term impact, as the contract could last several years; it means that the public authority should be able to build a long term strategy during the pre purchase phase. However, public authority faces to several difficulties when try to build such long term plan. Main reasons are that the waste sector is currently under a clear

evolution, and the best choice of today could be out of date much earlier than the contract. For instance, a long term plan should consider the possibility of different scenario of waste production as well the possibility that new way of disposal could become available, or not, during the contractual period.

At the point of trade, it is still the public authority the most relevant stakeholder. In this phase the data collected and the decisions made have to be translated in a signed contract. It is the public authority that after collecting the information about the different existing options have to choose how the service should be provided, and get all the responsibility about the decision. From the customer point of view there is still a strictly limited power on such phase as the only way to change provider for a final user, despite the control on public authority's choices, is considered to be to change city. Anyway the citizen is strongly affected by this phase, whatever is the reason, a new service contract in the municipality or a new service because the user himself is moving in a new city. In both cases the user will have to learn the rules of collection, which could be different from the previous.

The most important phase, for the citizens, is the day by day usage. During the regular period of the contract, citizens, as user of the service, will have to learn how the service works in order to be able to collaborate to the service provision. Moreover, any exception in the service would be noticed by users and could affect their satisfaction.

Citizen's role increases strongly during the service provision itself. Citizens have to collaborate in order to make possible the service provision, they can learn and improve their collaboration through the support of the provider. Moreover, as the citizens are the stakeholders directly involved with the provision, they are themselves who can notice any trouble with the service provision, if the provider respects the contract rules or not. Public authority can recognize most of the gap between the service planned and the service just through the complaints made by citizens. Public authority is not in the households during the service provision, and cannot easily check if the schedule of collection is fully respected, if bins are well maintained etc. The authorities are able to check if the technical parameters planned in the contract are fulfilled, but they cannot go far away from these.

Last phase is essentially managed by public authority. In the customer perspective the provision virtually never stops. The service provider could fully change without that any customer recognizes it. On contrary, when a contract with a provider is over, the public

authority has to make a summary of the results achieved, and prepare a new beginning. The contract could arrive to its deadline but waste collection services can't be stopped. Recognizing in which part of the process each actor is mainly involved could be helpful in order to assign responsibilities and in order to decide criteria of evaluation. For instance, the supplier should not be penalized for any user which is unsatisfied due to a decision taken by the public authority during the process of contracting out the service.

Thus, it is possible to posit that an evaluation of a waste service provider should include measures of the service provided considering all the phases which have an effect on the user.

Similarly, more and further *analyses based on VC concept could increase the understanding about the value in public service* (Hp4).

VI. Testing the Gap Model Revised

Through the data collected, the existence of all the gaps proposed in the model in Chapter 6.1 have been tested in waste management sector. In case managers interviewed have been reported actions useful to reduce the any of the gap such solutions have been also analysed.

While the gap model has been revisited through an extensive literature review, and a comparison with the original model, the data collected through the case studies have been later used to confirm the existence of the gaps in the model and the new antecedents outlined. In waste management sector, as earlier outlined, the predominant role of the public authorities makes that the institutional needs, reported through directives and laws have a strong influence in the service provided. Moreover, as for the user antecedents, also public authority claimed to be influenced on past experiences. Changes from private to public outsourcing have been reported for example in case T due to the fact they were not satisfied with the previous service privately provided.

Higher impact on previous experiences has been reported also in terms of expectation about the characteristic of the service supplied. Although public authorities are used to compare and evaluate their service through benchmarking, it looks they give a limited value to it recognizing the impact of the peculiar characteristics made by the external environment. Moreover, managers recognize a strong resistance to the change by both politicians and citizens. On the same time good part of the cost of collection and disposal service depends on

long term investments. For all the reasons above, managers and public authority are more likely to decide how the service should be through incremental changes. Previous experiences have then a more evident role than benchmark with other municipalities. Some difficulties to apply benchmarking can here be listed:

- Users in Uk are used to a much lower frequency than in Italy which has a strong impact on the costs.
- To collect food waste separately would be no useful at all for municipalities unable to compost it, however to collect it separately enhance the recycling ratio.
- The same for garden waste. Its collection increase recycling ratio as well collection and disposal costs.
- Promote that most of the customers have their own compost system, which is not always feasible, would decrease collection cost and amount of waste collected, however it would also decrease recycling ratio.
- People who are already used to do a separate collection, with few bins would be able to change for a more complex recycling system with more bins.

In case of **Gap 1** in waste management sector is possible to posit that the limited power of final users, the natural monopoly in each municipality about waste services provided to citizens, the need to protect the environment through a predominant normative approach and the difficulties to customize the service make that service providers have a limited attention on users' need. However, the need of collaboration in order to obtain high ratio of waste recycled requires that users do not boycott the collection rules. Moreover, there is no interest by supplier on doing something necessarily against citizens' willingness. For such reasons some efforts to reduce the gap have been recognized in all cases involved in door to door collection. However, the strength of such efforts is in no way comparable with that usually in a full private sector. Manager of service provider in case D has been reporting they have been slightly increased the collection frequency in one municipality which was out of the case study but included in the same contract, in order to go nearer to citizens' request. According to the manager to increase the frequency of collection only for organic waste from 2 to 4 times per week in one municipality among the eight in the contract was not a significant change. Moreover the same provider has been customized the collection of the refusal waste for the

families with specifics needs. If there are babies or old people the usage of nappies could make problem in storing refusal waste for one full week. For these specific families refusal collection is done together with all the other kind of waste collected, which means every two days. Manager claimed that there was no higher cost involved in such a change. Tariff applied didn't change at all as service provider didn't need to increase the number of employees, nor of trucks, neither the route for the collection.

It should be noticed that the higher frequency of food collection can just increase the recycling ratio (as recognized explicitly by manager in case T) while all UK managers agree that collecting refusal waste more often could decrease recycling ratio. For these reasons according to T's manager some authority in UK are collecting all recyclables each week, and refusal fortnightly. Moreover, UK waste providers have a specific policy about nappies, promoting the usage of washable nappies in order to strongly decrease the amount of refusal waste produced and to be landfilled.

Public authority in case E has been evidencing how the decision to collect the waste in front of the houses or in their backyard has been taken together with inhabitants. Householders in different zones could have different rules, but when there is a general agreement among people living in the same way usually their suggestion is accepted by the service provider. Such flexibility is generally welcome by citizens, at least till they are able to have an agreement among neighbours. While from an operation point of view nothing would change between the two options, being able to put the waste in the backyard could allow more tolerance on time for disposal, less esthetic impact on the roads, to avoid to displace all the waste collected during two weeks, from the backyard to the front of the house passing by all the house. Main disadvantages acknowledged by users in case of backyard collection are the impossibility to use backyard role for walks as well the excess of time during which waste could stay in the backyard road attracting rats and animals in general in case of misuse of tolerance in time by citizens. between the waste However, neither this change looks to change significantly the operational process.

Gap A in Waste Management Sector has been already studied and analysed when Hp2 has been discussed.

Gap B is well recognized in all case studies analysed**.** However, different decisions have been taken in order to reduce the gap. In particular, the private manager and the public authority in Italian case D, claim both that there is a lot of informal relation between the

provider and the public authorities. This relation helps the public authority to maintain a sort of control on the service even regarding part of the service conditions which are not in the contract. The supplier claim to take care of such informal relation in order to maintain the public authority satisfied. This could help the supplier itself to expand its business and to confirm its contracts after the deadline. However, it should be reminded that any Italian contract last for at least 15 years. Thus, although positive informal relations between public and private supplier could exist, it is not necessarily always true. For these reasons cases E and T have been deciding to provide the service through internal resources. It means that politic power maintains a very strong power on the service supplied. Case U instead opted for a co-ownership of a new company mainly owned by a private company. Such a solution has been chosen in order to combine the technical expertise from the private company with the interest to keep a sort of control on the service provided by the public authority. Despite the different possible solutions a kind of incompleteness evidenced during the analysis of the case study is the difficulty to consider in the contract the evolution of the technical solution about the service itself. Long term contract, do not work properly in a context of strong changes over the time. The rules, the aims, the technical solutions, could become out of date much earlier than the natural date of the contract.

Together with impossibility to provide a better service due to contract limitations, it goes the possibility that the incomplete contracts are interpreted by providers through an opportunistic point of view (**Gap C**). Although no manager from private company could confirm us any kind of opportunistic behavior, it is clear that a private company which aim is looking for profit, would evaluate the possibility to save costs in terms of earnings more than service quality.

A gap between public authority's request and what managers plan to do in the service has been recognized to be possible by all the managers the existence of a gap between public authority's request and what managers plan to do in the service (**Gap C + Gap D**) and public authorities interviewed. However, they have been reporting to have applied specific measures in order to reduce the gap and several of them claimed to be pretty satisfied with the results obtained. In particular, the specific action taken can vary from case to case. Some have opted for provide the service under the direct control of the public authority, claiming it would reduce the gap. Others have chosen to create a company co-owned by the municipality and by a big private company in order get the skills of the private company and do not lose the control on the service, in both cases the lack of a counterpart strongly limit the effects of such

gap, although technical managers assigned by public authority could still try to plan a service slightly different from what is required by politicians, or trying to influence their choices and not just to be influenced by them. In another case, local authority at municipal level did not have the power to choose how to provide the service, due to regional law which assigned the municipality to a consortium of municipalities. Thus, the consortium outsourced to a private supplier and the local politicians have been trying to maintain good and frequent informal relations with the private supplier in order to maintain a sort of control on the service provided, reducing the **Gap C + Gap D.** Public authority claims to be pretty satisfied by such a solution and genuine misunderstanding has been reported to be avoided.

The fact that the waste service specifications have to be strictly based on public authority request would leave not so much space for user request. For instance private manager in case study D, recognizes the need for some place where people can dispose their waste out of the collection timetable. However, the fact it is no mentioned in the contract, and that the costs for it would not be repaid to the provider, make that these places are neither in the plan of the waste manager supplier, and only an explicit decision of the public authority could change it.

There are many data which confirm the existence of **Gap 3**, it is normal that during a service provision several trouble can arise, and there is no reason why it should differ between public and private service. Lack of collaboration by users would strong affect the service provided despite any service manager choice. Employees could miss some bin during their collection which would be noticed by the user. Providers usually have a free toll number to be called in such cases. One more fact which could affect the gap, specifically in waste sector, it is the meteorological condition which could delay (even of weeks as happened during the period of the research in case E) the collection process causing a strong dissatisfaction to the user.

Some peculiarity can be noticed about **Gap 4**, as it looks that in all cases analysed, even when the service is fully outsourced to a private company there is a limited role of the external communication to customers made by the provider. Most of it usually comes from public authority and media. It is probably because the waste service itself in basic condition does not need, at least in manager's opinion, specific communication. Communication is relevant in order to enhance customer collaboration for improving the respect of the rules about disposal, especially in terms of separating the waste recyclable from refusal. As this aim affects the whole community more then single individual public authority usually decide to

keep a role in the communication. For instance, in case D where the service is fully outsourced, people from public authority visited each single house in order to promote recycling and correct behavior about waste. Also media are currently having a role for the high sensitivity of the subject.

Finally the **Gap 5** which represent the customer satisfaction, have same peculiarities in waste service. The main which is outlined through data collect is that although all customers in a municipality must to have an unique provider, their needs and request can be pretty different. An analysis made by manager of case U recognizes a different impact of socio demographic data on their willingness to collaborate. While both, young and retired look to be interest in the waste collection matters, and they are generally both able to invest their time to fulfill the rules, there is a portion of people pretty busy with their job which despite any possible interest on a better waste management program, could suffer a lack of time and attention in order to learn different rules about collection and behave accordingly.

In Table 12 data collected in cases studies has been resumed in terms of their recognition by the stakeholders involved. The existence of all gaps is explicitly recognized by the stakeholders that are directly related to these, with the clear exception of the gap that exists between the user's perceptions and the service really supplied. If users themselves were able to recognize that service supplied is not the same they perceive it would cease to exist. However, public authorities and managers know about its existence and try to reduce it at least communicating the target fulfilled.

Table 12 Gaps relevance in Case Studies analyzed

GAP	**Recognized by Parts Involed**	**Differences Among Places**	**Efforts to reduce**
Perceived vs supplied	No	Low	Yes
Gap 1	Yes	Low	Limited
Gap 2 - Gap D	Yes	Low	Contrasting requests
Gap 3	Yes	Yes	**Periodic checks**/ Informatic support
Gap 4	Yes	All care but in different ways/efforts	Forum, mail, personal visit, phone number
Gap 5	Yes	Related with flexibility	Noone/ only during election periods
Gap A	Yes	High	Only about minor issues
Gap B/C	Yes	High	Partnership/ no privatisation

6. Software tool for simulating public service provision

I. Developing an Agent Based Models

The general on-going privatization in municipal waste service (MWS) claims for tools able to evaluate ex ante and in progress the supplier. In particular, it could be useful to forecast what would happen in terms of both value for customer and customer satisfaction when a particular waste management plan would be done by a particular supplier, before public authority has entrusted the service. Moreover, during and after the service provision would be useful to monitor the supplier evaluation through a dynamic model, considering the level of the operations as well the actions taken. In particular, while the system is constantly monitored and evaluated become possible to assess whether the policies or the management strategies applied have attained expected goals.

The generic considerations about public services and the triangulation of relations among the main actors involved in it have been already discussed en recognized (Figure 5). Starting from the triangulation of the relations in a public service furniture and the concepts of Value for Customer (Table 10; Table 11), and of Customer Satisfaction (Figure 15) a multi agent based model has been implemented.

In the proposed model there are three main actors: supplier, public authority, and customer(s) (Table 13).

The customers are represented as a complex entity in which a modifiable number of subagents are considered to be able to catch different behaviours, and to measure the service quality in several not homogenous areas. In particular each subagent can configured in order to consider:

- It's relevance (in terms of number of inhabitants that can be considered to have similar parameters as discussed later),
- The average amount of waste produced (can be approximated through socio-demographic characteristics as evidenced in chapter 4),
- The willingness to pay a tariff for a service considered to be good,
- The willingness to collaborate with the service without being forced, also in terms of willingness to learn about the service rules,

- The space availability to store waste between production and collection (e.g. shared room in the building free for the purpose),
- The space availability to compost if proposed (e. g. a garden),
- The time availability over the days and hours in the week to dispose the waste according to the rule (some customer could have the willingness to collaborate but being physically limited to do).

Table 13 Agents used in the model

Agent	**Supplier**	**Customer**	**Public Authority**	**Service Supplied**
Kind of agent	Active	Active	Active	Passive
Number of agent	Single	Multiple	Single	Single/ Multiple
Role	Providing the service	Participating to the service	Establishing rules and parameters	N.A.
Evaluates	Financial Constraints	Customer Satisfaction	Value for Customer	N.A.

The public authority has the possibility to modify the service parameters according to its priorities and service evaluation. In the simulation is possible to set a specific typology, and specific parameters that should be fulfilled by the provider. Moreover, during the simulation is possible to modify both, priorities and specific actions to be taken by the public authority.

The service provider in the simulation can be considered under both the hypothesis, to be under the direct responsibility of public authority, as in case of a public company, or to be a private player which main, but not necessarily the unique, interest will be the profit.

Although we have considered only three main actors, in order to correctly simulate the system, the model need to include also a virtual agent: the service supplied itself. This virtual agent includes all the parameters of the service actually supplied, which in turn depend on the

supplier and on the customers' behaviour. The role of this agent is passive, and its characteristics depend and can be modified only by the other actors .

In Table 14, the relationships among the four agents (Supplier, Users, Public Authority, and Service) are reported. In particular, with reference to the service provided, it is clear that the service is shaped by the actions and decisions of the supplier which have to consider the public authority rules. However, the users also impact on the service provision. In fact, the users affect the service by disposing their wastes according or not to the rules (timing for disposal, differentiating among the typology of garbage provided, etc.). The service quality would decline if the customer were unwilling to collaborate.

Table 14 Resume of the Relations to be Included in a Multi Agent System Applied to a MWS

Relations	Operation	Variables
Supplier-User	Supplier sends bills.	Tariff
Supplier-Service	Supplier provides the service and its decisions affect service quality.	Technical Parameters Costs Tariff
User-Supplier	Customers have to pay bills periodically. Customers sends complaints when they recognize a poor service.	Tariff Technical Parameters Customer Satisfaction
User-Service	Customers participate in the service through use, affecting it.	Technical Parameters
User-Public Authority	Customers have to vote periodically for the politicians, and vote determines pressure on the public authority for changes.	Minimum Level Required Customer Satisfaction Value for Customer
Public Authority-Service	Public authority evaluates the service according to technical parameters.	Value for Customer
Public Authority-Supplier	Authority sets rules to be fulfilled according to customer pressures, political choices, etc.	Minimum Level Required

Supplier and users interact in two main cases: periodically when a bill is sent/ paid, and when a customer complaints to the supplier for a perceived low quality of service. Users could also direct their complaints to the public authority, as the one which entrusts the supplier with the service provision. Users' voicing power with respect to the public authority consists mainly in the vote. However, dissatisfaction due to a specific public service would

have only a partial influence on the vote, as the political choice depends on many more variables.

The public authority evaluates the service quality by means of a specific set of technical parameters.

Its action can be decided at the beginning of the simulation and changed during it.

Our model considers a set of technical parameters (Table 10) that has been validated through a focus group with experts and tested in other cases, similar to the one analysed here. However, as the set of parameters has been recognized not sufficient in order to take into account the user perspective along the timeline of the process, the simulation tool developed give the possibility to consider one or more parameters as already listed (Table 9; **Figure 15**).

According to the previous considerations, an agent-based model has been developed to simulate the relationships among the actors. Among the different tools available in literature to develop a multi- agent system (see Railsback et al., 2006), the tool Mason (Luke, 2004) has been chosen mainly because of its capability to simulate several agents with different behaviours, for the unlimited number of agents that can be simulated, as well for the large variety of tools available and for the facilities provided that allow monitoring of the evolution of the parameters over the time.

Options are:

- Increase/decrease the frequency of waste collection
- Invest in listening the customers
- Invest in changing customer expectations about the service
- Increase/decrease the number of different bins to collect different kind of items
- Increase/decrease the kind of waste recyclable
- Force customers to adapt to the service through fines and bills and rejected collections

II. Evidences from simulations through Agent Based Models

The evolution of the system has been simulated with a time frame of 1 hour during a 3-year period. The short time frame has been chosen in order to consider a model detailed enough and the evolution of the basket collectors over all the day. Thus, each user could

choose to meet a waste collector at different times of the day, according to the planned behaviour. The situation of the waste collector meeting with the user depends on the number of users that disposed of their waste with the same collector from the last cleaning by the provider. The last has been considered a modifiable parameter influenced by the request of the public authority. In the simulation here reported it evolved between two and three times per day.

The bills are sent to the customers by the supplier at the end of each month. The tariff can change every year, depending on the public authority's allowance. Two times per year the supplier is allowed to change its strategy, in order either to increase the investments or to improve the CS or the VC or both.

Thus, although the time frame is pretty short, most of the activities are involved only in a reduced number of time steps.

Each subagent customer is requested to dispose his/her garbage at a fixed time of the week and in fixed days every week. Some of the customers could be dissatisfied with the service, in case they have a high willingness to follow the rules that contrasts with any difficulty to respect the times scheduled. All the customers will be dissatisfied if wastes are accumulated in the boxes for many hours, or if the boxes are already full. CS will be evaluated during each time frame. It will depend on CS during previous time frame plus the effect of any interaction that occurred during the time step according to the rules defined above. This effect could be positive, for example when the customer found a box cleaned, or could be negative. The indicators set for the subagent customers are shown in Table 5.

Table 5 Indicators for the customers

Indicator	Unit of measure	Typology	Variable
Bills paid/ month	Euro	Economic	Internal
Willingness to respect the rules	From 0 to 1	Behavioural	Internal
Time-Availability of a collector	Boolean	Customer Satisfaction	External: depends on the agent Service
Distance of collectors	Meters		
Waste in collectors	Kg		

The public authority evaluates the service one time per day, however the VC will depend on the average value measured during the previous 365 days. At the end of each year the Authority evaluates whether the tariff should be modified, according to the suppliers' requests and considering the VC measured during the period.

All the system has been simulated with different hypotheses and three explicative cases are reported in what follows.

In Figure 17 is reported the evolution of the CS according to the three cases analysed.

In the first case the provider establishes a door-to door service, as planned, at the beginning of the simulation period and implements it after two months. It is supposed a high frequency in the waste collection that increases the CS during the period. At the end of the year the public authority, that has calculated a high VC for the high quality of the service, works to increase the tariff in order to compensate for increased costs. The higher costs impact the customers, whose satisfaction starts to decrease after the first year despite the high quality of service provided.

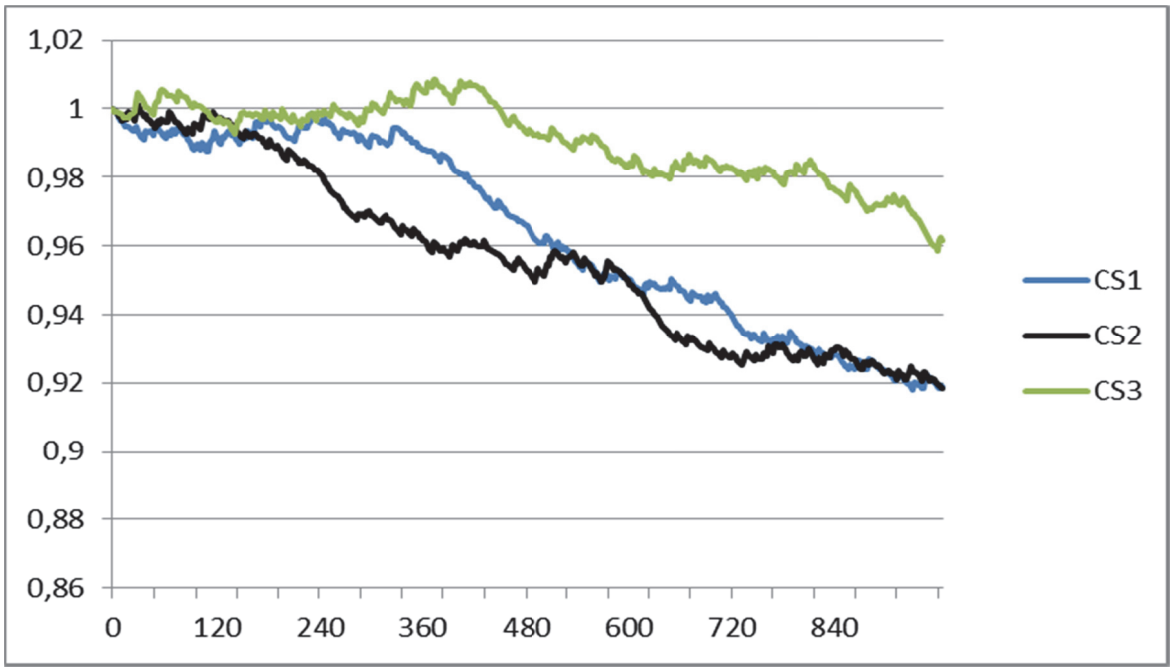

Figure 17 CS Evolving During Three Different Scenarios

In the second case the supplier provides a great number of boxes. Despite this, the provider to save costs does not collect the waste very often. This approach causes complaints from the customers. Disposal out of the time scheduling causes excess of garbage inside the

boxes and complaints by the neighbours. Satisfaction decreases rapidly until the authority forces the supplier to improve the service.

In the third case the supplier bases service on customer needs. The supplier makes an effort to study customer needs, however costs for such studies were not recognized by the public authority through the VC. So after one year, and despite high customer satisfaction, the public authority did not recognize any increment in the tariff, demotivating the supplier, which diminishes its efforts to adapt to customers' needs. However, customer satisfaction remains higher than in the other two cases. Most of the customers do not have to change their habits along the period, as the service provider explicitly consider customer needs and initial efforts made by the supplier have a positive impact even after.

Building on the outcomes of the analysis above reported, it is possible to posit that if CS is explicitly taken into account as a parameter of VC for the public authority, the service providers will be more motivated to consider customer needs on their strategies. As a result, the customers are more satisfied when providers have to pay attention to CS.

7. Conclusions

In this concluding chapter, we summarise the results of the study and provide a discussion of their relevance for theory and management, A brief outline of future research directions concludes the dissertation.

I. Analysis of results

The main results of the research can be summarized as follows:

1. Customer satisfaction and service quality as evaluated by the public authority do not necessarily coincide (Hp1).
2. The public authority perspective and customer satisfaction are both relevant and should be both considered during an evaluation of the service supplied (Hp2).
3. Waste services complexities limit the possibility to compare services fairly if few parameters are considered (Hp3).
4. The VC concept has been applied to waste services, and several parameters have been identified in order to have measures for each phase of the service process and for each dimension of VC (Hp4).
5. The Gap Model has been revisited and the existence of the gaps has been confirmed (Hp5).
6. A multi agent based model has been developed, and waste provision has been simulated, including variable measures of customer satisfaction and value for customers (Hp6).

Results of the study suggest that service quality as evaluated by the public authority and customer satisfaction does not necessarily coincide. The main reason for the existence of this gap is that the antecedents of customer expectations are usually quite different from the antecedents of public authority expectations. Managers and public authorities have a deeper knowledge of the service, its constraints, and the long term effects of managerial decisions, while customers have heterogeneous characteristics which can hardly fit in a standard service, unless it can be customized for each single customer. Thus, the gap can be reduced but not eliminated. Managers can increase their attention to customers' requests; they can organize

focus groups or send out questionnaires to customers, as they actually do in some cases. However, the possibility to fully adjust the service to customers' requests is limited due to the contrasting needs expressed by different customers.

Moreover, in most of the case studies analyzed, managers pay attention to customers every time they are going to introduce a significant change in the service, since in such cases they expect dissatisfaction. It looks as if managers are more worried about dissatisfaction than about increasing satisfaction, but according to their reply it looks also that the main driver for their choice is to reach some technical measurable performance, usually in terms of decreased amount of waste landfilled linked with budget constraints. Even the attempts to avoid customer dissatisfaction look to be grounded more on the fact managers recognize that dissatisfaction implies a lower collaboration to recycling than on other reasons. Such behavior on the managers' side is explained by the fact that European legislation asks to reduce the amount of waste landfilled and in order to achieve such goal strong penalties have been imposed. However, customer satisfaction increases the customer collaboration which is essential in order to provide the service, and the short terms citizen's needs asked cannot be fully ignored in a public service provision.

Although some characteristics of the service are strictly related to the context in which it is provided, some choices can be ascribed to cultural reasons. These characteristics do not concern minor issues but rather they can greatly change the cost of the service. For instance, in the UK, managers could be in doubt whether to collect waste weekly or fortnightly and about whether to set or not a limit per household on the amount of waste not recyclable. On the other hand, in Southern Italy the question is about how many times per week the waste should be collected (whether two or three or even four, as well a daily collection when waste is collected through waste banks). Such difference does not only imply different customers' behavior, as to stock waste for two weeks is not the same than stock it for a couple of days, it also has a strong impact on costs. Service collection costs are directly proportional and almost only based on the collection frequency. Several managers have claimed that any other cost is usually covered by the earning made through selling the recyclable materials collected. However, customers have very low perception on this fact. English households pay a fee for their houses which include waste services, but it also includes many other services which get the largest part of this fee, thus citizens have to carefully study balance sheets, which are published online, in order to understand which is the cost of the waste services that they are

really paying. Instead, Italians pay a fee for the waste service which covers only partially the costs of waste services; although the percentage of cost covered by the fee is increasing, it does not yet cover fully the cost. This implies that Italian users can easily confuse an increase in the tariff for increments in the cost of the service, i.e.. citizens have very few ways to perceive the true cost of their waste collection services, and in no case we found any clear advertisement by the public authority about it. All these facts enhance the difficulties about comparing waste services from a municipality to another, at least till the comparison is based on a few parameters.

For the same reasons, the customer satisfaction gap model (Parasuraman et al., 1985) has been revised. The model developed explicitly recognizes public authority and citizens as two different kinds of customers. One has the role to "buy" the service, the other to "use" it. The increased complexities for a public provision have underlined the needing of considering more gaps which affect the user satisfaction than in the private services. Such gaps have been studied, and their existence has been tested in the case studies.

The present paper proposes also a methodology to evaluate the quality of a MWS. Such a methodology is based on an aggregate measure of the value for customers, which includes both the perspectives of the public authority and of the customers. Specific parameters have been selected in order to have measures relevant for each kind of customer involved during each phase of the service provision.

The proposed approach is to evaluate and compare several waste management services according to the different perceptions that local authority and customers may have during interactions with the supplier. It may constitute a basic tool for a regulatory authority in defining how to enhance efficiency and effectiveness (quality performance) in managing waste services. Moreover, this tool could be used by the local authorities to select among several competitors the supplier to be entrusted with the service provision.

Although customer satisfaction investigations are becoming common in public services, they are not yet included in the contracts neither with the supplier of waste management services nor in the evaluation of other public services. Thus, the relevance of such a measure is not yet recognized and public policy makers underestimate the added value it could bring to a service. In our case study, we developed and used a MAS in order to confirm the possibility of considering both perspectives and simulating supplier decisions according to both external pressure and self-interests. Moreover, it has been used to demonstrate that customer

satisfaction should be explicitly considered as a parameter of evaluation in public services, as this inclusion has positive influence on the supplier's behaviour.

The MAS could be used for more purposes, such as for comparison among different suppliers or the study of which technical or financial parameters should be used to evaluate the service in order to give the wished direction to the supplier's behaviour.

The proposed methodology has some limitations and requires more research efforts. It would be important to investigate customer's behaviour in order to be able to simulate real users' reactions to changes in the service provided. Moreover, the relations simulated in the model could be better detailed after specific investigations, increasing the accuracy of the tool and the quality of the forecasts.

II. Contribution to the theory and originality of the approach

Several results can be acknowledged in the present piece of work in terms of contributions to the theory. Empirical data collected in several case studies proved the existence of a gap between the public authority's expectation and citizen's expectation. Moving from this first result, the gap model (Parasuraman et al., 1985) and the value for customer (Woodall, 2003) have been revised in order to explicitly consider citizens and public authority as two different kinds of customers which perceive and evaluate differently the service provided by the supplier.

The two models give relevant insights about the peculiarity which make a public service differ to a private. More specifically, while in fully private context the aim for the supplier to satisfy customers is limited only by the profitability of its actions, in public context there is one more priority which overcomes the user satisfaction; it is to fulfill the long term public interest as stated and required by the public authority.

Thus, the main contribution of this piece of work can be considered the development of a comprehensive service quality model which takes into account the three main actors involved in the public service provision, namely user (citizen), supplier and buyer (public body). A part of the proposed model is based on insights from public service management and represents an adaptation of the well-known gap model by Parasuraman et al. (1985). Several new gaps have been identified and their impact on service provision and on service quality perception has

been discussed.

The revised gap model for public services considers that the multiple perspectives of the stakeholders involved play different roles and impact differently on each aspect of the service. As both customers (users and buyer) are relevant, their evaluations are mutually important.

In general, this approach offers a useful tool to improve an user orientation in public services. It offers to the managers of the firm entrusted with public service provision an agenda to verify where the service quality can be improved and where the main point of weaknesses are. It provides to the managers of the public body a framework for evaluating the points to be discussed with the service provider and suggests them how to structure appropriately survey instruments to investigate on service quality perceptions by users.

The new gaps outlined in the revisited model develop a map of possible issues which compromise customer satisfaction, which is at our knowledge, something new in literature. As well, to adopt the value for customer concept in order to identify which is the actor that has the major role in each phase of the process, and which are the variables to be considered for each dimension of the VC has not yet done in other researches.

Last, although the multi agent based model have been applied in a number of sectors, for a broad number of different aims, the application of a multi agent based model in order to make a complex evaluation for customer satisfaction and value for customer at the same time for a public service, considering the interactions among multiple actors has not done in previous researches to our knowledge.

To sum up what is above mentioned, to care about service quality in public context is not a at all a new issue; neither is new to get measures of customer satisfaction regarding public services. However, there are few work which investigate the relevance and the role of customer satisfaction in public services, and the present work do it through the adaptation of models largely recognized in literature to public services. Thus, the originality of the research is due to the new approach regarding the customer satisfaction and value for customer, as well the proposal of a simulation toolkit for the analysis of the interactions among stakeholders.

III. Discussion and Managerial Implications

The revised gap model has been useful in order to recognize which are the antecedents of customer expectations and perceptions of a public service.

The evidence of such antecedents have lead not only to a new conceptual framework, but the empirical facts emerged in the analysis of the gap can be useful for practitioners in order to improve the strategies coherently with any aim of improving customer satisfaction, as well improving technical parameter without causing adverse reactions in the final user due to an excess of dissatisfaction.

In particular, several managerial implications can be outlined from the results of the research.

The first result of the present work has been to present concrete elements for the recognition of a gap between the expectations of citizens and those of public authority. Such a gap is clearly unavoidable, due to the difficulties to homogenize user requests in a standard service, as well to the difficulties for citizens to recognize all the long term effects of their behavior. Somehow, the only case in which, for mere hypothesis, this gap could not exist, is when all citizens have a full trust on their government, and do not neither try to judge the service according to their personal opinions but accept and are satisfied with the service provided whatever it is. This hypothetical case is anyway far away from the modern world, as citizens' claims about their role as individual are increasingly relevant. However, in the context analysed there are a number of complexities which are not easily solvable for most of the users. The reason for the existence of differences between the services provided in different countries, regions, or just municipalities few kilometers far away from each other, is not immediately understood by the users or neither explained to them. Thus, public authority can go mainly on the direction of provide a more standardized service, making efforts to reduce such differences. Moreover, a better promotion of the service process could reduce gap 4 and thus customer dissatisfaction.

According to the results, customer satisfaction cannot serve as the main and only ground for a judgment about a public service. Public authority's priority can be strongly important in a long term perspective and it is not necessarily understood by most of the customers. However, the previous cannot be interpreted as a good reason for low efforts in increasing

customer satisfaction, as usually happens, at least for the fact public service require the collaboration of the citizens in order to be effectively provided.

Public authority, as well as the service provider, has several options in order to increase customer satisfaction without ruin the long term's aims. The previous implies that customer satisfaction should be considered among the parameters for evaluating a public service. However, the usual measurement of customer satisfaction as the difference between expectations and perception, would not result adapt for the measurement. Customer Satisfaction measures should explicitly consider the effect of public authority needs on citizen perceptions. Thus, the Customer Satisfaction Revised should be measured as the difference between Gap5 and GapA plus GapB, as proposed in Chapter 5.2.

Through the lesson learned in the case of door to door collection, waste service provider and public authorities should have learned how much is relevant the customer collaboration and how is possible to improve it. Several of these actions could be applied also when a cheaper waste bank collection is done. However, it is only when the increased costs and complexities of the door to door collection put pressure on the management that most of these actions are applied.

Moreover, each gap studied through the model focused by public authority or supplier in order to increase user satisfaction without loose the long term aims.

A resume of the actions that can be taken in order to improve customer collaboration in public services, has been later reported. Such list has been prepared considering the gaps outlined in the model and combining it with the results from the interviews with all stakeholders in the waste service. Thus, a similar work could be done by practitioner, adopting the gap model revisited to the analysis of their specific service.

To provide to the user information:

- When there is a service change,
- Periodically in order to improve the perceptions of the service and solve users' doubts,
- Through mail,
- Through personal visits,
- Through free toll number,

- Through forum and conference to the citizens, or group of these,
- During the door to door collection through employees or target mail,
- Through advertisements in the media,
- Through limits, coercion, penalties and avoiding to collect waste which has not been properly disposed by the user,
- Limiting the number of waste banks placed in roads under limited control,

One more action is promoting the cooperation of the user during the several stage of the waste process planning:

- Through focus groups in order to anticipate adverse reactions,
- Through customization,
- Through reduction of tariff in order to rewards correct behaviours,
- Participative democracy.

Moreover, the main difficulties of implementation should be recognized. Among these:

- Heterogeneity among users,
- Existence of seasonal users, or other kind of users which have to cooperate for limited amount of time (for example students).

Moreover, the paper deals with value for customer technical parameters in waste in order to recognize at least one parameter for each dimension of the value for customer. Such a statement implies that, during the process of contracting out a service the several stages of the process should be considered in terms of specific parameters to be measured which are valuable by the customer involved in the stage.

IV. Limitations and Recommendations for future research

Although the present research has been grounded on several cases studies which present a good variety of examples, it cannot be considered fully exhaustive about the valuation issue in public service. First, the data collected regards only one specific public service, the municipal waste service. Thus, the generalization of the results could concern at best the framework

proposed and not the specific measures, as are the parameters of the VC proposed in Chapter 5.5.

For the same reasons, as the research has been carried out through the analysis of two specific countries, it is possible that data collected about the way service is provided could have changed if different countries had been included. Several country-based differences have been recognized among the cases studies, and is not possible to exclude that in terms of waste management services, other issues could identified if the investigation involved a different set of case studies, especially considering other countries in the sample. However, the main aim of the work was just to provide a number of indicators to be immediately used to evaluate a waste management service, and to provide a framework for better choosing them according to the specific conditions which could differ not only from a sector to another one, but also between the same service provided in two different municipalities, even if by the same supplier. Thus, what can be reused is the framework of the approach.

Moreover, through the stakeholder salience approach, the three key players for a public services have been underlined. However, it has been outlined during the research that the public authority is represented by different entities at national and local levels. The model always considers the last in the chain of power (municipal level or AATO) as the one who represent the interests and the rules previously stated by the others. Similarly the citizens have been generally considered for their role of users, disregarding the fact they can have a role also through active associations of citizens, media, etc. Thus, other actors not considered may be relevant in different countries due to different legislations and industry structure. Further development of the models, in particular considering the simulation tool, could consider these actors specifically, introducing them as new agents in the system..

Finally, the original Gap model was used later to develop operational tools, such as SERVQUAL, SERVPERF and others. In the same way, future research could operationalize the new model not only in terms of a multi agent based model, but also through surveys and the usage of abundant quantitative data which could improve also the applicability of the multi agent model.

In spite of these limitations, this study contributes to a better understanding of the nature of the relationships among the three main actors involved in public service, providing a

common framework that takes into account the main problems that actually may exist in the relationship among them.

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9. Appendix

I. A tutorial about the software

In order to execute the software it is necessary to have a Java software installed in the computer. In particular it has been used the java version 1.6.0_13 from Sun Microsystems. Moreover, it is necessary to download the MASON toolkit, and the extensions required for the graphic outputs.

The waste simulation tool developed consists in six different forms:

- Main Menu – Waste collection - *Raccolta Rifiuti*,
- A general display - *Generale*,
- A specific display for door to door collection - *Servizio Porta a Porta,*
- A specific display for bulky bin collection - *Servizio Bidoni,*
- The graphic output with Value for Cusomer and Customer Satisfaction measures – *VC e CS,*
- The table with the list of action occurred during the simulation - *Report Completo*.

Before than start the simulation it is possible to modify the parameters through which each zone of the city is configured. It can be done through the page *Model* in the main menu (Figure A.1).

Under this menu it is possible to choose the number of zone to simulate.

Moreover, it is possible to decide the inhabitant density (N° inhabitants for 1000 square meters), the waste production on average per inhabitant, the ratio of waste recycled if door to door service is applied and if just bulk bin collection is done, and the typology of service activated in each zone.

After the main parameters of the model are chosen, it is possible to create and initialize it pressing the button PAUSE.

As soon as the model is initialized it stays at the moment zero of the simulation, called “At Start” in the simulator.

From this point it is possible to modify the data of each agent through the general display - *Generale* (Figura A.2).

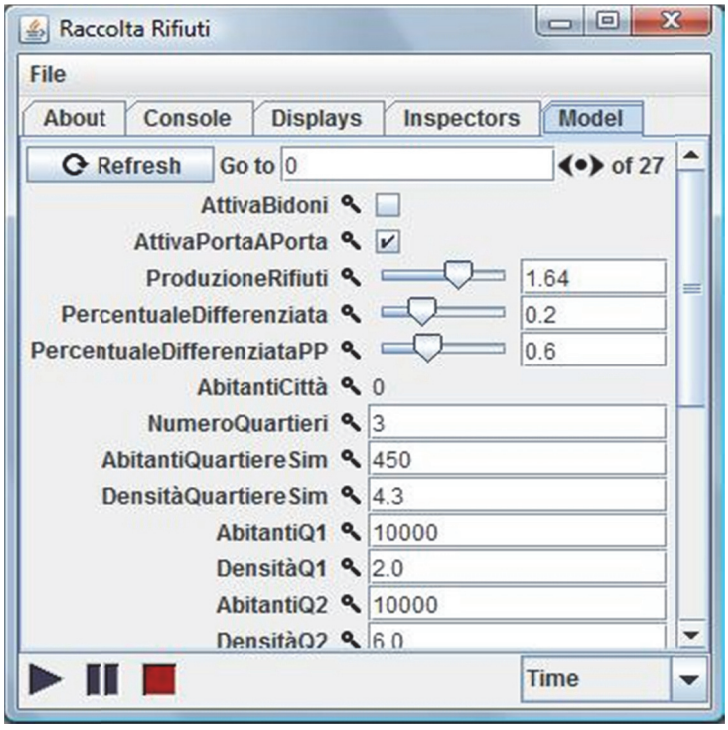

Figure A.1 : Main Menu – Page Model

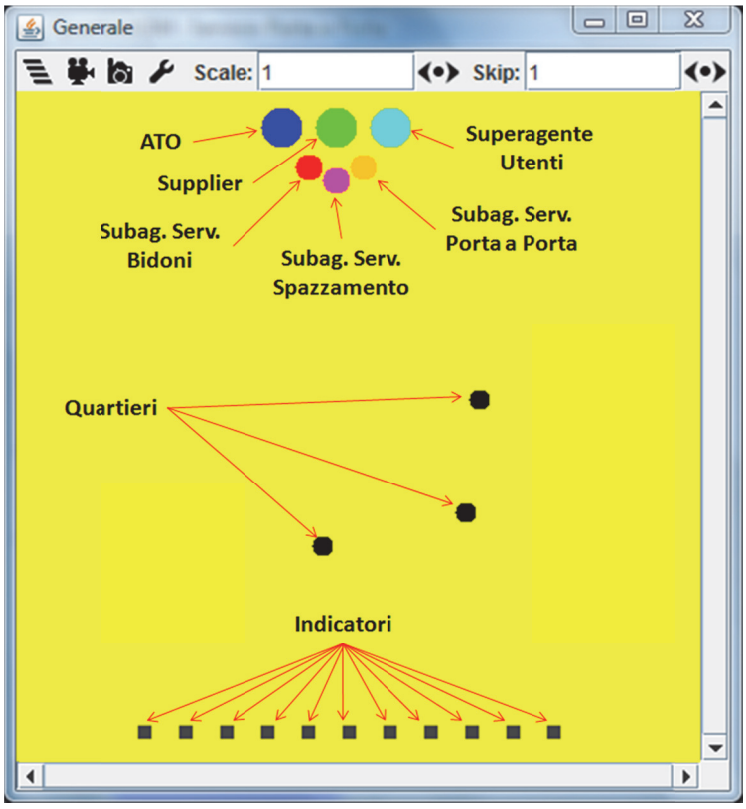

Figura A.2 : The General Display - Generale

In order to change any option inside the agent is enough do a double click on each of figure representing one of it. A new menu, *Inspectors*, appears in the main menu, it will show all parameters, those who are modifiable as well the others that can be just seen to check the system.

Figure A.3 shows some of options available in the tool developed. Such options can be changed at any time during the simulation.

For instance in fig. A.4 it is possible to select the limit of VC value and CS value which should be fulfilled by the public authority and in Figure A.5 for the supplier. Through the option *DecisionMaker* is possible to activate, or not, the possibility for the supplier to take some decision out of the contract in order to improve the service in terms of VC and/or CS.

In figure A.6 is reported a short list of possible parameters to be considered as part of the VC. For each of theses it is possible to modify the weight on the final measure of VC.

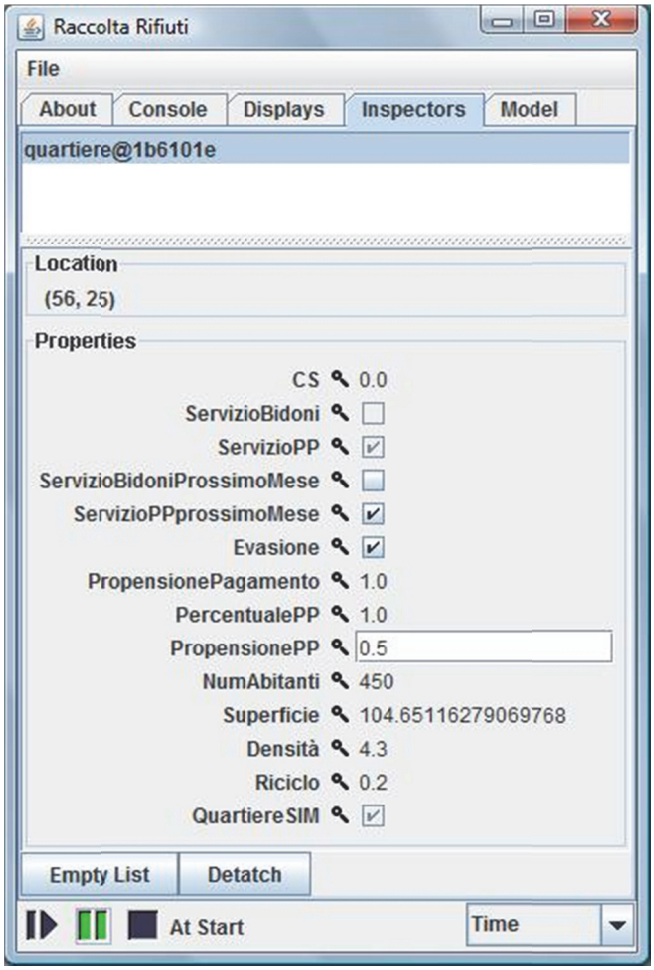

Figure A.3 : Agent Zone, before to starting the simulation

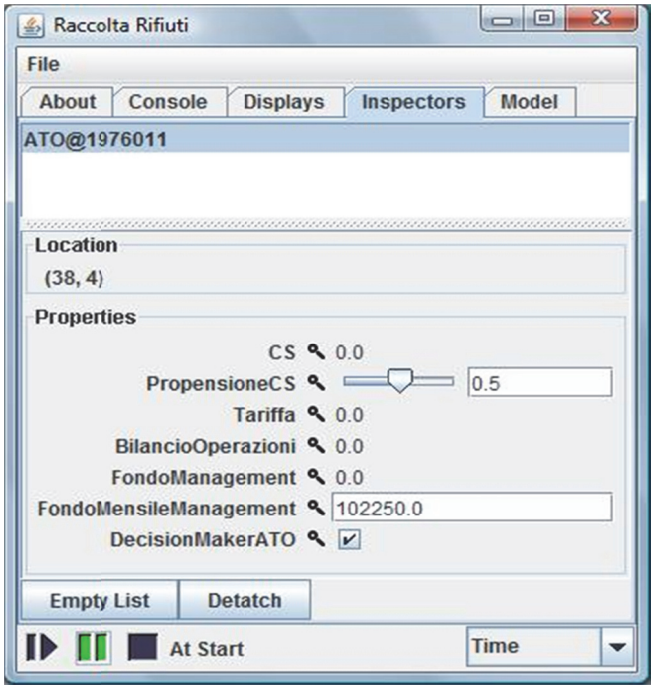

Figure A.4 : Agent Public Authority before to starting the simulation

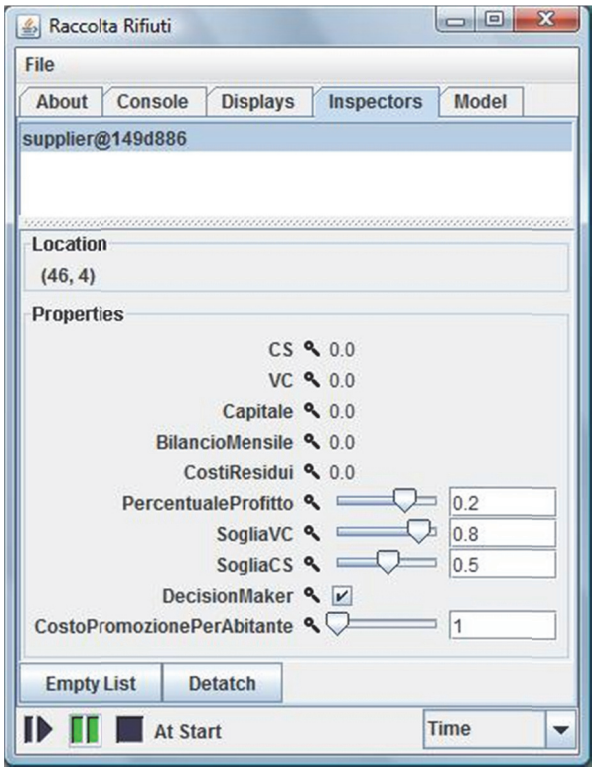

Figure A.5 : Agent Supplier, before to start the simulation

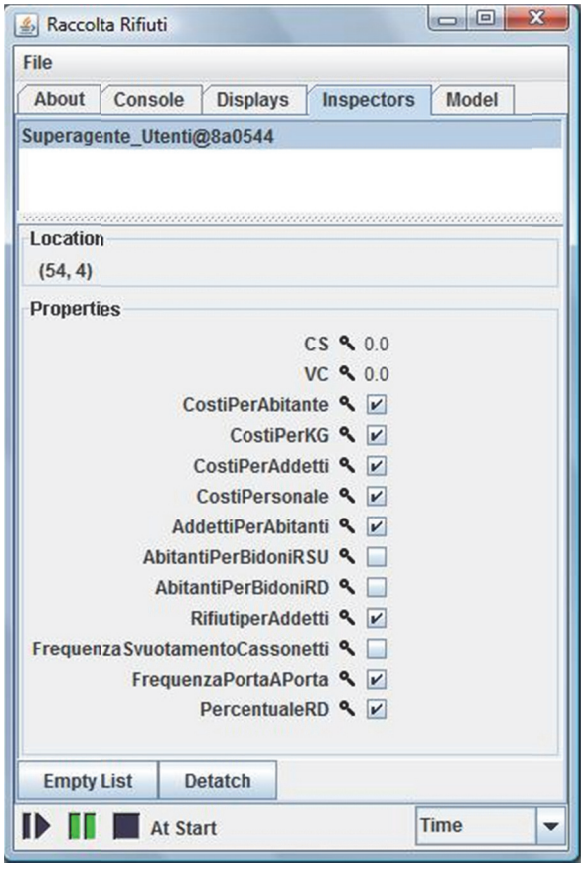

Figure A.6 : Agent AllUsers

In Figure A.7 it is possible to display the evolution of waste collection over the time. Every time that a waste bank (blue dot) is full, a red square is drawn around it. Black dots represent inhabitants, which deposit their waste in the nearest waste bank. A similar display (Figure A.8) represents door to door collection. As each day is represented through 4 steps of simulation, citizens are allowed to deposit their waste near their building during just 1 step each four (in case of a daily collection). Actions from supplier and public authority are supposed to be active no more than one time each 120 steps (one time per month).

Through display in Figure A.9 it is possible to select which measures are considered in order to evaluate VC and CS.

Moreover, it is possible to save the simulation in any part of it, in order to try the effect on any change done in any temporal frame of the simulation.

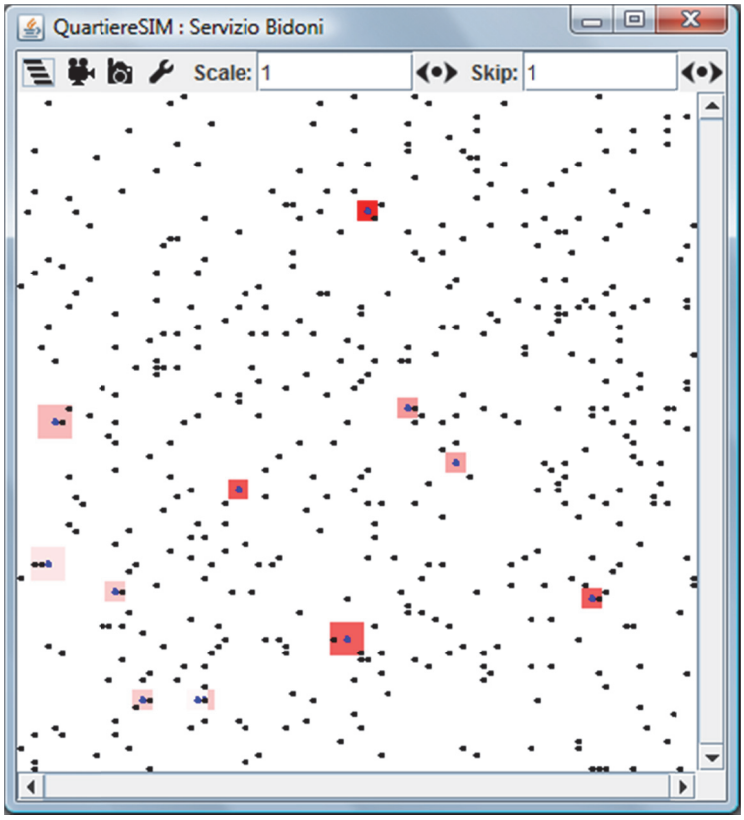

Figure A.7 : Display of a single zone, collection through waste banks

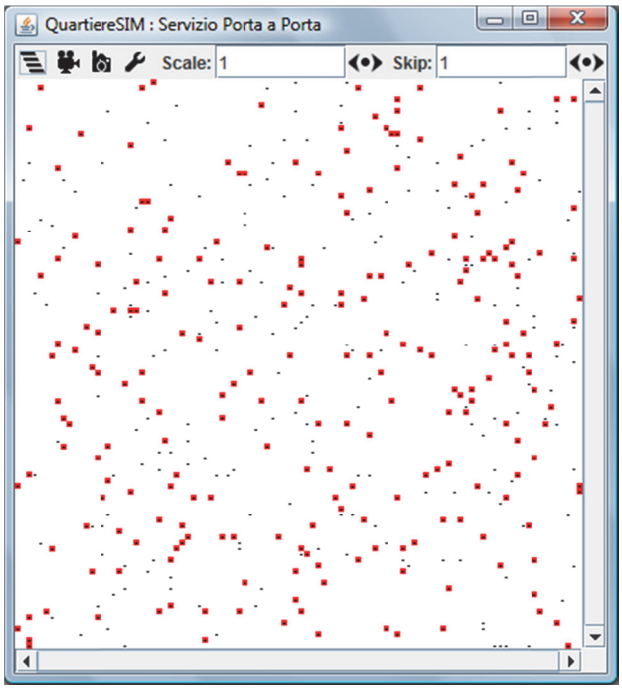

Figure A.8 : Display of a single Zone, collection through door to door collection

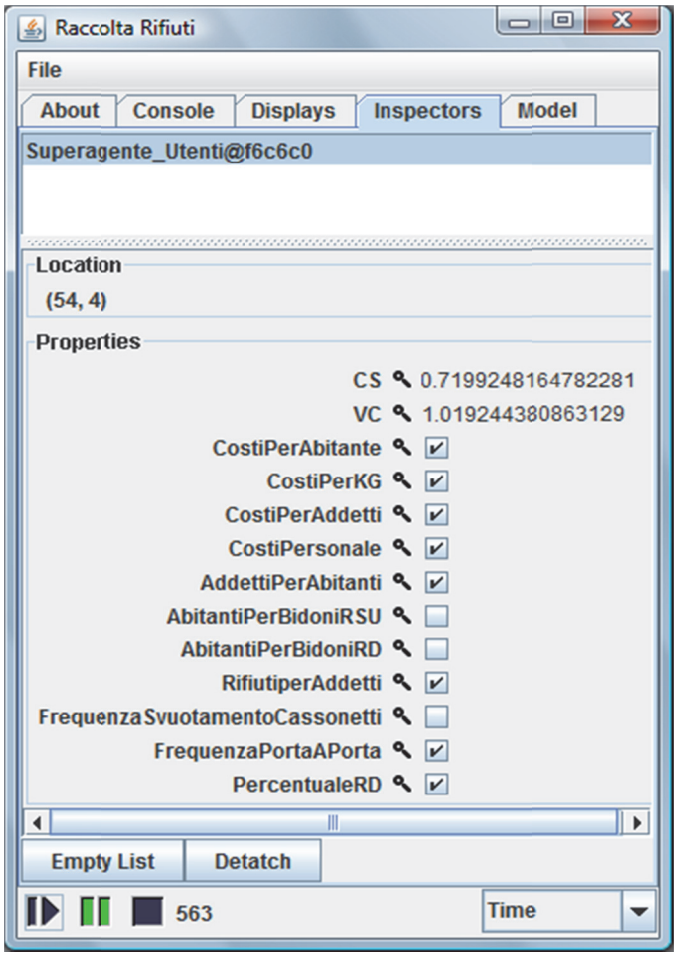

Figure A.9 : List of VC parameters to be considered by Users

In Figure A.10, it is represented the financial state of the simulation together with a measure of Customer Satisfaction.

In Figure A.11 is shown how is possible to get a graphic evidence in realtime during the simulation for any numerical data considered by the simulator.

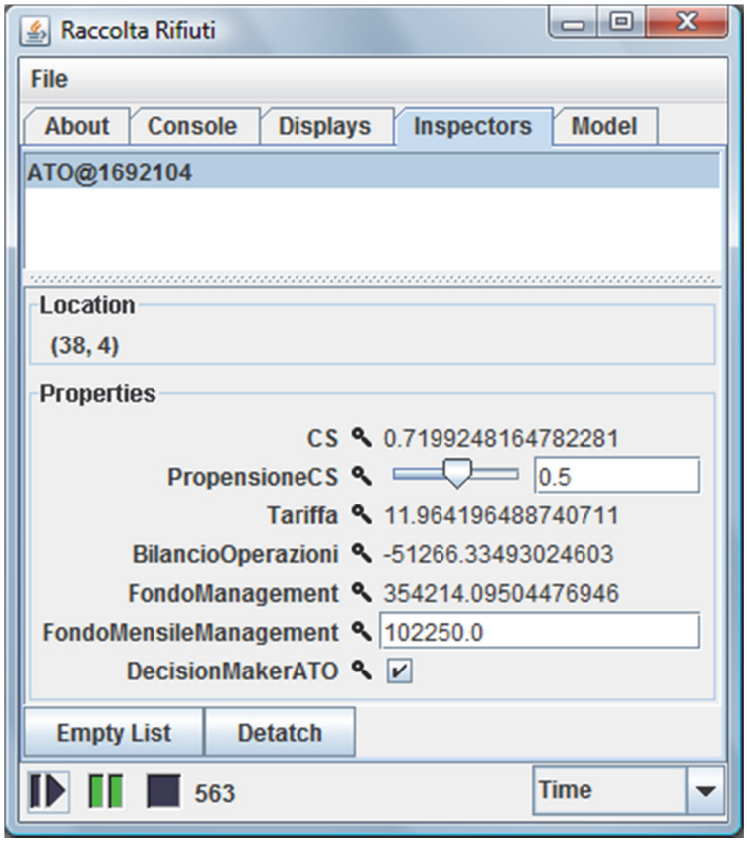

Figure A.10 : Public authority status during the simulation

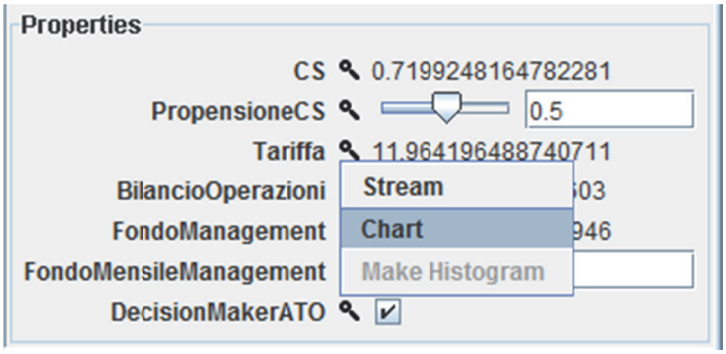

Figure A.11 : Form to create Streame of data or a Chart

In the historical chart shown in Figure A.12 there is the temporal representation of the values of VC and CS. Moreover, the tool has been modified in order to write some comments during the simulation one time each six months of simulation, in order to save evidence of the some of the reason of the parameters' evolution. Due to the space limits the actions taken over the time have been resumed through acronyms, for instance 2P- means that during that semester two times the supplier had to decrease its profits for improve CS and VC due to specific target to be reached. The same informations, have been reported in a resume month by month, each line represent an year (Figure A.13)

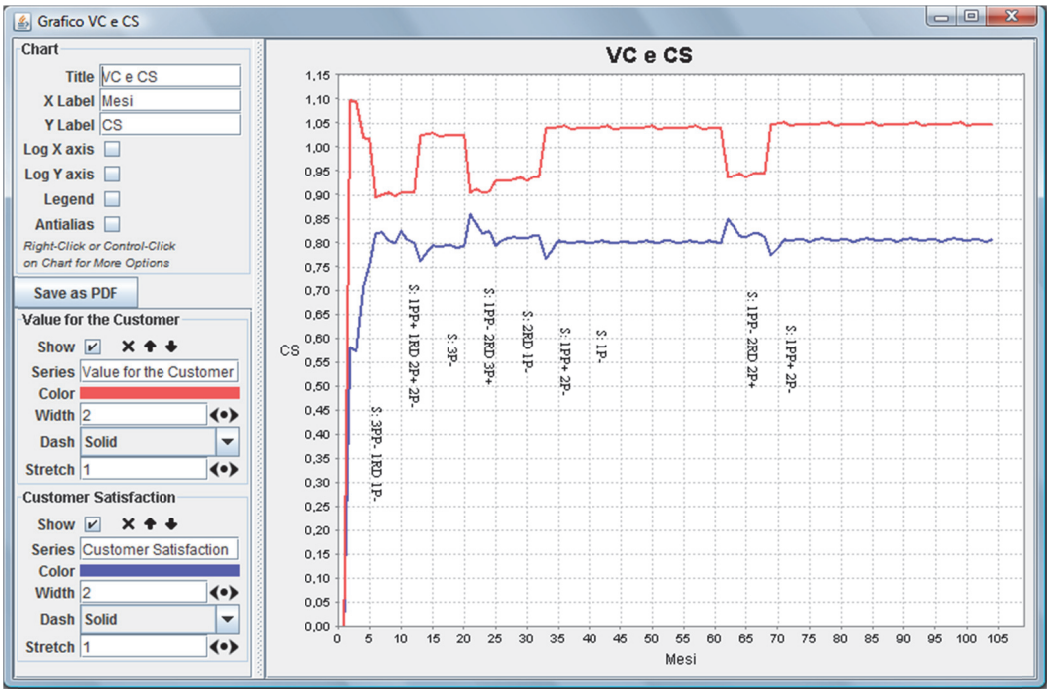

Figure A.12 : Chart with VC and CS

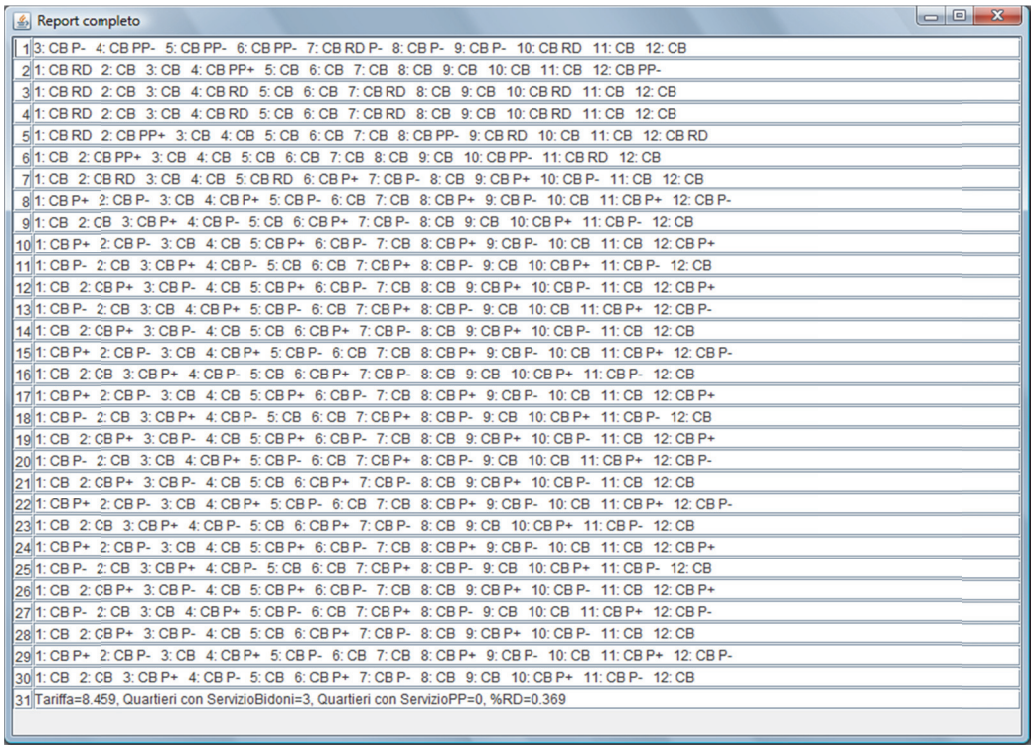

Figure A.13 : Full Report

In Figure A.14 there is an example of the java code implemented, in particular it contains the rule applied before a suppier's decision can be taken. In particular when the decision maker is activated it does a check about the actual satisfaction, compared with the minimum satisfaction required and then, eventually takes actions accordingly.

```
public void decisionMaker(double random, RaccoltaRifiuti rr) {
    boolean bassoVC = false;
    boolean bassoCS = false;
    if (supervisore.vc < prioritàVC) bassoVC = true;
    if (supervisore.cs < prioritàCS) bassoCS = true;
    if (bassoVC) {
        double scelta = 0.5;
        if (prioritàVC-supervisore.vc > 0.1) scelta+=0.25;
        if (capitale<0) scelta+=0.25;
        if (prioritàVC-supervisore.vc < 0.03) scelta-=0.25;
        if (bassoCS) scelta-=0.25;
        if (random<scelta && downPP==0 && !pienoPP()) {
            aumentaPP();
            rr.commentC += "PP+ ";
            rr.countCommenti[0]++;
            upPP = 6;
        }
        else if (upRD == 0 && !promFallita) {
            promozioneRD();
            rr.commentC += "RD ";
            rr.countCommenti[2]++;
            upRD = 3;
        }
    }
    if (bassoCS) {
        double scelta = 0.5;
        if (prioritàCS-supervisore.cs > 0.2) scelta+=0.25;
        if (capitale<0) scelta+=0.25;
        if (prioritàCS-supervisore.cs < 0.04) scelta-=0.25;
        if (bassoVC) scelta-=0.25;
        if (random<scelta && upPP==0 && cittàPP) {
            riduciPP();
            rr.commentC += "PP- ";
            rr.countCommenti[1]++;
            downPP = 6;
        }
        else if (profitto>0.05) {
            abbassaProfitto();
            rr.commentC += "P- ";
            rr.countCommenti[4]++;
        }
    }
    if (profitto<profittoDesiderato)
        if (supervisore.cs-prioritàCS > 0.02) {
            aumentaProfitto();
            rr.commentC += "P+ ";
            rr.countCommenti[3]++;
        }
}
```

Figure A.14 : Decision Makers supplier side

In Figure A.15 is reported the code used in order to evaluate VC. The amount of parameters and their weight can be modified during the simulation. The rule applied in the model regard the rule applied in order to get a final value.

The mathematical formulation has been done as follows:

$$VC = \sum_{p=1}^{N_a} (W_p \cdot Y_p)$$

$$W_p = \frac{Y_1 - Y_2}{\sum_{i=1}^{N_a} (Y_{1_i} - Y_{2_i})}$$

$$Y_p = Y_1 + \frac{(Y_2 - Y_1) \cdot (X_p - X_1)}{(X_2 - X_1)}$$

Yp = Usefulness of p-indicator
Y1 = Low Usefulness
Y2 = High Usefulness
Wp = Weight of p-indicator
Xp = Value of p-indicator
X1 = Lowest value acceptable
X2 = Highest value acceptable
Na = Number of active indicators

In Figure A.16 is reported the code used in order to evaluate CS. The amount of parameters and their weight can be modified during the simulation. The rule applied in the model regard the rule applied in order to get a final value.

Tariff applied is compared with the level of tariff considered acceptable by these users, waste not collected is compared with the waste produced on average on a daily basis. The CS is calculated separately for each group of users, although a final CS is considered as the average value.

The mathematical formulation has been done as follows:

$$CS = \frac{\frac{T}{T_0} \cdot P_t + \frac{SA}{PR} \cdot P_{SA} + PS \cdot P_{PS} + SS \cdot P_{SS}}{P_T + P_{SA} + P_{SP} + P_{SS}}$$

T = Tariff applied
T0 = Acceptable Tariff
PT = Weight of Tariff
PS = Road Cleaning
PPS = Weight of Road Cleaning
SA = Waste Produced Not Collected
PR = Waste Production
PSA = Weight of Waste Produced Not Collected
SS = Service Satisfaction
PSS = Weight of Service Satisfaction

```
public double calcolaVC () {
    double vc = 0;
    calcolaUtilità();
    calcolaPesiRelativi();
    for (int i=0; i<size; i++) if (indicatori[i].attivo)
        vc += indicatori[i].utilità * indicatori[i].pesoRelativo;
    return vc;
}

private void calcolaUtilità () {
    for (int i=0; i<size; i++) if (indicatori[i].attivo) {
        double x = indicatori[i].valore;
        double x1 = indicatori[i].valoreAccettabile - indicatori[i].range;
        double x2 = indicatori[i].valoreAccettabile + indicatori[i].range;
        double y1 = 1 + indicatori[i].deltaUtilità;
        double y2 = 1 - indicatori[i].deltaUtilità;
        indicatori[i].utilità = (y1 + (y2-y1)*(x-x1)/(x2-x1));
    }
}

private void calcolaPesiRelativi () {
    double totUtilità = 0;
    for (int i=0; i<size; i++) if (indicatori[i].attivo) {
        if (indicatori[i].deltaUtilità >= 0)
            totUtilità += indicatori[i].deltaUtilità * 2;
        else totUtilità += -indicatori[i].deltaUtilità * 2;
    }
    for (int i=0; i<size; i++) if (indicatori[i].attivo) {
        if (indicatori[i].deltaUtilità >= 0) indicatori[i].pesoRelativo
                = indicatori[i].deltaUtilità * 2 / totUtilità;
        else indicatori[i].pesoRelativo
                = -indicatori[i].deltaUtilità * 2 / totUtilità;
    }
}
```

Figure A.15

```
public void calcolaCS (double percentualeSpazzamento, double prodRifiuti,
                       double bollettaOttimale) {
    qualStradePulite = percentualeSpazzamento;
    if (servizioBidoni && servizioPP) qualTipoServizio = 1;
    if (!servizioBidoni) qualTipoServizio = propensionePP;
    if (!servizioPP) qualTipoServizio = (1-propensionePP);
    double qualSpazzaturaAccumulata = 0;
    double sommaPesi = pesoBolletta + pesoSpazzaturaAccumulata
            + pesoStradePulite + pesoTipoServizio;
    double qualBolletta = bollettaOttimale / bolletta;
    if (servizioBidoni && servizioPP) qualSpazzaturaAccumulata
            = 1-(spazzaturaAccumulataPP * (1-propensionePP))/(prodRifiuti*numAbitanti);
    if (!servizioBidoni) qualSpazzaturaAccumulata
            = 1-(spazzaturaAccumulataPP * (1-propensionePP))/(prodRifiuti*numAbitanti);
    if (!servizioPP) qualSpazzaturaAccumulata
            = 1-spazzaturaAccumulataBidoni/(prodRifiuti*numAbitanti);
    cs = (qualBolletta * pesoBolletta
            + qualSpazzaturaAccumulata * pesoSpazzaturaAccumulata
            + qualStradePulite * pesoStradePulite
            + qualTipoServizio * pesoTipoServizio)/sommaPesi;
}
```

Figure A.16: Customer Satisfaction

II. Communications to customers

What follows is an example of communications done to customers in order to teach how the system works, which are the aims to be achieved. However, such communication sent by mail to the people is not always enough to provoke a full change in users' behaviours.

Caro Concittadino,

dal 1° luglio 2009 sarà attivata la raccolta porta a porta di tutte le frazioni di rifiuti differenziati in casa dagli utenti.

Da sempre ha fatto a meno dei cassonetti per le strade, da anni ormai viene praticata la raccolta differenziata porta a porta. Oggi si vuole dare una svolta decisa alla differenziazione dei rifiuti separando la frazione umida, cioè tutta la parte biodegradabile che da sola rappresenta un terzo del peso totale di quanto prodotto e che se non smaltita più in discarica per essere destinata a diventare fertilizzante per l'agricoltura abbassa i costi del sevizio e diminuisce l'inquinamento ambientale. I cittadini saranno istruiti singolarmente, presso il loro domicilio, da personale incaricato , ad utilizzare il kit per la raccolta differenziata dell'**umido** e ad ognuno sarà consegnato il contenitore in plastica anti-randagismo ed i sacchetti in carta, biodegradabili, necessari alla raccolta che verrà effettuata a giorni alterni, **lunedì**, **mercoledì** e **venerdì**, a domicilio. La raccolta dei **rifiuti non riciclabili** sarà invece effettuata, sempre porta a porta, nei giorni di **martedì** e **sabato** utilizzando appositi sacchetti di plastica trasparente forniti dal comune non verranno ritirati sacchetti contenenti materiale riciclabile.

La raccolta porta a porta di **carta**, **vetro** e **plastica** avverrà solo il **giovedì** per tutto il territorio comunale, mediante l'utilizzo dei sacchetti e contenitori di diverso colore e del codice a barre necessario per ottenere la riduzione del 25% della TARSU al raggiungimento della quantità stabilità, di almeno 48 sacchetti annui per nuclei familiari composti da una sola persona e 84 nel caso di due o più persone. L'obiettivo è quello di arrivare almeno al 35% di raccolta differenziata così come previsto dalla legge che determina pure le relative sanzioni per chi non lo raggiunge. Questo obiettivo così ambizioso comporta però la partecipazione attiva e consapevole da parte di tutti i cittadini e di tutte le famiglie. I hanno sempre dimostrato spiccato senso civico e sensibilità nella difesa dell'ambiente e anche in questo passaggio così delicato e decisivo per la nostra crescita civile non deluderanno.

Assessore all'Ambiente Sindaco

CALENDARIO SETTIMANALE RACCOLTA RIFIUTI PORTA A PORTA

Quando	tipologia	Cosa mettere	Come
Lunedì	Umido	Alimenti deteriorati di ogni tipo, bucce di frutta, fondi di caffè, dolci, fiori appassiti, foglie, gusci di uova, molluschi o frutta secca, lische di pesce, noccioli di frutta,carne, ossi con pelli e piume di animali, pasta e pane avanzati, riso avanzato, semi, thè, torsoli di frutta, verdura scartata, bustine del thè, carta assorbente da cucina, tappi di sughero, tovaglioli di carta usati, vaschette di cartoncino (quelle usate per i dolci) materiali di carta o legno naturali che possono essere tranquillamente trasformati in compost.	Nel sacchetto da 8 lt. di carta riciclabile posto all'interno del contenitore marrone con chiusura anti-randagismo.
Martedì	Secco non riciclabile	Vaschette in pvc o polistirolo, Contenitori per liquidi in tetrapack (latte, vino, bibite, succhi di frutta) Cellophane Calze nylon Oggetti in plastica (esclusi i contenitori per liquidi) Giocattoli Involucri in carta plastificata Carta stagnola, plastificata o oleata Filtri di aspirapolvere Piccoli scarti di legno trattato con prodotti chimici Pannolini, assorbenti Scarti di piccole lavorazioni domestiche	Nei sacchetti già forniti dal comune, neri o verdi, sino ad esaurimento scorte. Dopo nei sacchetti trasparenti sempre forniti dal comune. **non inserire il codice a barre** **N.B.: Se questo sacchetto contiene materiale riciclabile non verrà ritirato.**
Mercoledì	Umido	Alimenti deteriorati di ogni tipo, bucce di frutta, fondi di caffè, dolci, fiori appassiti, foglie, gusci di uova, molluschi o frutta secca, lische di pesce, noccioli di frutta,carne, ossi con pelli e piume di animali, pasta e pane avanzati, riso avanzato, semi, thè, torsoli di frutta, verdura scartata, bustine del thè, carta assorbente da cucina, tappi di sughero, tovaglioli di carta usati, vaschette di cartoncino (quelle usate per i dolci) materiali di carta o legno naturali che possono essere tranquillamente trasformati in compost.	Nel sacchetto da 8 lt. di carta riciclabile posto all'interno del contenitore marrone con chiusura anti-randagismo.
Giovedì *Solo oggi usa codice a barre*	Vetro	Tutti i tipi di contenitori in vetro; bottiglie, vasi e barattoli in vetro puliti.	Nel contenitore fornito dal comune con codice a barre ogni volta rinnovato.
	Plastica	Bottiglie, flaconi, dispensatori, confezioni rigide e vaschette per alimenti in genere, buste e sacchetti in plastica puliti.	Nel sacchetto giallo fornito dal comune. Aggiungi il codice a barre.
	Carta	Carta pulita e non plastificata, cartone, cartoncini di ogni genere ridotti e ben piegati, giornali e riviste	Nel secchiello fornito o in qualsiasi contenitore di cartone. Aggiungi il codice a barre
Venerdì	Umido	Alimenti deteriorati di ogni tipo, bucce di frutta, fondi di caffè, dolci, fiori appassiti, foglie, gusci di uova, molluschi o frutta secca, lische di pesce, noccioli di frutta,carne, ossi con pelli e piume di animali, pasta e pane avanzati, riso avanzato, semi, thè, torsoli di frutta, verdura scartata, bustine del thè, carta assorbente da cucina, tappi di sughero, tovaglioli di carta usati, vaschette di cartoncino (quelle usate per i dolci) materiali di carta o legno naturali che possono essere tranquillamente trasformati in compost.	Nel sacchetto da 8 lt. di carta riciclabile posto all'interno del contenitore marrone con chiusura anti-randagismo.
Sabato	Secco non riciclabile	Vaschette in pvc o polistirolo Contenitori per liquidi in tetrapack (latte, vino, bibite, succhi di frutta) Cellophane Calze nylon Oggetti in plastica (esclusi i contenitori per liquidi) Giocattoli Involucri in carta plastificata Carta stagnola, plastificata o oleata Filtri di aspirapolvere Piccoli scarti di legno trattato con prodotti chimici Pannolini, assorbenti ,Scarti di piccole lavorazioni domestiche	Nei sacchetti già forniti dal comune, neri o verdi, sino ad esaurimento scorte. Dopo nei sacchetti trasparenti sempre forniti dal comune. **non inserire il codice a barre** **N.B.: Se questo sacchetto contiene materiale riciclabile non verrà ritirato.**

RACCOLTA PORTA A PORTA SECCO / NON RICICLABILE

Giorni: martedì e sabato dalle ore 06 alle ore 08

La frazione non riciclabile è l'unica che va smaltita in discarica con costi considerevoli ed inquinamento ambientale, quindi è interesse di tutti ridurre al minimo essenziale il contenuto di questi sacchetti.

Cosa mettere nel Sacchetto Trasparente di plastica fornito dal Comune, della frazione non riciclabile:

Tutto quello che NON è recuperabile:

- *Vaschette in pvc o polistirolo*
- *Contenitori per liquidi in tetrapack (latte, vino, bibite, succhi di frutta)*
- *Cellophane*
- *Calze nylon*
- *Oggetti in plastica (esclusi i contenitori per liquidi)*
- *Giocattoli*
- *Involucri in carta plastificata*
- *Carta stagnola, plastificata o oleata Filtri di aspirapolvere*
- *Piccoli scarti di legno trattato con prodotti chimici*
- *Pannolini, assorbenti Scarti di piccole lavorazioni domestiche*

Non inserire umido o quant'altro riciclabile. In tal *caso il sacchetto verrà riconsegnato all'utente.*

N.B.: Esporre il sacchetto solo quando è pieno.

RACCOLTA PORTA A PORTA DELL'UMIDO

Giorni di raccolta: lunedì, mercoledì e venerdì.

All'esterno del proprio domicilio dalle ore 6 alle 8 deve essere esposto, in posizione ben visibile e solamente nei giorni sopra indicati, il sacchetto di carta biodegradabile per l'umido nel contenitore in plastica ben chiuso fornito dal Comune.
Il contenitore è dotato di chiusura anti-randagismo per evitare spargimenti del contenuto e deve essere a cura dell'utente tenuto pulito e con il codice a barre adeso alla parete esterna per identificare il proprietario.

Cosa mettere nel Sacchetto di carta biodegradabile della frazione umida?

Alimenti deteriorati di ogni tipo, briciole, bucce di frutta, fondi di caffè, dolci, fiori appassiti, foglie, gusci di uova, molluschi o frutta secca, lische di pesce, noccioli di frutta, carne, ossi con pelli e piume di animali, pasta e pane avanzati, riso avanzato, semi, thè, torsoli di frutta, verdura scartata, bustine del the, carta assorbente da cucina, tappi di sughero, tovaglioli di carta usati, vaschette di cartoncino (quelle usate per i dolci) materiali di carta o legno naturali che possono essere tranquillamente trasformati in compost.

Non inserire:

- *Vetro, plastica, confezioni di alimenti (vaschette, barattoli, retine, buste, cellophane, ecc.)*
- *Piatti, bicchieri e posate di plastica*
- *Rifiuti generici e rifiuti liquidi*

Bastano piccole quantità di questi rifiuti per rendere tutto il resto non riciclabile.

RACCOLTA DIFFERENZIATA di materiali particolari:

Farmaci scaduti - pile esauste - scarti informatici e toner - alluminio: presso il sito di raccolta di via
nello spazio a fianco il municipio nei contenitori dedicati aperto tutti i giorni anche festivi.

Rifiuti ingombranti: elettrodomestici e mobili in disuso contengono componenti riutilizzabili; se hai bisogno di smaltire queste tipologie di rifiuto contattaci al Tel.

Utenze non domestiche ed esercizi commerciali: possono concordare con il Comune le modalità di conferimento più consone. Sig.ra Tel.

Ramaglie: possono essere conferite il Mercoledì dalle ore 15,00 alle 17,30 ed il giovedì dalle ore 9.30-alle ore 11.30 presso il centro di raccolta comunale di via del Polivalente nello scarabile ad esse dedicato.

COMPOSTAGGIO DOMESTICO

È il metodo che permette di trasformare in concime la frazione umida dei rifiuti. Chi ha lo spazio necessario può scegliere questa modalità naturale ed economica di smaltimento del rifiuto organico.
Il Comune incentiva questa virtuosa pratica contribuendo all'acquisto della compostiera e se si raggiunge il numero di almeno 20 utenti organizzerà un corso per addestrare i cittadini all'uso della compostiera e del compost ricavato.
In seguito verrà anche premiato economicamente con ulteriori sgravi sulla TARSU chi ricorre a questa pratica di riciclo dell'umido.

RACCOLTA PORTA A PORTA VETRO, CARTA / CARTONE E PLASTICA

Zona A e B insieme: giovedì dalle ore 06:00 alle ore 08:00 applicando a ogni confezione il codice a barre necessario per ottenere lo sconto sulla TARSU.

Cosa mettere nel SECCHIELLO BLU della raccolta del vetro?
Tutti i tipi di bottiglie, vasi e barattoli in vetro puliti.

Cosa non mettere:
Piatti e bicchieri di plastica, ceramica (piatti, tazze).

Nel SECCHIELLO fornito dal Comune o in QUALSIASI SCATOLA DI CARTONE.
Mettere carta pulita e non plastificata, cartone, cartoncini di ogni genere ridotti e ben piegati, giornali e riviste.

Cosa non mettere:
Piatti e bicchieri di carta plastificata, carta carbone, carta accoppiata con altri materiali (tipo tetrapak)

Cosa mettere nel SACCHETTO DI COLORE GIALLO o altro colore già fornito dal Comune per la raccolta differenziata della plastica?
Bottiglie, flaconi, dispensatori, confezioni rigide e vaschette per alimenti in genere, buste e sacchetti in plastica puliti.

Cosa non mettere:
Piatti/bicchieri/posate di plastica, rifiuti ospedalieri come siringhe o contenitori per liquidi fisiologici o emodialisi, beni durevoli e complementi d'arredo e casalinghi, giocattoli, custodie per CD/musicassette/videocassette, canne per irrigazione, articoli per edilizia, barattoli e sacchetti per colle-vernici-solventi, grucce appendiabiti, borse/zainetti/valigie, cartellette e porta-documenti.

CALENDARIO SETTIMANALE della Raccolta Porta a Porta (dalle ore 06,00 alle ore 08,30 nei giorni feriali)

Lunedì	Martedì	Mercoledì	Giovedì	Venerdì	Sabato
Umido	Secco Non Riciclab.	Umido	Vetro Carta Plastica	Umido	Secco Non Riciclab.

Nel caso di festivi infrasettimanali la raccolta è effettuata il giorno successivo; nel caso di due festivi consecutivi infrasettimanali (es 25 e 26/12) il turno s'intende sospeso.

CENTRO RACCOLTA DIFFERENZIATA (Accanto polivalente)

È APERTO per deposito ramaglie ed oggetti ingombranti.
Mercoledì ore 15 -17,30 / Giovedì ore 8,30-11,30

Ogni dubbio può essere chiarito con la comunicatrice ambientale incaricata dal Comune che verrà a casa tua per consegnarti il kit necessario alla raccolta differenziata.

III. Pictures from a Case Study

What follows is a graphic example of some reasons of dissatisfaction which can be hardly considered through the technical parameters usually applied.

The difficulties about fulfilling the rules, the negative effects for esthetic, smells, and health issues due to strict rules about collection and low frequency can hardly being considered through any quantitative data which is not formalized on ad-hoc situations.

While some picture show the laziness of users which store glasses within in their garden visible from public ways for several weeks before to waste it in waste banks, some other show how a family can easily produce an excess of waste which in some cases is not collected by the provider, which leaves a message complaining for the excess of waste disposed during the period. In another picture is showed an house which has an higher number of floors than the average and almost no garden. It implies that several waste bins have to stay during all the year in front of the house. Last picture shows garden waste for which users have to pay an extra fee. For some reasons such kind of waste can stay in the road for several days, even more than a week, before being collected.


Refuse Collection Service
We have not collected your refuse today because:
It is too heavy.
Your bin is not at the boundary.
Access was blocked by vehicles/roadworks.
It contains trade waste.
You have put out the wrong bin.
It contains garden waste.
You have put out too much refuse.
For more information please phone
01392 665010