Asset management in the urban waste sector in Portugal: The role and contribution of the regulator

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1 ABSTRACT

Purpose

Assess and discuss the contribution and role of the regulator for the asset management in the urban waste sector in Portugal, focusing in the service quality data and indicator system developed and the financial reporting model for the operators.

Methods

Comparison of the actual performance indicator and financial reporting approaches against some of the applicable asset management requirements of the ISO 55000 series of standards.

Results

The indicator system provides information on the asset and asset management performance, but limited information on the asset management system. The financial reporting does not capture the life cycle cost of the assets and only informs the financial performance of the utilities. Possible improvements are identified.

Conclusions

The regulator may contribute to improvements at the system and the processes adequacy level in view of enhancing asset management. On that regard, the regulator should evolve to equally control the system and the processes adequacy, rather than the asset management results alone, and understand the variables affecting the quality of the urban waste collection service in Portugal.

2 INTRODUCTION

Over the past decades, and following the requirements of the European Directive 2008/98/EC of the European Parliament and of the Council, of 19 November 2008, the environmental policies regarding waste evolved from processes oriented to systems oriented, which is reflected in the current Portuguese National Waste Management Plan (Resolution of the Ministers Council nº 11-C/2015). This evolution was not limited to the environmental dimension of the waste sector, it was also embedded at all levels. Additionally, there has been also a shift from public to mixed or private service providers.

This increased complexity, both in process and organizational terms, augmented the need to establish accountabilities. Those in charge of the economic resources to provide the waste service must give account of their stewardship and the various stakeholders (users, service providers, government and the general public) will continue to demand value for the investment in the infrastructure assets. The multiple demands of the stakeholders and the need to meet the expectations for quality including safety, operational efficiency and accountability placed pressure on the service providers to improve their asset management (Figure 1). This contributes to explain the rising importance of asset management that can be seen with the growing number of reports and guidelines published by various organizations managing infrastructure assets, especially for roads, water and energy (e.g., [1-8]) and, in a broader scope, the publication of the ISO 55000 series of standards in 2014. In addition, several professional bodies of knowledge sharing were and are being set in place in order to promote the concept of asset management (e.g., the Institute of Asset Management in the UK, Asset Management Council in Australia). In the waste sector, in part due to the nature of their assets, there has been less developments on the topic.

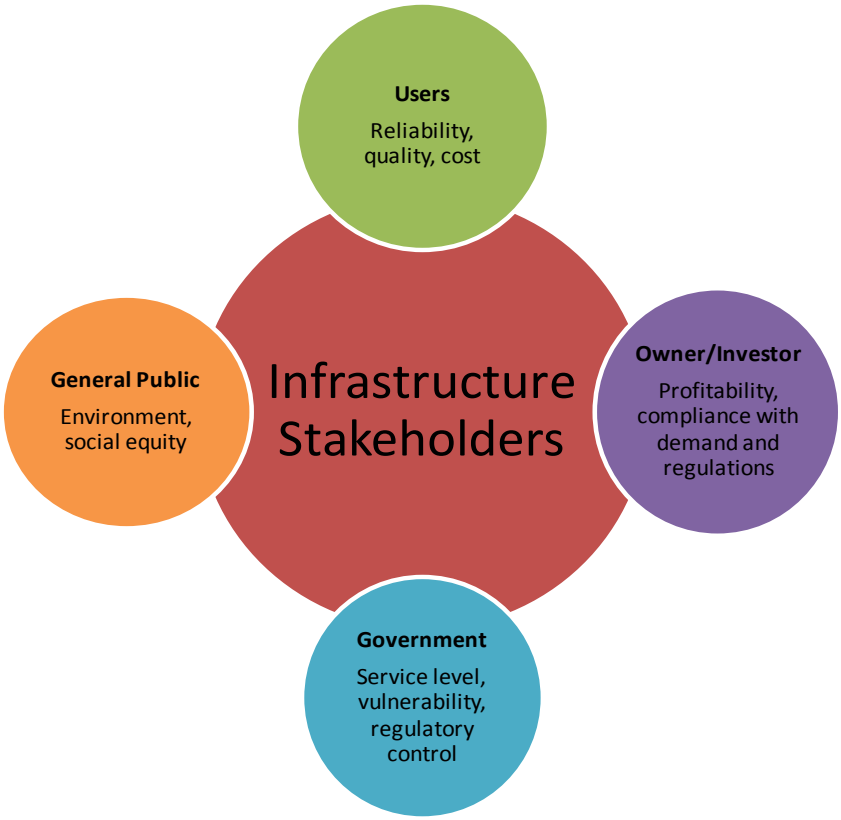

Figure 1 – Infrastructure stakeholders requirements [9]

One of the legal requirements in the Portuguese law (Law-Decree 194/2009, of 20 of August) is that companies (water, wastewater and/or waste) serving more than 30 000 inhabitants have to implement an asset management system. Despite the potential benefits from such a system, the Portuguese urban waste sector still needs to work on the development of such systems, this being particularly noticeable for lower-resourced operators. This communication summarizes the Portuguese urban waste sector framework and model. It also discusses the role and contribution of the regulator towards the implementation of asset management systems in waste management operators. An overall evaluation of the existing service quality data and indicators system and financial reporting is carried out and possible improvements identified.

3 ASSET MANAGEMENT

Asset management evolved significantly since the term was first used back in the 1980s. The first public sector document reported was the "Total Asset Management Manual", published in 1993. In 2004, the PAS 55 specification was published by the IAM, which was latter updated into the PAS 55-1:2008 [10] standard by the British Standards Institution. In 2014, the ISO 55000 series of standards was published, which are general in nature and are applicable to physical assets.

The ISO 55000:2014 [11] defines asset management as "the set of coordinated activities that an organization uses to realize value from assets in the delivery of its outcomes or objectives", whereas the realization of value requires "the achievement of a balance of cost, risks and benefits". Asset management can be approached through a system to manage the relation between performance and risk of something of value, either tangible or intangible, to an organization, group or individual in a sustainable way. According to ISO 31000:2009 [12], risk includes both hazards and opportunities. Following Hale [13], performance covers several areas (technical, economical, ecological and ethical) and different levels (strategic, organization, process and operation).

According to PAS 55-1:2008 [10], there are five broad categories of asset types that have to be managed to achieve the organizational strategic plan: i) physical assets,; ii) human assets; iii) information assets; iv) financial assets; and v) intangible assets. It is the authors believe that asset management is particularly suited for optimizing and implementing decisions on creating/acquiring (e.g., plan, design, build), using (e.g., operation), maintaining (e.g., inspection, periodic maintenance, repair) and renewal/disposal (e.g., rehabilitation, deconstruction, decommission, substitution) of physical assets in order to deliver a sustainable service. The physical assets interact with other asset types within a generic business/activity, namely human (e.g., motivation, communication, roles and responsibilities, knowledge, experiences, competence and capability, leadership teamwork), financial (e.g., life cycle cost, investment criteria, value of asset performance), information (e.g., condition, performance level, hazards and opportunities, processes, protocols and activities) and intangible (e.g., reputation/image, moral and ethics constraints, socio-cultural and environmental impacts).

Asset management comprises a management and a technical dimension. These dimensions are interrelated, with the management providing the context for the technical approach, which will influence the tools and methods used, and the technical promoting changes in the management due to the continual improvement goal. The management dimension is covered by the PAS 55 and ISO 55000 series standards, both of which adopt the traditional Deming cycle (PDCA: Plan-Do-Check-Act) structure common to other management related standards.

4 THE PORTUGUESE URBAN WASTE FRAMEWORK

4.1 THE SECTOR

The Portuguese urban waste sector is divided spatially (municipalities and regions) and functionally (collection and final destination), resulting in a universe of 282 utilities. In terms of function, there are 259 utilities responsible for waste collection (retail services), usually at a municipality level, and 23 responsible for waste disposable (bulk services), serving several municipalities. These division resulted in advantages in terms of economies of scale, particularly for the waste disposal, but implied losses in process economies [14].

The Law n.º 88-A/97, of 25 of July (changed by the Law n.º 35/2013, of 11 of June), set the rules for the private participation in waste management and allowing it through concession contracts with the State or the municipalities. As a result, the existing utilities vary in the degrees of public and private participation (Table 1) and operate in a very wide range of contexts due to variability of the Portuguese territory in terms of aspects such as population and wealth distribution, topography, infrastructures network, size, land use and main commercial activities of each region, and the culture, behaviour and demography of the individuals.

The current National Waste Management Plan (PNGR 2014-2020), approved by the ministry council nº 11-C/2015, defined as strategic objectives: i) promote the efficient use of natural resources in the economy; and ii) prevent or reduce the negative impacts from waste production and management. These strategic objectives are further detailed into 8 operational objectives and detailed in specific management plans and prevention programs. For urban waste, the

Strategic Solid Urban Waste Plan (PERSU 2020), approved by the ordinance n.º 187-A/2014, defined 8 objectives and established a set of goals in line with the national and European aims, namely the reduction from 63% to 35% the deposition of biodegradable waste in landfill, relatively to the year of 1995, the increase of the rate of waste preparation or reuse and recycle from 24% to 50% and ensure a selective collection of 47 kg/hab.year.

Table 1 – Distribution of the management model and role of the urban waste utilities in Portugal

Management model	Number of utilities [-]	Municipalities covered [-]	Area covered [km^2]	Population served [1000 hab]	Population density [hab./km^2]
Waste Disposal					
Multimunicipal concession	12	180	49 198	6 672	136
Muncipal or intermunicipal companies	8	71	32 194	2 099	65
Association of municipalities	3	23	4 860	1 220	251
Total	*23*	*274*	*86 252*	*9 991*	*151*
Waste Collection					
Municipal concession	1	5	2 225	58	26
Muncipal or intermunicipal companies	18	19	6 230	1 310	210
Association of municipalities	2	17	4 764	204	43
Municipal or intermunicipal services	7	8	3 206	992	309
Municipality	231	231	72 910	7 495	103
Total	*259*	*280*	*89 335*	*10 059*	*138*

4.2 THE REGULATION

Due to the fact that these services are natural monopolies and due to the ever increasing performance demand from the various stockholders, a service regulator[1] (for water and urban waste services) has been created with the main goal of protecting the interests of these services' consumers by promoting the quality of the service provided by the operator. ERSAR (with almost 20 years of existence) also aims to stimulate other economic activities within the water and waste sector through the reinforcement of the entrepreneurial activity, as well as the contribution of these services to environmental sustainability and to provide technical guidance to companies in the sector. The technical guidance is focused on legal compliance and regulatory demands, following internationally and nationally accepted best practices. In that regard, the Portuguese regulator ERSAR has published 20 technical guides, among other useful documents targeting the water and urban waste sector.

In operational terms, the ERSAR regulatory action has two main vectors, technical and financial. The technical regulation covers the service provided and is based on a set of service quality data and indicators that the utilities have to report yearly. Different goals were set for evaluating the service quality depending if the area covered by the utilities is mainly rural, balanced or mainly urban. The utilities are also required to provide a detailed yearly financial report to ERSAR that links with the service quality data and indicators. The financial report has a detailed record of the acquisition, depreciation and main investments for each asset but the remaining life cycle costs are record as a total sum by cost category (e.g., insurances; fuel; electricity; cleaning, hygiene and comfort; conservation and repair; labour).

5 DISCUSSION

The quality data (Table 2) an indicators (Table 3) reported by the utilities provide information regarding the physical assets, asset management and asset management system performance, as required by the ISO 55001:2014 [15]. The evaluation of the asset management system provided by the set of data and indicators is limited to the existence of certification. There is still a monitoring gap at the level of the asset management policy or the strategic asset management plan, as well as regarding other key elements of an asset management system.

[1] ERSAR – Entidade Reguladora dos Serviços de Águas e Resíduos

Table 2 – Service quality data link to monitoring requirements of ISO 55001:2014 [15]

DATA		PERFORMANCE			Observations
		Asset	Management	System	
Identification					
dRU01ab	Identification of the utility				
dRU02ab	Governance model				
dRU03b	System user				
dRU04ab	Type of area	X			Information on demand
dRU05ab	Shareholders positions				
dRU06ab	Contract period				
Households					
dRU07b	Households with waste collection		X		Information on service
dRU08ab	Households with selective waste collection		X		Information on service
dRU09ab	Existing households	X			Information on demand
Complaints					
dRU10ab	Complaints and suggestions		X	x	Information on service
dRU11ab	Replies to complaints and suggestions		X	x	Information on service
Waste amount					
dRU12ab	Total waste collected		X		Information on service
dRU16ab	Packages selectively collected		X		Information on service
dRU17b	Waste collected conveyed for recycling		X		Information on service
dRU24b	Unseparated waste collected		X		Information on service
dRU26b	Package collection goal		X		
Vehicles, equipment and their use					
dRU28ab	Distance covered by the vehicles	X	x		Information use
dRU29ab	Number of waste collection vehicles	X			Information on resources
dRU30b	Installed waste collection vehicles capacity	X			Information on resources
dRU31ab	Waste collection vehicles CO2 emissions	x	X		Information use
dRU32ab	Number of containers washed	X	x		Information use
dRU33ab	Number of containers	X			Information on resources
Energy					
dRU36b	Fuel consumed	x	X		Information use
Economy					
dRU39b	Average cost of the waste management service		X		Information on service
dRU40ab	Average family income				
dRU41ab	Total revenue				
dRU42ab	Total expenditure		X		Information on service
Human resources					
dRU44ab	Waste management service in-house personnel		X		Information on service
dRU45ab	Waste management service outsourcing personnel		X		Information on service
Infrastructures					
dRU46ab	Number of ecopoints	X			Information on resources
dRU47ab	Number of ecocenters	X			Information on resources
dRU52ab	Number of transfer stations	X			Information on resources
dRU54b	Installed container capacity	X			Information on resources
Certifications					
dRU55ab	Environmental management system certification			X	
dRU56ab	Quality management system certification			X	
dRU57ab	Health and safety management system certification			X	
dRU58ab	Other certification			X	

Table 3 - Service quality indicators link to monitoring requirements of ISO 55001:2014 [15]

INDICATOR		DATA	PERFORMANCE		
			Assets	Management	System
Costumer relation adequacy					
Service accessibility					
RU01b	Service coverage	dRU07b / dRU09ab		X	
RU02ab	Selective collection coverage	dRU08ab / dRU09ab		X	
RU03b	Affordability to the service	dRU39a / dRU40ab			
Service Quality					
RU04ab	Waste containers cleaning	dRU32ab / dRU33ab	X		
RU05ab	Replies to written complaints	dRU11ab / dRU10ab		X	x
Service Sustainability					
Economic					
RU06ab	Coverage of total costs	dRU41ab / dRU42ab		X	
Infrastructure					
RU07b	Waste packaging recycling	dRU16ab / dRU26b		X	
RU11ab	Waste collection vehicles renewal	dRU28ab / dRU29ab	x	X	
RU12b	Waste collection vehicles efficient use	dRU24b / dRU30b	x	X	
Human resources production					
RU13b	Adequacy of human resources	(dRU44ab + dRU45ab) / dRU12ab		X	
Environmental sustainability					
Natural resources use efficiency					
RU14b	Efficient energy use	dRU36b / dRU24b	x	X	
Pollution prevention					
RU16b	Greenhouse gas emissions	dRU31ab / dRU24b	x	X	

Analysing the indicators defined, the economic affordability to the service stands out in relation to the other indicators. While most indicators focus on the service quality based on the options made on the context and options made be the utilities, this indicator (economic access to the service) describes quality in terms of community wealth. As a consequence, according to this indicator a poor management in a wealthy community would indicate a good service performance while a good management in a poor community might indicate a poor service performance. Other aspect to account for is the reference used for the indicators. For instance, resorting to the 2013 data collected and reported online by ERSAR (http://www.ersar.pt/website/), comparing the indicator for energy use (RU14b), that is calculated as the fuel consumption per amount of waste collected, with the fuel consumption per number of houses serviced the difference between the types of area vanishes (Figure 2).

The data collected allows the calculation of additional indicators, such as the loading capacity per tonne of waste collected or house serviced (Figure 3). Probably even more informative for the asset management system, the fraction of the loading capacity used (Figure 4) indicates that, in average, the operators use only 50% of the installed loading capacity.

Observing Figures 2, 3, 4 and 5 it is noticeable that, despite the slight differences between type of area, the service performance of most operators overlap independently if the area is mainly rural, balanced or mainly urban. Consequently, for benchmarking purposes a question arises whether the type of area alone is able to explain the service performance differences or other if other variable are more relevant. For instance, there seems to be an increasing trend on the cost per tonne of waste with the waste produced per house (houses with waste collection) in mainly rural and balanced areas, but not in areas mainly urban (Figure 6).

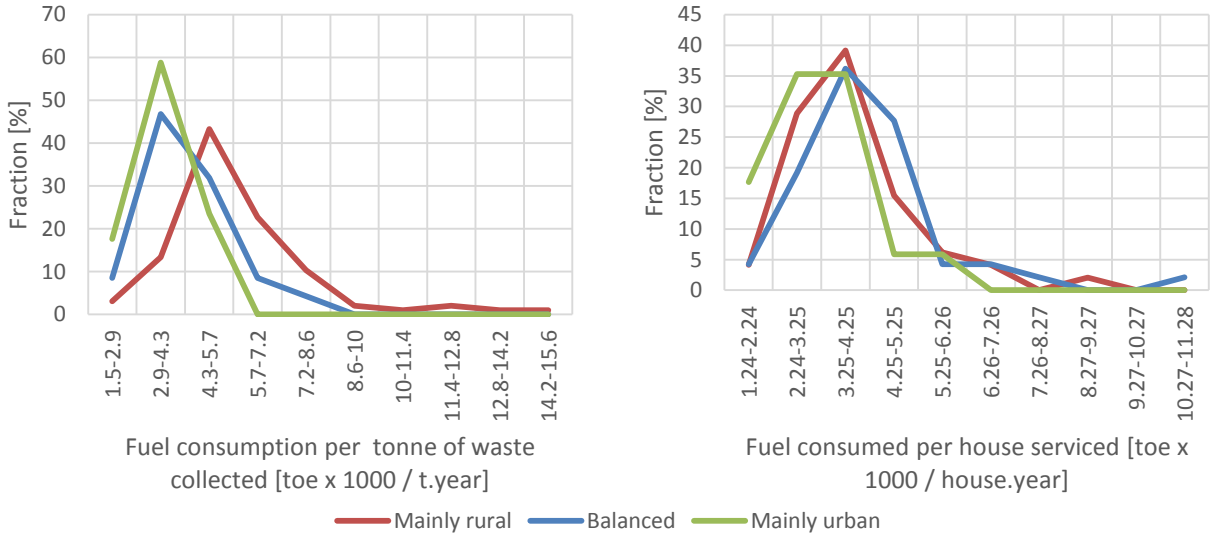

Figure 2 – Fuel consumption variability per tonne of waste collected (left) and per house serviced (right)

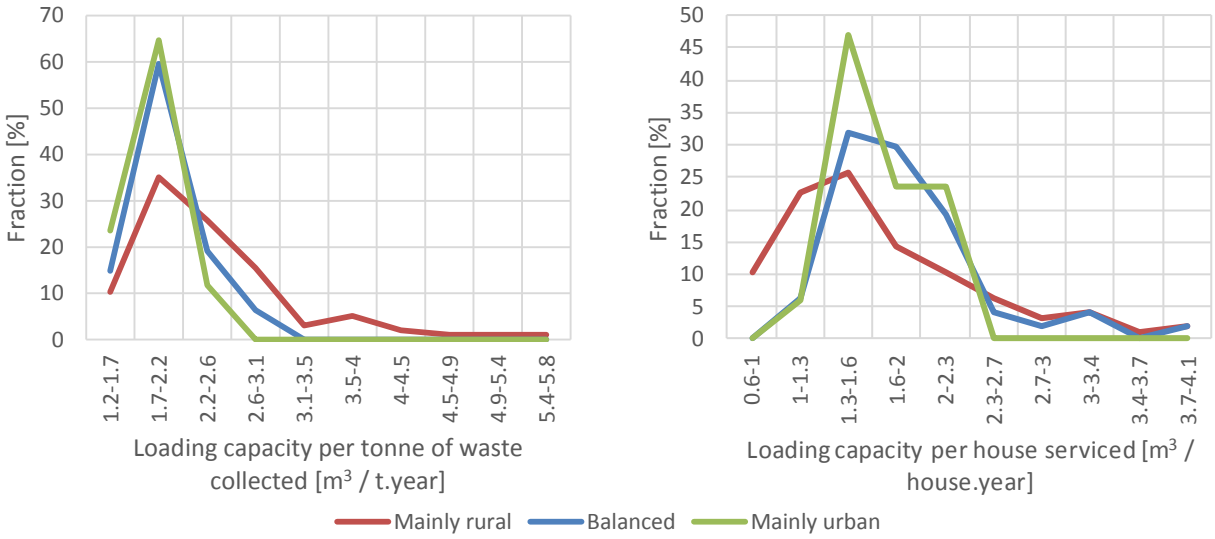

Figure 3 – Loading capacity variability per tonne of waste collected (left) and per house serviced (right)

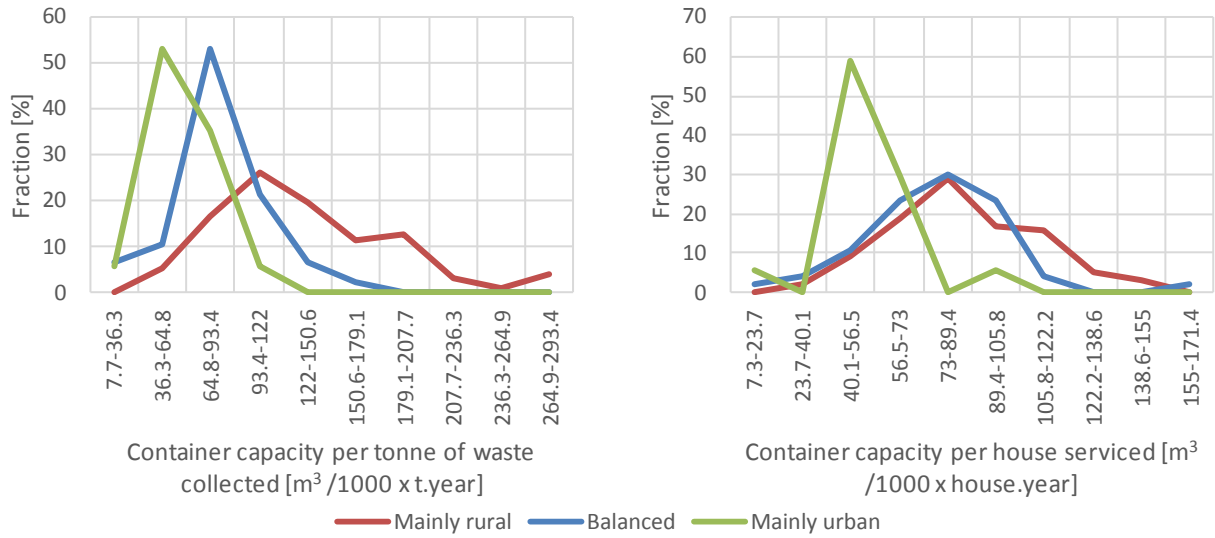

Figure 4 – Container capacity variability per tonne of waste collected (left) and per house serviced (right)

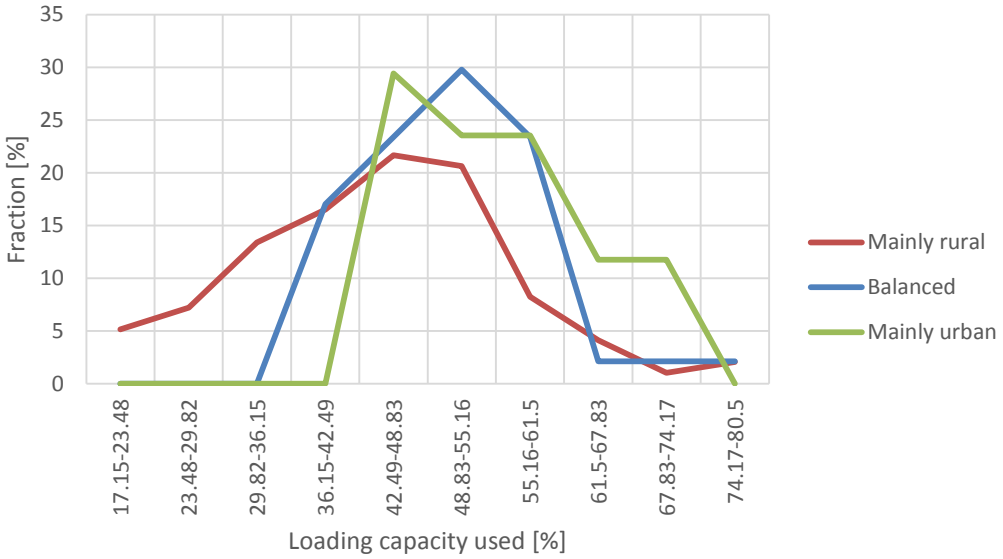

Figure 5 – Loading capacity used

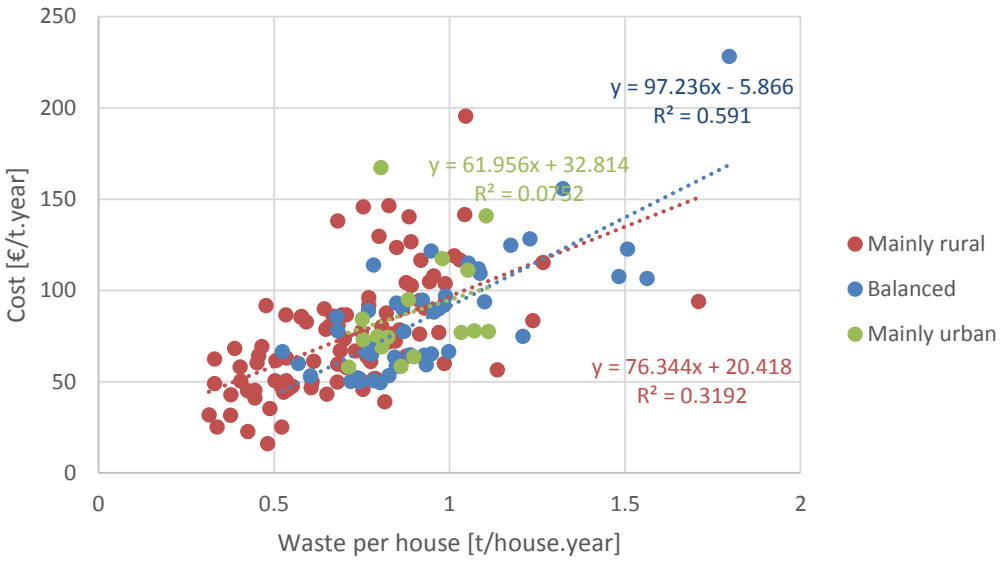

Figure 6 – Fuel consumption variability per tonne of waste collected (left) and per house serviced (right)

Assuming similar level of service quality, it is possible to evaluate waste management performance is terms of the fees charged to the final consumer. Considering an annual water consumption of 120 m^3, the urban waste collection fees charged to the final consumer in Portugal vary from as little as 4.20€ to up to 157,44€ per year. However, given the differing contexts of each operators the relative evaluation of the waste management performance through benchmarking is not an easy task. The implementation of a uniform tariff system based on the waste produced would eliminate the bias from the water consumption/waste production relation, but would still overlook various factors affecting the urban waste collection costs (e.g., demography, topography, population density, road network and traffic). An alternative approach for regulating the sector is by controlling the rationality of the decisions made rather than the final results, which may be done by assessing the asset management system implemented by the utilities. For that purpose, defining the common set of requirements that the asset management systems must comply with is of paramount relevance to allow ERSAR to assume its duties and responsibilities.

Additionally, the optimization of urban waste collection is not limited to a spatial optimization, but also a time optimization. The former deals with the problem of defining the best combination between types and characteristics of equipment and facilities required for municipal waste collection and their spatial distribution (location and routes) with the goal of minimizing the overall cost while maximizing the competing requirements (e.g., quality, safety, environment). This has been approached by several researchers with varying degrees of sophistication of the methods

used and complexity of the problems (e.g., [16-19]). The latter is concerned with determining the best operation, maintenance and replacement strategies with the goal of minimizing the equipment and facilities life cycle costs. To the best of our knowledge, life cycle cost data is used for spatial optimization of urban waste collection but seldom optimized. Regardless of the challenges presented by both the spatial and time optimization problems, their interdependence adds an additional layer of complexity. Recording the life cycle costs by asset, and not only the acquisition and main interventions/upgrades, would provide the information needed to more accurately estimate the: i) influence of different acquisition, operation and maintenance strategies in the life cycle costs and durability; and ii) the relation and relative proportion of acquisition, operation and maintenance costs.

6 FINAL REMARKS

ERSAR already published asset management guidelines for the water sector and is now committed to do the same for the urban waste sector. In addition to considering particularities of the urban waste sector in Portugal, the recently published ISO 55000 series of standards may be used as a reference. In addition to being part of ERSAR responsibilities, a common asset management system framework is expected to have several benefits, namely: i) better evaluation and performance monitoring; ii) better benchmarking and transfer of experiences between operators; and iii) setting realistic goals and adequate fees.

The present research represents a contribution for the implementing asset management on the urban waste sector in Portugal by reviewing the role of ERSAR on the topic and identifying potential improvements. The improvements include the evaluation of additional indicators, a better understanding regarding the underlying variables explaining the service quality data and indicators variability and an adjustment of the financial reporting system to allow for calculating the life cycle cost of the assets.

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