

PERFORMANCE EVALUATION OF URBAN SOLID RESIDUE MANAGEMENT SYSTEMS IN MADEIRA AUTONOMOUS REGION

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ABSTRACT

Services of Urban Solid Residues (USR) should be encouraged to attain high standards of efficiency and innovation. One way to achieve this is through regulation, by applying a framework of performance assessment in the sector. Based upon the regulation model of performance assessment instituted by Instituto Regulador de Águas e Resíduos (IRAR - Institute for the Regulation of Waters and Waste), the present paper aims at proposing a framework for the assessment of the performance of USR management systems for the Autonomous Region of Madeira, following the parameters and goals of a social regulation model, in which the rights of the users prevail. This model of performance assessment generated from the presentation, to the population of Madeira, of a set of performance parameters and asking the participants to select the ones that they rated most relevant to evaluate. Once the assessment criteria of the regulation model had been produced and specified, based upon performance metrics of general scope, non-selective waste collection, selective waste collection and final disposal, the model was then applied in the Municipality of Funchal, to verify its applicability. The application of the model of performance assessment to one municipality in the Autonomous Region of Madeira, allowed for both positive and negative aspects related to the management of USR systems to be monitored, thus facilitating future planning of improvements or continued investment in certain strategies. The applicability of the proposed assessment model was confirmed.

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INTRODUCTION

Exponential growth of the population, increasing consuming habits and industrialization have determined an increase in the production of Urban Solid Residues (RSU). This fact, along with a greater awareness of environmental issues, has contributed to a greater responsibility in the way communities face production and management of residues. Not only has waste collection become a priority, but final destiny has assumed major relevance. Progress in the sector of solid residues presents itself today as an important indicator of a country's development.

In the early 90s, Portugal still had 300 active, non-controlled waste dumps. In the last 20 years, however, the solid residue sector has evolved in a significant way, although there is still a long way to be trodden in this area. Of utmost importance have been the investments in the sector, the role of both the environmental regulator (Instituto Nacional de Resíduos) and the economical regulator (Instituto Regulador de Águas e Resíduos), as well as the application of European Community Regulation.

Waste management plays a decisive role in the sector. In the conception, development and exploitation of a waste management system, the operations of deposit, collection, transport, treatment and final destiny are included.

Services of urban solid residues (RSU), as they operate in a regimen of natural monopoly, among other reasons, are characterized by limited incentives to efficiency and innovation. Performance assessment can assume a very decisive role to withstand this situation.

Regulation, adequately put into practice, can be efficient, objective and controllable. Such regulating action can be a transparent way to control and supervise the activity of entities performing services in a monopoly regime.

The issue of regulation of the activity of managing entities of urban solid residues can not, therefore, be ignored, along with its correct regulation.

The regulation model applied to a management system must be adequate to the local specific characteristics. Notwithstanding the fact that a regulation model already exists, by the Instituto de Águas e Resíduos (IRAR), it is applied on mainland territory. Consequently, it seemed of high interest to adequate a regulation model which could be applied to Ultra Peripheral Regions (RUP) such as the Autonomous Region of Madeira (RAM).

The RAM is characterized by a dominant economic component, strongly based on tourism, along with an immense environmental value, mainly owing to the fact that it possesses the most extensive and best preserved Laurel Forest stand in the world. Madeira indigenous forest, the Laurel Forest is a real world environmental treasure, covering about 20% of the Island surface. The over 15 thousand hectares of forest are thoroughly protected by Madeira Natural Park and, for its immense environmental worth, were declared a UNESCO World Heritage Site in 1999.

Environmental and social aspects, along with standards of service quality, must constitute both obligations and restrictions to the functioning of the sector of solid residues. Socio-economic balance can be attained with higher efficiency through regulation of the sector.

In the scope of a social regulation, the aim of this paper is to present a framework for the implementation of performance assessment of RSU management systems for the Autonomous Region of Madeira (RAM).

The main goal is based on the evaluation of performance of RSU systems from the first contact with the populations to their final destiny, thus focusing on every aspect of this “route“ of the residues, so as to analyse whether their process is bringing out the desired goals, obtaining a maximum profitability, sustainability and efficiency in a way that can be both economical and satisfactory for all parts involved.

SELECTION OF PERFORMANCE PARAMETERS FOR THE AUTONOMOUS REGION OF MADEIRA (RAM)

CHARACTERIZATION OF THE MANAGEMENT SYSTEMS IN RAM

Madeira Archipelago lies about 500 miles off the coast of Mainland Portugal and has an area of 797,77 square kilometres.

Madeira Autonomous Region (RAM) is subdivided into 11 municipalities in the two inhabited islands, Madeira and Porto Santo, with a total population of 241.418 inhabitants (2006).

The demography of Madeira Island presents an important floating population of about 15.673 visitors a day, as a result of the Region’s strong tourism oriented activity.

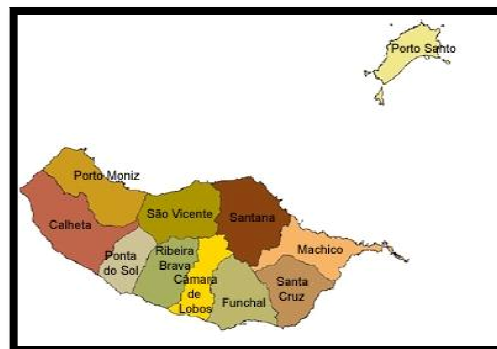


Figure 1. Madeira Autonomous Region (RAM)

In what concerns the management systems of Urban Solid Residues (USR) in the Region, collection is carried out by the municipalities, whereas Valor Ambiente, a company managed exclusively by public funds, is in charge of treatment and final disposal.

There are three Transfer Stations, situated in Funchal, the East Zone and the West Zone of the Island. Located in the same facility as the East Zone Transfer Station, is the Sorting Station.

Located at Meia Serra, the Solid Residue Treatment Facility integrates systems of waste-to-energy valorisation of USR.

REGULATION MODEL PROPOSED FOR MADEIRA AUTONOMOUS REGION

The purpose of this paper is to propose a performance evaluation framework for the management of Urban Solid Residue systems in Madeira Autonomous Region, through the use of performance parameters. In order to achieve this goal, it was necessary to devise performance parameters which could evaluate the systems in an efficient and effective way.

In order to evaluate the RSU Systems in the Autonomous Region of Madeira, performance parameters had to be devised, reflecting the issues and relevant aspects specifically related to the Region. Based upon the regulation model already in existence in our country, instituted by IRAR, upon the foundations of a social regulation, as well as the specific characteristics and interests that are effective in the Region, performance parameters were devised, allowing for a social regulation of RSU Systems on the Island.

In order to select from among the suggested parameters, those that were really relevant to the evaluation of performance of RSU management systems on Madeira Island, an inquiry was presented to the population with the aim of questioning the importance of each of the parameters in an evaluation system.

GENERAL
Cleaning of public places
Care with garden areas
Response to complaints
Visitor's opinion
UNDIFFERENTIATED WASTE COLLECTION
Coverage of collection system
Type of collection (door-to-door or drop-off)
Frequency of collection
Balancing collection frequency with container size, to avoid overflow
Collection schedule
Noise of container dumping
Care in container selection and cleaning to avoid smells
Average service fee charged by Municipalities
SELECTIVE WASTE COLLECTION
Coverage of collection system
Type of collection (door-to-door or drop-off)
Frequency of collection
Balancing collection frequency with container size, to avoid overflow
Collection schedule
Noise of container dumping
Average service fee charged by Municipalities
FINAL DESTINY
Destiny of USR
Type of Treatment for USR
Valorisation of USR

Table 1. Proposed performance parameters

The inquiry allowed to determine, for each of the proposed parameters, its degree of importance, rating them 1 to 5, being 1 less important and 5 very important.

The methodology developed was, in this case, to a regional scale, considering the 10 Municipalities on the Island. Two hundred inquiries were responded, evenly distributed according to the population of each municipality.

The inquiry allowed to estimate which of the proposed performance parameters presented over 75% of 4 and 5 answers. They were then considered performance parameters to evaluate the RSU management systems on Madeira Island.

GENERAL		1	2	3	4	5	4+5
G01	Cleaning of public places	0	1	12,5	25,5	61	86,5
G02	Care with garden areas	0	1	19,5	38,5	41	79,5
G03	Response to complaints	1,5	9	15	34,5	40	74,5
G04	Visitor's opinion	1	5	24,5	33,5	36	69,5
UNDIFFERENTIATED WASTE COLLECTION		1	2	3	4	5	4+5%
RI01	Coverage of collection system	0	2,5	13,5	37	47	84
RI02	Type of collection (door-to-door or drop-off)	0,5	6	21	38	34,5	72,5
RI03	Frequency of collection	0	3,5	16,5	41	39	80
RI04	Balancing collection frequency with container size, to avoid overflow	0,5	6	15,5	37,5	40,5	78
RI05	Collection schedule	3	9	31,5	38	18,5	56,5
RI06	Noise of container dumping	4,5	14	33	29,5	19	48,5
RI07	Care in container selection and cleaning to avoid smells	2	8	21,5	25,5	43	68,5
RI08	Average service fee charged by Municipalities	5,5	10	30	32,5	22	54,5
SELECTIVE WASTE COLLECTION		1	2	3	4	5	4+5%
RS01	Coverage of collection system	1,5	2	13	32,5	51	83,5
RS02	Type of collection (door-to-door or drop-off)	1	4,5	20,5	42,5	31,5	74
RS03	Frequency of collection	1	3,5	20	46	29,5	75,5
RS04	Balancing collection frequency with container size, to avoid overflow	0,5	3,5	19,5	36	40,5	76,5
RS05	Collection schedule	5	10	33,5	36	15,5	51,5
RS06	Noise of container dumping	6,5	15	30,5	31	17	48
RS07	Average service fee charged by Municipalities	6,5	13,5	27,5	34	18,5	52,5
FINAL DESTINY		1	2	3	4	5	4+5%
DF01	Destiny of USR	0,5	0,5	19	33,5	46,5	80
DF02	Type of Treatment for USR	0,5	1,5	13,5	39,5	45	84,5
DF03	Valorisation of USR	0,5	5,5	13,5	39,5	41	80,5

Table 2. Inquiry Results

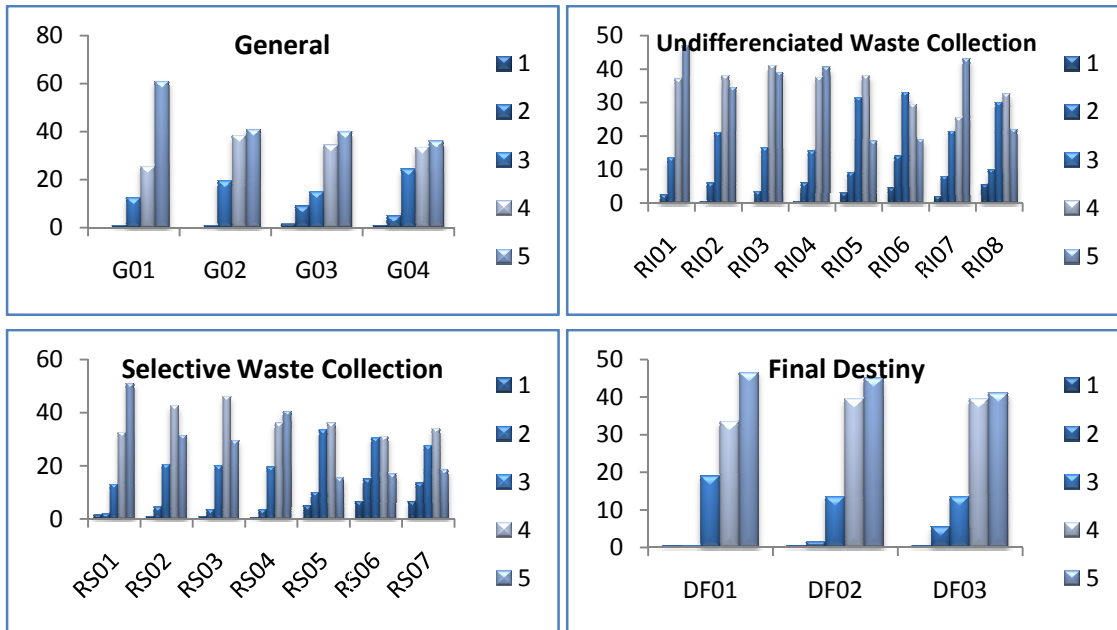


Figure 2. Inquiry Results

The performance parameters considered by the population of Madeira were selected and, for each parameter, evaluation criteria were established, which in general included field work, assessment by service users and comparing data with optimal quality markers.

GENERAL
Cleaning of public places
Care with garden areas
Response to complaints
UNDIFFERENTIATED WASTE COLLECTION
Coverage of collection system
Frequency of collection
Balancing collection frequency with container size, to avoid overflow
SELECTIVE WASTE COLLECTION
Coverage of collection system
Frequency of collection
Balancing collection frequency with container size, to avoid overflow
FINAL DESTINY
Destiny of USR
Type of Treatment for USR
Valorisation of USR

Table 3. Performance parameters

CONCLUSION

Through this enquiry we can conclude that the population of Madeira Island is well aware of environment preservation issues, such as the care with the final destiny of residues or recycling.

Public spaces and garden areas should be a priority for Municipalities, since people are proud of the island's wealth and beauty.

Service quality is viewed as more important than cost. Should the quality of service excel and contribute to the quality of life, then a higher cost seems to be deemed of little consequence. However, many of those enquired favoured the user-payer policy, or a tax reduction for those who contribute to recycling as well as maintaining their municipality clean and well presented.

Some of the enquired, particularly the suburban or elderly among them, seemed to be unaware of some of the issues, such as the final destiny of USR, type of treatment or valorisation, which suggests that information reaches the schools and urban centres, but not so much the village or northern coastal populations.

Through this enquiry we also concluded that the population's interests and worries are quite specific to the conditions and characteristics of the Region.

The fact that the economy depends to a great extent on tourism, as well as on the indigenous Laurel Forest determines the major focus on environmental issues.

The quality of life is viewed as of utmost importance by the madeiran population. Competent, efficient services, optimization of spaces for residue management, namely final destiny options, extinction of waste dumps and infrastructures for the valorisation and treatment of residues, are also among their concerns.

CASE STUDY – APPLICATION OF PERFORMANCE PARAMETERS IN FUNCHAL

CHARACTERIZATION OF THE MANAGEMENT SYSTEM IN FUNCHAL

In order to confirm the applicability of these parameters in the Region, they were applied to one of the Municipalities, Funchal, with reference to the RSU Systems for 2007.

The case-study that presupposes the application of the proposed RSU performance evaluation system was carried out in the Municipality of Funchal as it is the most populous and presents more diverse features.

In the Municipality of Funchal, the tertiary sector prevails, closely related to tourism, in the areas of commerce, catering and hotel services.

The Municipality of Funchal comprises 44% of urban areas, below the 500m level, where orography is smoother. More than half of the municipality surface presents rather steep slopes of over 30%.

The predominant tourism sector in the Municipality, with variations and high rates of floating population, which can reach as much as 14% of the total population in the month of August, strongly influences other sectors, namely the management of residues.

The Municipality is divided into 10 'freguesias' (civil parishes). In the coastal 'freguesias', most hotels and services are located, whereas the inner ones, commonly referred to as 'zonas altas' (high zones) present a quite different reality, as they are mostly residential areas.



Figure 3. City of Funchal

In a brief history survey of the 'recent' growth of the City of Funchal, it can be noted that, from the final 50s, as in most European cities, a continuous migration of population from other municipalities of the Region occurred, in search of employment and consequently better living conditions.

This demographic explosion and chaotic construction of houses built in places of difficult access, along narrow lanes and paths sliced by time, brought along countless problems of urban planning, which will only find a solution in a realistic management and planning policy of the neediest areas of Funchal.

In order to evaluate the performance, various methods were jointly used, to classify the performance parameters both internally and externally in relation to the management system being assessed:

- A questionnaire was devised to allow system users, the resident population of Funchal, to assess performance by rating the parameters in a satisfaction scale.
- Simultaneously, a thorough data gathering was carried out, both at the Municipality of Funchal and at Valor Ambiente.

- In the course of several months, a field research was carried out, that is to say, a detailed observation was made, on different weekdays and different times of the year, regarding issues related to the evaluation of performance parameters.

Through the evaluation criteria defined for each parameter and using the evaluation methodology described above, the performance of USR systems in the Municipality of Funchal was assessed.

PERFORMANCE PARAMETERS	AVALIAÇÃO DO DESEMPENHO
GENERAL	
Cleaning of public places	4
Care with garden areas	4
Response to complaints	3
UNDIFFERENTIATED WASTE COLLECTION	
Coverage of collection system	5
Frequency of collection	3
Balancing collection frequency with container size, to avoid overflow	3
Selective Waste Collection	
Coverage of collection system	4
Frequency of collection	4
Balancing collection frequency with container size, to avoid overflow	4
Final Destiny	
Destiny of USR	5
Type of Treatment for USR DESTINY	4
Valorisation of USR	5

Table 4. Results of the application of performance parameters

CONCLUSIONS OF THE APPLICATION OF PERFORMANCE PARAMETERS IN FUNCHAL

In a general way, performance evaluation of USR systems in the Municipality of Funchal presents positive results. For the parameters assessed, the Municipality revealed a high degree of satisfaction, in spite of the difficulties for being an Outermost Region.

The Municipality presents a high concern and correct procedure in the care of public garden areas and cleaning of public places, mainly in the zones that attract more visitors.

Nevertheless, the population still argues that high zones are neglected in comparison with coastal zones. This issue requires attention, through measures of service improvement and presentation of public places in the referred higher zones of the Municipality.

In what concerns waste collection, the Municipality faces major issues owing to the rough orography and difficult accessibility to some zones, owing to the narrowness of some lanes and intense traffic flow.

We presume that waste collection frequency is bi-weekly due to the collection difficulties the Municipality has to face.

The transit of collection vehicles at some hours in some zones can indeed be a complicated task.

The Municipality has clearly made an effort to improve the quality of accesses, namely trying to reduce the number of lanes, which were once 800 in the whole municipal area and are nowadays significantly less.

A continuous interest is demonstrated by the Municipality in the promotion of recycling and the citizens are encouraged to invest further in selective collection.

Campaigns to develop public awareness, along with investment in door-to-door selective collection, appear to be an excellent strategy and the result has been a clear increase in recycling rates.

The Municipality of Funchal, in Madeira Autonomous Region, enjoys the privilege of a modern solid residue treatment facility, with infrastructures that allow a considerable improvement in directing residues to their final destiny. The facility promotes energy as well as organic recovery.

According to Joana Rodrigues, engineer at 'Valor Ambiente' the creation of incineration and composting infrastructures in the Region does not hinder the increase of recycling, as there will always be residues which can not be recycled and these must be directed to recovery. Therefore, recovery is a goal, as well as the considerable reduction of the space taken up by residues on an island.

CONCLUSION AND RECOMMENDATIONS

The regulation of services through performance evaluation of RSU management systems provided an actual and truthful idea on the state of the services, thus allowing an awareness of what is functioning satisfactorily and what still requires improvement.

Performance evaluation of the management systems of RSU allows thus to find scopes and areas where further investment is possible and carry the good work further on, as well as improve the gaps and flaws that may be occurring.

The performance evaluation system must, therefore, be conveniently adjusted, requiring sound knowledge of the features, idiosyncrasies and current state of the area where the evaluation pattern is to be applied.

The current research confirmed that the creation of an evaluation model based on the specific characteristics, interests and problems of the island and its population, brings out a more thorough, coherent assessment.

Through performance evaluation it is possible to establish both positive and negative points in the current condition of USR management systems. That much was achieved through the application of the regulation model in the Municipality of Funchal, which enabled an awareness of the aspects in which measures and strategies being adopted were producing positive results.

Along the years, the population became more civically aware. The extinction of waste dumps encouraged them to improve their civic behaviour and promoted a greater interest in issues related to residues.

In what concerns USR management systems, most outermost regions (RUP, Ultra-peripheral Regions) are way behind as to the European strategy in this matter, some regions finding themselves still in the course of sealing their dumps as well as planning and constructing adequate treatment and final destiny solutions, facing various financial and technical difficulties. In view of this scenario we can conclude that, in a general way, Madeira Autonomous region finds itself, in recent years, in a very satisfactory stage of progress and development.

The research on the residue sector of the RAM can prove to be of interest to other outermost regions, allowing them to observe and follow some of the steps and investments taken which appear to be producing satisfactory results.

REFERENCES

PUBLICATIONS

[A] LEVY, João Quinhones, CABEÇAS, Artur João. Resíduos Sólidos Urbanos - Princípios e Processos. Lisboa, AEPSA, Abril de 2006, 317pp.

[B] LEVY, J.; TELES, M.; MADEIRA, L.; PINELA, A. O Mercado dos Resíduos em Portugal. Lisboa, AEPSA, 2002, 268pp.

[C] MARQUES, Rui Cunha (2005). Regulação de Serviços Públicos. Lisboa: Edições Sílabo, 337 pp.

[D] IRAR, Guia de avaliação da qualidade dos serviços de águas e resíduos prestados aos utilizadores, Versão 3, 28 Fevereiro de 2007

[E] PERSU II. Plano Estratégico para os Resíduos Sólidos Urbanos 2007-2016. Ministério do Ambiente, do Ordenamento do Território e do Desenvolvimento Regional. Lisboa – 2007, 194pp.

[F] POÇAS MARTIN, J. Serviços Públicos de Abastecimento de Água e de Saneamento. Opções de financiamento e gestão nos Municípios Portugueses. AEPSA – Associação das Empresas Portuguesas para o Sector do Ambiente. Setembro de 1998.

[G] LEVY, J.; PINELA, A. Os Sistemas Tarifários de Resíduos Sólidos Urbanos, em Portugal – Junho de 2004. CESUR – Centro de Sistemas Urbanos e Regionais, Instituto Superior Técnico – UTL.

[H] Gestão e Tratamento de Resíduos, Coleção Ambiente 7 – Outubro de 2008. Almedina, 933 pp.

[I] MARQUES, RUI CUNHA; LEVY, JOÃO QUINHONES (2006)- A Qualidade do Serviço de Abastecimento de Água – O Parecer do Consumidor – AEPSA, 53 pp.

[J] AGÊNCIA REGIONAL DA ENERGIA E AMBIENTE DA REGIÃO AUTÓNOMA DA MADEIRA, Gestão de Resíduos Sólidos Urbanos e Gestão de Embalagens e de Resíduos de Embalagens nas Regiões Ultraperiféricas – Identificação de Problemas e Dificuldades Específicas (2001), AREAM, 52 pp.

[K] DEPARTAMENTO DE PLANEAMENTO ESTRATÉGICO GABINETE DE INFORMAÇÃO GEOGRÁFICA (2007). Funchal em Mapas e Números – Conheça Melhor o seu Concelho, Câmara Municipal do Funchal, 59 pp.

[L] VALOR AMBIENTE, GESTÃO E ADMINISTRAÇÃO DE RESÍDUOS DA MADEIRA, S.A. Relatório e Contas 2007, Valor Ambiente, 76 pp.

WEB SITES

[1] Instituto Regulador de Água e Resíduos (IRAR) - <http://www.irar.pt/>, consultada em Janeiro 2009

[2] Agência Portuguesa do Ambiente – Ministério do Ambiente, do Ordenamento do Território e do Desenvolvimento Regional - <http://www.apambiente.pt/> consultada em Dezembro 2008

[3] Direcção Regional de Estatística - <http://estatistica.gov-madeira.pt/> consultada em Janeiro 2009, consultada em Novembro 2008

[4] Câmara Municipal do Funchal (CMF) - <http://www.cm-funchal.pt/cmfi/> consultada em Março 2009, consultada em Março 2009

[5] Sociedade Ponto Verde - <http://www.pontoverde.pt/>, consultada em Dezembro 2008

[6] Valor Ambiente – Gestão e administração de resíduos da Madeira, S.A. - <http://www.valorambiente.pt/>, consultada em Outubro 2008