



Socioeconomic impact of waste over the lifetime of project **LIFEPAYT**

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1. INTRODUCTION

The key for the success of initiatives for reducing municipal waste (MSW) generation, as well as promoting source separation for recycling, such as the ones proposed by LIFE PAYT project relies on the will of the involved population to collaborate with the project.

Furthermore, financial sustainability of the proposal is of uttermost importance for the municipalities responsible for the implementation of new tariff schemes such as pay-as-you-throw (PAYT) – the objective of LIFE PAYT project. Moreover, putting in place innovative tariff schemes like this one, requires a considerable investment in new collection and measuring equipment, as well as an adaptation and new organisation of waste collection, including training of the responsible personnel.

In view of this context, it was necessary to thoroughly assess and evaluate the socioeconomic consequences derived from the project, and comparing them with the situation found prior to its implementation, in order to obtain conclusions regarding the effectiveness of the project. To this purpose, four main successive tasks were planned, all of them under the scope of Action C2 of the LIFE PAYT project:

- Definition of a relevant set of indicators
- Establish the baseline
- Periodically monitoring of the project socioeconomic impact
- Overall socioeconomic comparison before and after the project implementation

The description of developments for each of these tasks is explained in the following sections of this report.

2. DEFINITION OF RELEVANT SET OF INDICATORS

The definition of socioeconomic indicators had as objective the establishment of a suitable framework for evaluating the socioeconomic progress of the project. Moreover, the definition of the set of indicators was articulated with the design of the surveys to be applied to collect information required to calculate the initial values of the indicators.

After discussing initial proposals with the partners in LIFE PAYT project – specially with the LIFEPAYT team at NTUA (Athens) – the final set of indicators was established in March 2018, shortly before performing the corresponding first survey in Aveiro demonstration area. The set consisted of 12 indicators (named SE1 to SE12), of which the first six focused more on economic aspects (SE1–SE6) and the last six on social aspects (SE7-SE12), though making a specific distinction between the two groups was not intended – for example: indicator SE6, relative to potential employment creation, may be referred both as an economic as well as a social positive consequence of PAYT.

The set of socioeconomic indicators used is presented in Table 1. More detail on the selection of the indicators and method of calculation of the values is provided on another document (Dinis *et al*, 2018)

Table 1: Set of socioeconomic indicators for LIFE PAYT project (MSW: Municipal Solid Waste)

INDICATOR		UNITS	CALCULATION FORMULA
SE1	MSW management cost for municipality	€ / year	Cost in target zone per year
SE2	MSW management revenue from domestic and non-domestic sectors	€ / year	MSW tariff paid value in target zone per year
SE3	Individual cost of MSW management	Commercials	€
		Families	Degree of effort (mean score between 1–5)
			Hourly salary · Necessary hours
			$\frac{\sum \text{individual scores}}{\sum \text{total answers}}$
SE4	Coverage of MSW management costs	%	$\frac{\text{MSW tariff revenue}}{\text{Cost of MSW management}} \cdot 100$
SE5	Economic revenue due to increased recycling	€ / year	$\sum_i (\text{Units of recovered MSW } i \text{ fraction} \cdot \text{Unitary price of MSW } i \text{ fraction})$
SE6	Potential employment gains	No. jobs	$\sum_i (\text{Units of recovered MSW } i \text{ fraction} \cdot \text{jobs created by unit MSW } i \text{ fraction})$
SE7	Satisfaction with MSW collection system	%	$\frac{\sum \text{positive answers} \cdot 100}{\sum \text{total answers}}$
SE8	Acceptance of MSW management pricing	%	$\frac{\sum \text{positive answers} \cdot 100}{\sum \text{total answers}}$
SE9	Population percentage who separates MSW at source	%	$\left(1 - \frac{\sum \text{answers "I don't recycle"}}{\sum \text{total answers}}\right) \cdot 100$
SE10	Population percentage practicing home composting	%	$\frac{\sum \text{positive answers} \cdot 100}{\sum \text{total answers}}$
SE11	Population perception on the importance of recycling	Mean score between 1–5	$\frac{\sum \text{individual scores}}{\sum \text{total answers}}$
SE12	Project visibility	%	$\frac{\sum \text{positive answers} \cdot 100}{\sum \text{total answers}}$

3. ESTABLISH THE BASELINE

The values of the indicators proposed in C2.1 were obtained from information by the municipal authorities responsible for MSW management – for instance, the information related to costs and revenues – and, on the other hand, through the attitudinal survey made to the population of the target areas.

These surveys were intended to be a socioeconomic assessment of MSW management on each demonstration site. This assessment focused on economic implications derived from MSW and also on the perceived attitude of the population in the area towards the waste issue. The survey was meant to take place twice at each site: before the implementation of the project – to build the baseline, and after that implementation, to check possible improvement compared to the initial situation.

The survey was performed in the form of questionnaires to be answered by a sample of the population affected by the project – both residents (depending if they are included or not within the scope of the project in that particular area) and commercial establishments – also, where applicable. Therefore, two versions of the questionnaire were prepared: for domestic (residential) and for non-domestic MSW producers.

The surveys were done shortly before the installation of the new PAYT system, through field interviews (to the residents and commercial establishments) and through an on-line questionnaire available on the project website. The calendar of surveys in the different project locations and number of questionnaires constituting each sample is shown in Table 2.

Table 2: Calendar of Action C2 surveys

Location	Initial survey (baseline)		Final survey (conclusion)	
	Date	Sample (number)	Date	Sample (number)
Aveiro	April 2018	76	June 2021	57
Condeixa-a-Nova	January 2020	122	----	----
Larnaka	May 2019	76	September 2021	29
Lisboa	April 2020	15	April 2021	8
Vrilissia	June 2020	48	December 2021	30
TOTAL		337		124

The first surveys provided a basis for the calculating the initial values of the set of indicators. These values constituted an assessment of the socioeconomic situation regarding MSW management in target zones prior to the implementation of the LIFE PAYT project. Hence, this initial assessment was used as a baseline against which the progress achieved by the project in socioeconomic dimension will be evaluated. The definition of these baseline was explained in specific reports for each of the participant municipalities (Bringsken *et al.* 2018a, 2018b, 2020a, 2020b 2020c), including the scripts of the questionnaire.

In the case of Condeixa-a-Nova, given the delay in implementing the PAYT system, it made of no sense to perform a second survey to the participant establishments, since no major perceptive changes had taken place, so no gains were observed by the respondents.

4. PERIODICALLY MONITORING OF THE PROJECT SOCIOECONOMIC IMPACT

The task consisted on the monitoring of costs and revenues associated to the new system and the level of satisfaction of the users, based on information to be obtained from the municipalities.

Regarding the indicators more related to economic parameters, the required information was obtained directly from the involved municipalities. In the case of Portuguese municipalities, they are required to yearly report these parameters – also some related to satisfaction – to the national waste regulatory authority (ERSAR) for evaluation purposes, therefore it was not difficult to obtain data when needed.

Larnaka municipality – which initially had a fixed tariff scheme – was also able to report these data when asked. However, this was not the case with Vrilissia municipality, since there does not exist a specific tariff to be paid by residents for MSW management. Instead, households pay a joint fee which is intended to support several municipal services, including MSW management, but also street cleaning, public illumination and other. This made difficult to obtain a complete assessment for Vrilissia.

5. OVERALL SOCIOECONOMIC COMPARISON BEFORE AND AFTER THE PROJECT IMPLEMENTATION

This task was completed in the end of the project, when the final situation in each target area was compared with the baseline previously established. For those municipalities where reliable results were obtained, those are shown in Table 3 for Aveiro, Table 4 for Larnaka and Table 5 for Lisbon.

Table 3: Comparison of socioeconomic indicators results for **Aveiro** demonstration area

INDICATOR		RESULTS		
		Before the project (2017)	After the project (2020)	
SE1	MSW management cost for municipality	42656 €/year	22543 €/year	
SE2	MSW management revenue from domestic and non-domestic sectors	45790 €/year	23854 €/year	
SE3	Individual cost/effort of MSW management	Establishments	3.58 €/week	3.15 €/week
		Households	3.2 (moderate effort)	3.5 (high effort)
SE4	Coverage of MSW management costs	107.3%	105.8%	
SE5	Economic revenue due to increased recycling	16408 €/year	24143 €/year	
SE6	Potential employment gains due to recycling	0.29 jobs	0.32 jobs	
SE7	Satisfaction with MSW collection system	56.6%	57.9%	
SE8	Acceptance of MSW management pricing	1.7%	5.9%	
SE9	Population percentage who separates MSW at source	57.9%	94.7%	
SE10	Population percentage practicing home composting	2.6%	5.3%	
SE11	Population perception on the importance of recycling	4.86 (of 5)	4.86 (of 5)	

Table 4: Comparison of socioeconomic indicators results for Larnaka demonstration area

INDICATOR		RESULTS	
		Before the project (2017)	After the project (2020)
SE1	MSW management cost for municipality	198 303 €/year	102 191 €/year
SE2	MSW management revenue from domestic and non-domestic sectors	255 000 €/year	255 000 €/year
SE3	Individual effort of MSW management (Households)	3.4 (high effort)	2.9 (moderate effort)
SE4	Coverage of MSW management costs	128.6%	249.5%
SE5	Economic revenue due to increased recycling	7511 €/year	8146 €/year
SE6	Potential employment gains due to recycling	0.43 jobs	0.53 jobs
SE7	Satisfaction with MSW collection system	98.7%	100%
SE8	Acceptance of MSW management pricing	8.3%	51.7%
SE9	Population percentage who separates MSW at source	97.4%	100%
SE10	Population percentage practicing home composting	0%	0%
SE11	Population perception on the importance of recycling	4.38 (of 5)	4.55 (of 5)

Table 5: Comparison of socioeconomic indicators results for **Lisbon** demonstration area

INDICATOR		RESULTS	
		Before the project (2017)	After the project (2020)
SE1	MSW management cost for municipality	2 345 210 €/year	3 885 505 €/year
SE2	MSW management revenue from domestic and non-domestic sectors	2 054 181 €/year	2 173 178 €/year
SE3	Individual cost of MSW management (Establishments)	8.67 €/week	13.63 €/week
SE4	Coverage of MSW management costs	87.6%	55.9%
SE5	Economic revenue due to increased recycling	394 492 €/year	434 962 €/year
SE6	Potential employment gains due to recycling	6.01 jobs	6.71 jobs
SE7	Satisfaction with MSW collection system	76.9%	100%
SE8	Acceptance of MSW management pricing	61.5%	57.1%
SE9	Population percentage who separates MSW at source	100%	100%
SE10	Population percentage practicing home composting	N/A	N/A
SE11	Population perception on the importance of recycling	4.92 (of 5)	5 (of 5)

Looking at the information in tables 3-4, it can be concluded that in the experiences of Aveiro and Larnaka, more focused on resident population, the implementation of the project has met with a decrease of costs and an increase of the revenues generated by the higher rate of materials separately collected for recycling – and an associated creation of new employment.

It must be pointed, however, that in Aveiro the company responsible for MSW collection has been, at the same time, replaced by a new one which offered lower prices for the service, thus explaining the cost reduction. Conversely, the revenues received from tariff payments by the residents have been also reduced, but without compromising the sustainability of the system, since the balance with expenses has been kept. In Aveiro, irrespectively of the technical problems

experienced, the new system has been generally well received: the satisfaction with collection service and pricing is higher after the project, and more citizens are collaborating with source separation and home-composting, even if this has resulted in a higher effort.

The results are similar in Larnaka, though in this case the effort perceived by the residents is less than before, probably due to the better accessibility and use convenience of the door-to-door collection system put in place. Within the questionnaires distributed regarding the socioeconomic indicators the citizens were also asked whether they would be interested in home composting. The results were not very promising, therefore the Municipality decided to investigate the option of Municipal composting. This is why the indicator SE10 (Population percentage practicing home composting) did not change during the project (even though a few families did take up home composting).

In Lisbon, the results are more controversial (table 5). Even though the increase in recyclables collection resulted in higher revenues and employment creation, the costs for the municipality were not reduced, since the amount of mixed MSW generated did not decrease (see Action C1 for more information). Additionally, the PAYT system has resulted in additional effort for the participant establishments and less acceptance of tariffs, although the satisfaction with collection is generalised.

6. CONCLUSIONS

This study reveals that the application of a PAYT tariff system has a relevant effect on the behaviour of the population involved.

Nevertheless, measuring the precise extent of this effect isolated from other external influences has revealed itself to be a complex issue. The implementation of the LIFE PAYT project was coincident in time with other events which might have altered waste generation patterns, such as the COVID-19 pandemic.

In parallel, decisions taken by the political authorities have also influenced the results: in Aveiro, the change of MSW collection company allowed to lower the tariff values, whereas in Lisbon, further expansion of municipal collection to large MSW producers was counteracted by governmental decisions pointed in the opposite direction.

Additionally, the legal constraints for modification of tariff schemes have hindered a complete appreciation of the beneficial effects brought by PAYT.

Finally, the differences found between the several participant countries also made difficult to obtain uniform and generalised and comparable values.

The concerns of the population involved in the experience were focused on the technical problems encountered and the quality of the service provided – e.g. functioning of bins and cards – however the global satisfaction with the collection system has not been appreciably affected.

Moreover, the population is receptive and favourable to the PAYT concept, understood as a fairer approach for waste management pricing when compared to the previous systems – besides being also environmentally beneficial –, and probably this perception will be greater as long as the actual price discounts are greater too. This perception is also valid for non-domestic establishments such as those of Lisbon, however in this case the satisfaction with price has not improved

perhaps due to the higher effort required to handle waste in order to correctly separate it. This would require even further awareness efforts from the municipality to show the advantages of PAYT schemes.

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