INSTITUTO NACIONAL DE ESTADISTICA

Pilot study on water use in the services sector (2008-2013)

Year 2017

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1 Introduction

The National Statistics Institute (INE) for the first time is publishing a study on water use in Spain in the services sector, as a result of the exploitation of the module on water use, which has been included in the questionnaire of the *Survey on Generation of Waste in the Services Sector (EGRSS by its Spanish acronym)* over the past few years. The purpose of this study is to estimate the volumes of water used in some branches of economic activity in this sector, calculate water use coefficients and lay the foundations for the formulation of future specific studies.

2 Statistical methodologies for the study of water use in public supply networks

Unlike what occurs in the industrial manufacturing sector, most water volumes used in the services sector come from public supply systems (*public networks*), whereas private water collection (direct) from the environment is not significant, except in some recreational activities (water parks, golf courses, etc.). Therefore, in this study, the estimated volumes correspond to purified water (treated) and supplied by these networks.

With respect to effluents, due to health reasons, there are specific regulations for the treatment–prior to their discharge into the sewerage network–of wastewater from certain activities (hospital centres, repair of motor vehicles, pharmaceutical industry, etc.).

Two approaches can be established for the study of water. The first of them is based on the so called "*hydraulic balance*" which classifies the water supplied by the network into: *authorized consumption* (registered or estimated), *real losses* and *apparent losses*. Once the registered volumes have been identified–that is, measured by meter–the reporting unit of the survey performs a breakdown according to the type of user of the water: *households* (main or second residence) / *economic sectors* (agriculture and livestock, industry, services, construction) / *municipal consumption*. This breakdown according to economic activity of the user is known as "*economic analysis of water uses*".

This is the approach used by the *Survey on Water Supply and Treatment (ESSA* by its Spanish acronym), in which the reporting units are the entities, bodies or companies that provide the drinking water supply service. The economic categorization variable of the different users is the legal ownership of the water supply contract and their corresponding pricing characteristics.

A second approach, to which the EGRSS should be ascribed, is given by the structural surveys aimed at companies or establishments of the industrial, trade or services sectors. Viewed from this perspective, water use is studied as an intermediate consumption of economic activities.

As a general rule, for medium and large-population municipalities there are three type of contracts (or rates) depending on the uses made of water: *domestic (households)* / *commercial (services)* / *industrial*, while in small-population municipalities there is often a flat rate for all water uses. An indicative list of the above mentioned uses is presented below, with a brief description of water uses and their rate designations:

– Domestic uses[1]: Are those used by people in households who live in main or second residences to meet basic human needs (food preparation, personal hygiene, laundry, cleaning, and as the case may be, heating, plant and private gardens watering and pools in their own community without an independent water connection).

– Commercial and similar uses: these are uses made in water points contracted exclusively for such activities in which the water is not a basic but an indirect element of the economic activity. This section includes agricultural and livestock activities (greenhouses, small gardens, etc.).

Uses similar to commercial uses are often considered to be those carried out in official departments of Public Administrations, as well as in education centres, hospitals, military installations, health centres, sport centres, fairs, events, etc.

– Industrial uses: this section includes those carried out in water points contracted for this type of activities, in which water supply is a direct and indispensable element of them.

In principle, the volumes of water used by the Local Administration (irrigation of parks and gardens, street cleaning, cleaning of the sewerage systems, fire extinguishing, etc.) are computed under the heading of "*other uses*" or "*municipal consumption*", as they are not invoiced to the town council itself.

Commercial activities are usually carried out in establishments located at street level, although they can also be performed in dwellings entirely dedicated to a commercial activity (offices, law firms, company headquarters, etc.). On the other hand, tax legislation allows the partial appropriation of dwellings to an economic activity. These would be therefore main dwellings where people habitually reside, but where self-employed workers (" *legal persons*") or entrepreneurs without employees carry out a professional activity, being their own dwelling the registered office of the company.

[1] The epithet "domestic" may lead to confusion, since at the international level and following English terminology ("*domestic uses*"), this term usually covers volumes of water used not only by households, but also by the services sector.

3 Analysis of data

3.1 STATISTICAL AGREEMENTS

For the purpose of this study, the terms "*demand*" and "*use*" of water should be understood as synonymous, meaning by them the volumes of water that users acquire and use, since every demand for water is satisfied by the urban supply system.

On the other hand, in the context of the integral water cycle the terms *use* and *consumption* are not equivalent since, from the environmental perspective, consumption is the volume of water that, after use, does not return to the environment. However, the term "*consumption*" is sometimes used to define certain uses of water, such as that which occurs in tourist accommodations, hospital centres, etc., or in secondary residences. Therefore, the term "*consumption*" will not be used in this study, adopting the word "*use*" in the sense of water use by the company.

3.2 GROUPINGS OF INDUSTRIES OF ECONOMIC ACTIVITY (CNAE-2009)

The services sector is characterized by the great heterogeneity of its industries of economic activity. For that reason and for the purpose of this study, an ad-hoc grouping of the divisions of the CNAE-2009 has been carried out according to their economic affinities in the use of water.

Specific classifications by divisions of the CNAE-2009
Sale and repair of motor vehicles and motorcycles (45)
Wholesale trade and commission trade (46)
Retail trade (47)
Transport and storage (49-53)
Accommodation services (55)
Food and beverage service activities (56)
Information and communications (58-63)
Real estate activities, professional, scientific and technical activities, administrative and support services activities, except veterinary activities (68, 69, 70-74, 77-79, 80, 82)
Services to buildings and landscape activities (81)
Education (85)
Health activities, social services and veterinary activities (86, 87, 75)
Creative, arts and entertainment activities, and other personal service activities (90-96)

3.3 FRAMEWORK, SAMPLE DESIGN, DATA COLLECTION, INCIDENCES IN DATA COLLECTION AND ELEVATION OF SAMPLE DATA

The methodology of the *EGRSS* is published in the INE web site: http://www.ine.es/en/daco/daco42/resiurba/notaresi_ser_en.pdf

The framework of the Survey is made up by companies whose main activity is included from section F to section S, excluding activities related to Financial and

Insurance Activities (section K) and Public Administration, Defence and Compulsory Social Security (division 84) from the population scope. The observation unit (reporting) is the company. The type of sampling is stratified in function of the divisions of the CNAE and the number of salaried employees in the company. Companies with 500 employees and over are extensively interviewed.

The module on water use presented in the annex, requests information on volumes of water supplied through a public network, as well as the amount paid for such water use. Information is also collected on the existence of private water collection, broken down by its source (surface/groundwater/other sources). Since the number of responses received for these variables has not been significant, it has not been possible to exploit the sampling values of those variables.

The module does not include questions on treatment of waste-water generated by the company, on the grounds that most of it is treated in Waste Water Treatment Plants (EDAR's by its Spanish acronym).

In 2013, from a theoretical sample of 6,015 companies, a completed questionnaire was obtained for 4,590 units, representing a total response rate of 76%. For the years 2008, 2009 and 2011, this response rate has been maintained with no significant variations. It is not possible to provide estimates by Autonomous Community since the survey sample is not designed to make estimations for this territorial disaggregation.

In the collection of the 2013 time reference data, 131 units have not provided information on the volume of water used, although they have done so as regards the amount paid. On the other hand, 495 units have not provided any data for volume and amount variables. For the first incidence, the value of the unit cost estimated in the *ESSA* for the national total has been used as imputation auxiliary variable. For dealing with the second incident, it has been imputed to the unknown values the averages of such values in each stratum and division of the CNAE-2009.

In the expansion phase of the sampling data, the elevation factors have been calculated depending on whether or not the unit changes of stratum. If the unit changes of stratum the factor is calculated as the population size divided by the sample size for each stratum, also known as initial factor. In case the unit does not change of stratum, the factor is calculated as N°/n° where N° is the population size minus the sum of the number of duplicates and the number of units which change of stratum multiplied by the initial factor, and n° is the number of units of the effective sample that does not change of stratum.

Each unit of the sample is multiplied by its factor, which is an indicator of the number of units it would represent. Summing all units multiplied by their corresponding factor yields population data for company size (TAME by its Spanish acronym) higher or equal to 14. The resulting estimator is expressed as:

$$\hat{Y} = \sum_{h} \hat{Y}_{h} = \sum_{h} \sum_{i} y_{hi} w_{hi}$$

In order to obtain the results elevated for all the companies, the external source used has been the number of employed workers in the *Annual Services Survey (ASS)*, except for the branches of activity / groupings 85, (86, 87, 75) and (90 to 96), for which estimates of the *Economically Active Population Survey (EAPS)* have been used, since the *ASS* does not collect data from these industries of economic activity.

The elevated results obtained by the above-mentioned estimation procedure have been adjusted to the total population by means of a water volume ratio by employed person in each industrie / industrie grouping. To that end, the employed workers by branch / grouping provided by the *EGRSS* have been estimated. These estimated data have been subtracted from the total employed population provided by the *ASS* and the *EAPS*.

In a second phase, each employed person from the population estimated by the previous procedure has been assigned the ratio of cubic meter per employed person estimated by the elevated survey data. Therefore, it has been convened that the said ratio is not correlated with the size of the company. This could lead to an overestimation of the results, although it would not be significant given that in the services sector water resources do not generally have economies of scale, as is the case in the manufacturing industry.

3.4 FINAL RESULTS

Classification by divisions of the CNAE-2009	2008	2009	2011	2013
Sale and repair of motor vehicles and motorcycles (45)	14,275	11,731	15,235	13,253
Wholesale trade and commission trade (46)	44,794	30,412	35,595	35,861
Retail trade (47)	83,932	82,872	83,251	73,944
Transport and storage (49 - 53)	45,405	43,526	46,044	48,804
Accommodation services (55)	106,271	114,475	104,720	103,781
Food and beverage service activities (56)	133,023	124,719	120,629	109,235
Information and communications (58 - 63)	15,704	11,438	13,039	10,321
Real estate activities, professional, scientific and technical activities, administrative and support services activities, except veterinary act. (68, 69, 70 -74, 77 - 79, 80, 82)	47,181	35,428	34,539	36,027
Services to buildings and landscape activities (81)	3,138	2,268	3,642	3,535
Education (85)	57,602	61,886	54,911	47,341
Health activities, residential care activities and veterinary activities (86, 87, 75)	89,856	87,258	79,104	71,579
Creative, arts and entertainment activities, and other personal service activities (90 - 96)	53,808	55,366	60,819	52,425
TOTAL	694,989	661,379	651,528	606,106

Unit: thousands of m^3

4 Coefficients of water use

At the international level, the references of studies on the calculation of this type of coefficients in the services sector are scarce, limited in most cases to estimates more or less approximate. Only in the hospital and hotel sectors, specific studies have been carried out on water use aiming at making its use more efficient with the installation of water saving systems in toilets, promoting the reuse of water in the different circuits of the establishment and the appropriate campaigns to raise awareness among users for a good use of water.

In order to allow the calculation of these coefficients[2], a classification has been established which groups the branches of economic activity for which it is possible to calculate a coefficient with the help of a variable correlated with that activity.

The calculations of the breakdowns at economic activity group level (three digits of the CNAE), have been carried out with the same approach as that used for the estimation of water volumes (see section 3.3). It has been used as an external source for accommodation services, the number of employed persons of the *ASS* and for health activities, and the number of employed persons in the *EAPS*.

Classification	CNAE codes
Pre-primary, primary and secondary education	85.1, 85.2, 85.3
Post-secondary education	85.4
Hospital activities	86.1
Hotels and similar accommodation	55.1
Holiday, camping grounds and other accommodation	55.2, 55.3, 55.9
Food and beverage service activities	56
"Offices" (58 to 82 , excluded 64, 65, 66 y 75)	58 - 82

EDUCATION (85)

The auxiliary variable used has been the number of students pursuing studies at the education levels indicated according to the UOE questionnaires that Spain completes in the framework of the International Education Statistics. School year X / X+1 is considered to be the same as the calendar year X+1. Post-secondary education includes university education, higher vocational training and non-university higher education. Two types of coefficients have been calculated, per day and per school day, considering that each school year has 180 school days on average.

[2] It has been decided to use the term "*coefficient*" because the term *"provision*" is considered to be more suited to the agricultural irrigation and manufacturing industries sectors.

- Pre-primary, primary and secondary education (85.1, 85.2, 85.3)

	2008	2009	2011	2013
Water use *(thousands of m^3)*	48,197	52,522	45,258	38,896
Number of students	7,479,722	7,641,892	7,993,064	8,146,007
Coefficient *(litres / student / day)*	**18**	**19**	**16**	**13**
Coefficient *(litres / student / school day)*	**36**	**38**	**31**	**27**

- Post-secondary education (85.4)

In this type of education, two types of coefficients are calculated, one considering enrolled students and the other considering full-time equivalent enrolled students (eq). A full-time student is the one who is enrolled in an education programme, whose expected study load accounts for at least 75% of the normal full-time study load (in a school year).

	2008	2009	2011	2013
Water use (*thousands of m3*)	9,405	9,364	9,653	8,445
Number of students	1,781,019	1,800,834	1,950,482	1,969,413
Coefficient *(litres / student / day)*	**15**	**14**	**14**	**12**

	2008	2009	2011	2013
Water use *(thousands of m^3)*	9,405	9,364	9,653	8,445
Number of students (eq)	1,634,400	1,575,106	1,709,673	1,692,217
Coefficient *(litres / student eq / day)*	**16**	**16**	**15**	**14**

HOSPITAL ACTIVITIES (86.1)

The auxiliary variable chosen for the calculation of coefficients in this activity has been the number of *stays*. A hospital stay is considered to be when the patient spends the night in a hospital bed and has a main meal (lunch or dinner). Previously, it is necessary to break down the hospital activities (86.1) from the rest of health activities (86.2 and 86.9) and from divisions 87 (residential care activities) and 75 (veterinary activities).

	2008	2009	2011	2013
Hospital activities (86.1)	43,261	40,891	37,225	30,226
Rest	46,595	46,367	41,879	41,353
TOTAL (86, 87, 75)	**89,856**	**87,258**	**79,104**	**71,579**

Next, the coefficients of water use per bed, hospital stay and employed worker are calculated. For the estimation of the first of these two variables, the *Hospital Morbidity Survey* conducted by the INE has been used. On the other hand, the source used for the estimation of the number of hospital beds is the *National Hospital Catalogue* elaborated by the Ministry of Health, Social Services and Equality. A table of water use per employed worker is also presented, according to the results estimated by the *Economically Active Population Survey (EAPS)* for this variable.

	2008	2009	2011	2013
Water use *(thousands of m^3)*	43,261	40,891	37,225	30,226
Number of hospital beds	160,292	160,981	161,022	162,070
Coefficient *(litres/bed/day)*	**739**	**696**	**633**	**511**

	2008	2009	2011	2013
Water use *(thousands of m^3)*	43,261	40,891	37,225	30,226
Number of hospital stays	33,495,510	33,014,160	31,304,202	30,769,356
Coefficient *(litres/stay/day)*	**1,291**	**1,239**	**1,189**	**982**

	2008	2009	2011	2013
Water use *(thousands of m^3)*	43,261	40,891	37,225	30,226
Number of workers	578,300	579,300	601,400	546,400
Coefficient *(litres/worker/day)*	**205**	**193**	**170**	**152**

ACCOMMODATION SERVICES (55)

The auxiliary variable chosen for the calculation of coefficients in this activity has been the number of overnight stays (client/night). Previously, it is necessary to break down the accommodation activities (55) in hotels and similar accommodation (55) and other accommodation (55.2, 55.3 and 55.9).

	2008	2009	2011	2013
Water use (55.1)	85,050	90,622	85,018	85,760
Water use (Other)	21,221	23,853	19,702	18,021
TOTAL (55) *(thousands of m^3)*	**106,271**	**114,475**	**104,720**	**103,781**

- Hotels and similar accommodation (hotels, tourist complexes, aparthotels, motels) (55.1)

The source for the variable "overnight stays" (of travellers), is the *Hotel Occupancy Survey* carried out by the INE.

	2008	2009	2011	2013
Water use *(thousands of m^3)*	85,050	90,622	85,018	85,760
Number of overnight stays	268,551,840	250,984,810	286,761,259	286,030,160
Coefficient *(litres/overnight stay)*	**317**	**361**	**296**	**299**

"OFFICES" (58 to 82)

This section groups the economic activities that generally take place in offices. Given the heterogeneity in such activities, the ratios obtained for all "offices" should be taken with caution. As mentioned earlier, branches relating to financial services (64, 65 and 66) and veterinary activities (75) are excluded.

	2008	2009	2011	2013
Water use *(thousands of m^3)*	62,885	46,866	47,578	46,348
Number of workers*	2,517,900	2,404,100	2,379,900	2,314,100
Coefficient *(litres/employed worker/day)*	**68**	**53**	**55**	**55**

* *Source: EAPS*

5 Future developments

As of 2015 (temporal data reference), the INE is carrying out a reform of the questionnaires of the Annual Trade and Services Surveys. In the new format (*Structural Business Statistics: Trade sector/Services sector*), a variable related to purchases of water expressed in monetary values has been included.

By assimilating the purchases of water to its use, it is possible to handle the conversion of those values into physical quantities. This will provide background information for establishing relevant comparisons of water use intensity by category, geographical location and any other variable that characterizes the activities in the services sector.

6 Annex

Module on water use in the Survey on Generation of Waste in the Service Sector - 2013

3. Water supply

TOTAL

3.1 Through a public network:

1 Total volume of water supplied **(m^3/year)**

2 Amount of water supply rates **(€)**

3.2 Does your company perform private water collection?

___ Yes ___ No

TOTAL

3.3 Water volume collected by the company itself:

1 Surface water **(m^3/year)**

2 Groundwater **(m^3/year)**

3 Seawater: for desalination **(m^3/year)**

4 Seawater: not desalinated **(m^3/year)**

5 Other type of water resources (specify in **m^3/year**)

6 Amount of water collection fees **(€)**

Amount of water supply rates: amount paid to the corresponding company or town council for the volume of water from public supply. The amount corresponding to sanitation rates will not be included (sewerage and wastewater treatment).

Amount of the water collection fees: amount paid for the volume of water collected directly by the company to the corresponding institution (Hydrographic Confederation, Autonomous Community) on water use fee, regulation fee, production fee or occupation fee.