Guadalquivir water services cost recovery based on SEEA-W

Abstract

The Water Framework Directive (WFD) establishes a legislative framework for Community action in the field of water policy, aiming at improving and protecting the status of water bodies along Europe. The WFD also provides general criteria to consider drought impacts in the state of water bodies and includes the goal of full cost recovery of water services. The System of Environmental-Economic Accounting for Water "SEEA-Water", United Nations - DESA (2012) provides a conceptual framework for organizing hydrological and economic information in a coherent and consistent manner.

The European Commission (2014) affirm the convenience of linking SEEA-Water accounts to economic aspects of the WFD, and this research aims to fill the gap in knowledge on these issues:

- Application of SEEA-W tables to European Mediterranean basins.
- Proposal of a method to estimate cost recovery ratios based on the standard SEEA-W tables.

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1. Introduction

The Water Framework Directive (WFD) establishes a legislative framework for Community action in the field of water policy, aiming at improving and protecting the status of water bodies along Europe. The WFD also provides general criteria to consider drought impacts in the state of water bodies and includes the goal of full cost recovery of water services.

The WFD does not request compulsory full cost recovery as it states that Member States may in doing so have regard to the social, environmental and economic effects of the recovery as well as the geographic and climatic conditions of affected basin/region. In case that full cost recovery is not applied, WFD request that these exceptions shall be justified in the river basin management plans subject to the guarantee that environmental objectives of the Directive are reached.

In more detail, WFD Article 9 establishes that: water prices must allow for the (adequate) cost recovery of water services, including environmental and resource costs; the main water uses (disaggregated for households, industry and agriculture) must adequately contribute to the recovery of costs of water services, proportionally to their contributions to the pressures imposed on aquatic ecosystems in line with the 'polluter pays principle' and water pricing policies must 'provide adequate incentives for users to use water resources efficiently and thereby contribute to the environmental objectives' of the WFD.

The System of Environmental-Economic Accounting for Water "SEEA-Water", United Nations - DESA (2012) provides a conceptual framework for organizing hydrological and economic information in a coherent and consistent manner. It has been developed by Department of Economic and Social Affairs of the United Nations Secretariat with the support of other institutions. This is a key issue, as the origin is economics and the nature of the accounts is hybrid. In our opinion Water Accounts give the analyst the opportunity for facilitate analysis for both dimensions, economic and physical.

European Commission is working in a Guidance document on water balances Draft-v1.0 (European Commission, 2014) with the aim to standardize economic information regarding water use in Europe, therefore facilitating WFD reporting. SEEA-Water accounts also comprise valuation of water and water resources, although this category of accounts is still experimental and we will present some result regarding this issue. This research has been financed by European Commission under grant "System of Water Accounting in the Guadalquivir River Basin" (SYWAG).

European Environment Agency (2013) in a large review of water pricing and cost recovery in European Union concludes that, there is a lack of harmonised and operational concepts of cost recovery, Strosser and de Paoli (2013) conclude that recognising the diversity of MS contexts and priorities, priority should be given to good accountability and transparency in order to enhance the relevance of the economic assessments for MS policy making and for EU-wide policy making and additionally the need for additional guidance on the topic of cost recovery.

The European Commission (2014) affirm the convenience of linking SEEA-Water accounts to economic aspects of the WFD, and this research aims to fill the gap in knowledge on these issues:

- Application of SEEA-W tables to European Mediterranean basins.
- Proposal of a method to estimate cost recovery ratios based on the standard SEEA(W) tables.

Although some examples can be found of partial developments of SEEA-Water tables, no precedent of neither economic nor hybrid tables is found in European basins and to our knowledge there is a lack of common cost recovery definition and estimation in European Union and no precedent can be found of application of the tables for the estimation of cost recovery ratios. Next section will review the relevant literature describing the state of the art of the scientific and political knowledge on this topic.

2 Literature Review on cost recovery in water services

The European Water Framework Directive (WFD) was adopted in 2000 with a holistic view of water management and established the objective to achieve good status by 2015. WFD make an emphasis in the use of economic tolls and instruments to reach this goal. European Commission has published a strategic paper with the analysis of the achievements of this norm after 10 years of implementation (European Commission, 2012). The analysis concludes that the reasons for the currently insufficient levels of implementation and integration are complex consisting of a series of water management problems related to the insufficient use of economic instruments, lack of support for specific measures, poor governance and knowledge gaps.

Article 9 of the WFD requires implementation of pricing policies that provide an incentive to use water efficiently. Pricing is a powerful awareness-raising tool for consumers and combines environmental with economic benefits, while stimulating innovation. Metering is a pre-condition for any incentive pricing policy. Article 9 also requires cost-recovery (including environmental and resource costs) for water services, taking into account the polluter pays principle.

There is a extensive treatment of water pricing and water demand in the literature, both for irrigation and urban use, a review of European water pricing policies can be seen at Berbel et al (2007) and an integrated evaluation of impact of water pricing in irrigation demand can be seen Berbel et al (2009) and House-Peters et al (2011) for Urban water demand.

EEA (2013) presents a detailed assessment of current water pricing for selected EU Member States, the main conclusion being that there is a lack of harmonised and operational concepts of cost recovery, and environmental and resource costs including incentives to saving. Full cost recovery refers to 'water services' as the resource has no price itself although the definition of water services varies clearly among countries, the wider definition includes all man-made changes in the hydrological system that serve to a policy objective and benefits the society as a whole or some specific economic uses. Spain is a country where definition of water services is wider due the characteristic of climate and territory.

Prices constitute the economic information system but water itself has not a price in European Union as markets are almost absent (see Giannoccaro et al 2013). Water pricing generally in literature refers to the processes of assigning a price to water services, using instruments such as utility taxes, charges, tariffs. The revenue from water pricing instruments according WFD Article 9 should reach cost-recovery in order to support environmental and economic goals.

The concept of cost recovery as defined in the WFD and its call for the internalisation of all cost of service provision although the exact value of the costs of water service provision recovered is difficult to estimate due to the variability of climatic and economic uses of water among EU Member States. There are economic instruments like the water levy (canon del agua) in Spain which are said to tackle both environmental and resource costs under a single mechanism.

Compared with the abundant literature in water pricing, the published research and policy guidelines for cost recovery assessment is scarce, among the scarce published research on this theme, besides the mentioned EEA (2013) review, we may mention Krinner (2014) who presents a financial analysis of the Spanish water sector based upon financial and budget information of administrations, agencies, companies and users' associations involved in water resources management and water service provision using financial records to estimate the overall amounts of expenditure, cost and revenues, this reports follows the line of Environmental Ministry (2007) although with some methodological changes. Calatrava and Garrido (2010) focus their research in the analysis of irrigation subsidies based upon the information that Spain reported to the European Union.

According Strosser and de Paoli (2013) EU Member State have applied a diversity of methods to estimate cost recovery rates although the methods applied are rarely well-specified making difficult any use (as source of inspiration by other MS or for EU-wide assessment) of the results reported.

After 14 years of WFD approval, European Union is still lacking comparable systems for the reporting of administration and utility revenues to recover the costs European Commission is using a new standard reporting procedure for 2015 (second cycle of WFD implementation) in order to correct this shortcoming, but we believe that even if the presentation respond to a common standard for all 27 member states, the differences in methodology to compute this value will still require additional common methodology to be shared. In our opinion, it would be particularly useful to have a system, standardized across EU Member States and in our opinion SEEA-W presents an opportunity to fill this gap.

3 SEEA- Water economic tables

SEEA-Experimental Ecosystem Accounting offers a synthesis of the current knowledge of ecosystem accounting. Countries and institutions making complementary guidance and work are the EU (European Commission, 2014), Canada's MEGS and Wetland Asset Accounts and Experimental Ecosystem Accounts in Australia Cosier and McDonald (2010) are example of country experimental developments.

The advantage of water accounts over other types of water statistics is the ability to integrate water accounts with economic information, which facilitates economic analysis. Lange et al (2007) give water accounting following SEEA-Water for the Orange River Basin from an economic perspective on managing a transboundary resource building National water accounts for Botswana, Namibia and South Africa level. The accounts include supply and use tables, which are used to compare the contribution to water supply from each riparian state to the amount used. The water accounts are then linked to economic data for each country to calculate water use and productivity by industry and country.

The System of Environmental–Economic Accounting for Water is applied in many countries, such as Australia where Vardon et al., (2012) make an adaptation of the national level water account practices by the Australia Bureau of Statistics (ABS) to the SEEA-W framework eased by the similarity between both accounting frameworks. In China, the objectives of National Water Accounting Framework (CWAF) are consistent with those of SEEA (Gan et al., 2012), South Africa (Lange et al., 2007). Most of the applications use the hybrid nature of the table to produce ratios of apparent water productivity by sector/region. Unfortunately the published research on SEEA-Water implementation is scarce, specially with a full exploitation of economic tables.

Our research aims to explore this gap, specially the cost recovery estimation that can be obtained by using SEEA-Water tables as the basis for the computation.

4 Case study: Guadalquivir basin 2004-2012

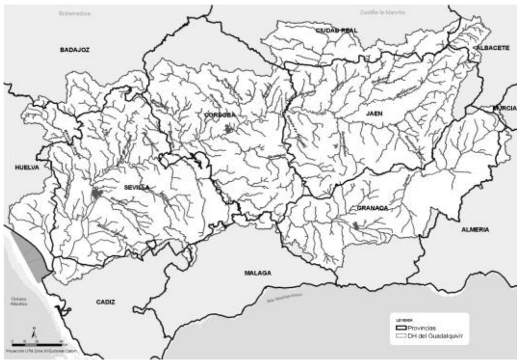
The Guadalquivir River is the longest river in southern Spain with a length of around 650 km. Its basin covers an area of 57,527 km2 and has a population of 4,107,598 inhabitants (see Figure 1 for a map of the basin). The basin has a Mediterranean climate with a heterogeneous precipitation distribution. The annual average temperature is 16.8°C, and the annual precipitation averages at 573 mm, with a range between 260 mm and 983 mm (standard deviation of 161 mm). The average renewable resources in the basin amount to 7,043 (arithmetic mean) and 5,078 GL/year (median), ranging from a minimum of 372 GL/year to a maximum of 15,180 GL/year (Arguelles et al., 2012). In a normal year a potential volume of around 8,500 GL can be stored through a complex and interconnected system of 65 dams. The main land uses in the basin are forestry (49.1%), agriculture (47.2%), urban areas (1.9%) and wetlands (1.8%). For a complete description of basin evolution see Berbel et al (2013).

Agriculture is the main user in the basin and it has implemented an intense investment in water saving measures (called ‘modernization’ (MARM, 2006). An interesting feature in this basin is the widespread of deficit irrigation technique, Berbel et al (2011) analyse the influence of this system in the basin and the consequences for economic of irrigation.

The period to be analysed is 2004-2012 where we can find the following features:

- Drought period 2005-2008.
- Increase of water saving investment (modernization).
- Increase of energy cost.
- Approval of Program of Measures and Hydrological Basin Plan (2009-2015).

Figure 1: Guadalquivir River basin



Source: Adapted from Confederación Hidrográfica del Guadalquivir. www.chguadalquivir.es.

4 Material: the SEEA-W tables for Guadalquivir 2004-2012

The philosophy of SEEA-W is the time and resource saving efficiency in data gathering, it is crucial that data is based in officially published information avoiding 'ad hoc' estimations. Following this strategy, our have used the following data base and official sources that are summarized in table 1.

Table 1. Economic and hydrologicc variables related to cost recovery analysis

Variable	Units	Standard Table (1)	Data source	Institution	Scale (2)	Comments
Abstraction	hm^3/year	A.1.1	SIMPA, Own calculations	CHG, Environmental Ministry	Basin	
Use	hm^3/year	A.1.1	PHC, Survey water services, Own calculations	CHG, Environmental Ministry, INE	Basin	
Returns	hm^3/year	A.1.1	Own calculations based on IPH	CHG, Environmental Ministry	Basin	
Consumption	hm^3/year	A.1.1	Own calculations based on CHG	CHG, Environmental Ministry, INE	Basin	
Intermediate consumption	€/year	A.1.3	I/O Tables regional	IEA	Regional	
Gross Value Added	€/year	A.1.4	Regional Accounts	INE	Regional	
Gross fixed capital formation	€/year	A.1.4	Regional Accounts, WB investment series	INE, WB	Regional, National	Investment since 2009 estimated with WB annual investment serie.
Clossing stocks of fixed assets	€/year	A.1.4	Water tariff, Administration budget (2004-2008)	Environmental Ministry	Basin	Investment since 2009 estimated with WB annual investment serie.

Water self-service production cost: Groundwater	€/m[3]	A.1.5	Ministry Report	Environmental Ministry	Basin	Water cost published by Ministry.
Water self-service production cost: Surface	€/m[4]	A.1.5	Water tariff	Environmental Ministry	Basin	Water tariff (yearly).
Water self-sanitation	€/m[5]	A.1.5	Survey water services	INE	Regional	Yearly average all sectors.
Government account table	€/year	A.1.6	Administration budget (2004-2008), WB investment series	Environmental Ministry, WB	Regional, National	Expenditure since 2009 estimated with WB annual investment serie.
Specific transfers	€/year	A.1.7	Administration budget (2004-2008), WB investment series	Environmental Ministry, WB	Regional, National	

INE= Instituto Nacional de Estadistica; IECA= Instituto de Estadistica y Cartografia de Andalucia; WB = World Bank; (1) First apparence (2) Assembled to basin limits

In table 1, revenue to cover cost is included based upon the following instruments:

- Water tariff 'canon del agua' is applied by Water Agency at basin level to cover all cost of reservoirs, distribution, policy and management of basin surface resources.
- Utilities recover the cost of distribution, treatment, collection and sewage by the urban water price, utility recover 100% of their services.
- Water User Associations recover their distribution cost as the finance themselves in a cooperative way therefore they should self finance their common services.
- Water levy which is an environmental tax designed to protect water resources, with the objective of guaranteeing supply and quality. The charge is calculated as a function of the water used by domestic and industrial users and is designed as an increasing block tariff. This levy has been applied since 2011. The income from this tax finances mainly sewage and sanitation plants.
- Self supply farmers and industry support the cost of abstraction (mainly groundwater), distribution, treatment and sanitation (the latest exclusively for industry).

Regarding the cost of water services, the capital and investment costs and operational and maintenance costs are also included in the SEEA-W. Regarding time series, we have always used the most recent information, with the following solutions:

- Annual data for hydrological variables, Gross Value Added, and so on.

- Intermediate consumption based on 20008 I/O tables.
- Public investment and expenditure; 2004-2008 yearly Administration budget (2004-2008) and 2009-2012 estimated based upon WB yearly investment series.

Spatial dimension has been addressed by assigning to basin scale data available at regional or national scale, according to population for industrial and urban data and area for agricultural and other land based activities.

We want to focus in cost recovery analysis which is in another task inside WFD implementation that need also a common standard methodology assumed by all Member States, and this will be done in the next section.

5 Method

This exercise will address only financial cost recovery because only financial costs are captured by SEEA-Water in the 2012 version. Therefore, environmental and resource cost are not addressed. Some environmental services are summarized in table "A1.6 Government account table for water-related collective consumption services”. These services are classified according to the Classification of the Functions of Government (COFOG). It should be noted that the COFOG categories refer to collective services of the Government. The categories COFOG 05.2 (wastewater management) and 06.3 (water supply) should not be confused with activities of “sewerage” and “water collection, treatment and supply”, classified under ISIC divisions 37 and 36, respectively, which are considered individual services in SEEA-Water. Expenditures incurred by Governments at the national level in connection with individual services, such as water supply and sanitation, are to be treated as collective when they are concerned with the formulation and administration of government policy, the setting and enforcement of public standards, the regulation, licensing or supervision of producers, etc., as in the case of education and health.

Also only expended urban sanitation cost are captured by the Spanish Statistical Office (INE) in a yearly basis but the 'avoided cost' for deficient sanitation (lack of equipment or under-operation of facilities) that can be considered 'environmental cost' are present in official data base that are the basis for the SEEA-Water. When pollution removal is solved by adequate treatment they are internalized. This discussion is not present in SEEA-Water guidelines (UN-DE, 2012) therefore this research does not address this important and difficult question that should be treated at European level with practical and operative definitions.

Besides this improvement to standard tables, the distinction between Blue water and Green water is crucial to understand recovery cost. SEEA-W (2012) handbook defines (section 6.29/page 94). "Abstraction also includes the use of precipitation for rain-fed agriculture as this is considered removal of water from the soil as a result of a human activity, such as agriculture. Water used in rain-fed agriculture is thus recorded as abstraction from soil water".

This definition is not operative when some Mediterranean basins have over 25% of area irrigated (and also forgets forestry and rangelands). Therefore we have adapted this definition to Guadalquivir conditions as 'soil water abstraction is the water evapotranspirated by crops both in rain fed and irrigated agriculture and by pastures and trees in forest areas'. We should mention that green water (soil water abstracted by irrigated agriculture) in Guadalquivir is an average of 55% with the remaining 45% coming from the irrigation water (blue water) properly. Therefore, we must modify the definition that SEEA-Water-2012 gives of 'soil water' to account for all soil water in the territory and not limited to rain fed agriculture that may gives a partial and misleading figure 2.

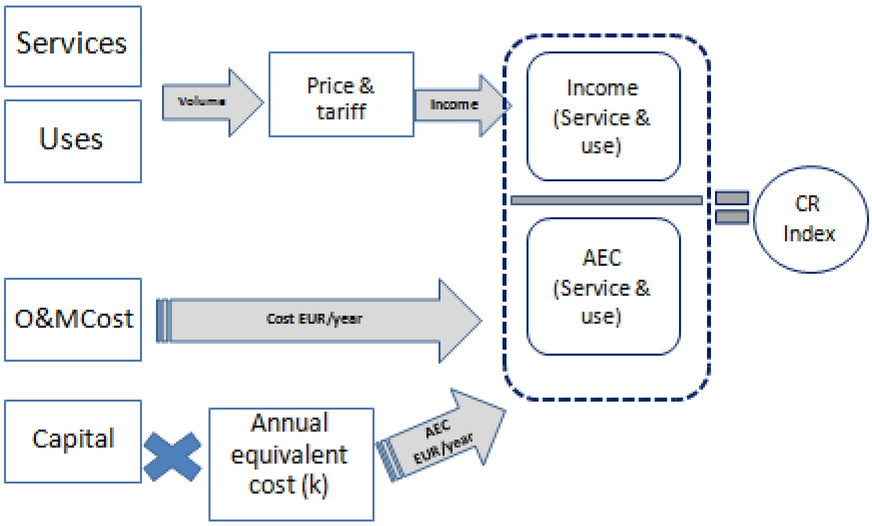


Figure 2: Methodology for estimation of Cost Recovery Index

In order to give a relevant and meaningful cost recovery ratio, it is important to understand that only blue water services (urban and irrigation) should pay the cost of the water storage, distribution and supply. Similarly, cost of water sanitation should be paid by users of industrial and urban water. Diffuse pollution (agricultural or other origin) is not addressed by the existing cost recovery instruments.

Spanish water management is based in the Basin Water Agencies that have been in charge since decade of 1920' of all Spanish basins. Confederación Hidrográfica del Guadalquivir (CHG) is the Water Agency responsible for water reservoirs and water supply to economic activities and environmental management. In Spain this is called 'upper services' and the Water Law (BOE, 2001) determines the tariff to compensate this services. Another important institution is the 'Water Users Associations' (WUA) that manages collective services to farmers. Therefore we have subdivided the “Water Supply” division into three agents: urban water utilities (generally accepted 36 industries) plus another two divisions that are CHG and WUA. Those three agents are in charge of water supply either at 'high level' or at 'bottom distribution level'. This method allows the cost recovery estimation with more detail and transparency according en SEEA-W handbook ((UN-DE 2012, pg. 71). “Note that activities are classified into the relevant ISIC (International Standard Industrial Classification of All Economic Activities) category regardless of the kind of ownership, type of legal organization or mode of operation. Therefore, even when activities for water collection, treatment and supply (ISIC division 36) and sewerage (ISIC division 37) are carried out by the Government (as may be the case in some countries), they should be classified to the extent possible in the specific divisions (ISIC 36 and 37) and not in ISIC division 84, public administration”.

The hypothesis behind the estimation of cost recovery for Guadalquivir basin is:

H1) Public and private costs are mainly dedicated to 'blue water' and soil water used agriculture is not relevant for this analysis. 'Blue water' expenses are mainly:

a) 'blue water' (irrigation + industry and urban supply);
b) Sanitation and sewage treatment.

H2) Operation and management cost are covered 100% by expenses paid either:

a) self supply operations (groundwater farmers, WUA, industry);
b) Utilities for urban sanitation and sewage treatment (both network industry and domestic users).

H3) Capital cost are not partially recovered when there is an economic instrument (tariff or tax):

a) capital investment in surface management by Water Authority, recovered by 'canon del agua';
b) Capital investment by Regional Government (recovered in 98% of basin by 'infrastructure canon’ self supply operations (groundwater farmers, WUA, industry).

H4) Capital cost are not recovered when there is a subsidy to private agent and there is not instrument to recover the subsidy (as it is the case generally).
H5) Capital cost paid by private users and utility are fully recovered.

We have developed a method based on the official data detailed in table 1; a relevant source is the I/O table (IECA) that gives the intermediate consumption. Combining intermediate consumption and Gross Value Added by sector obtained by Regional Accounts by INE, we compute the total income (earnings) by all sectors in the basin. Regarding water services we divide the total value of payments in the basin for water services according each sector contribution. As an illustration, from GVA and intermediate consumption we can know the expenses for water supply for agriculture and the global figure obtained from this source can be split up between 'upper services' (supplied by the water agency -CHG) and 'bottom services' supplied by WUAs, similarly for rest of sectors. Additionally, for those self supply users (groundwater use farmers and industry) the total cost of self-supply and the volume served can be obtained directly from "Table A1.5 Hybrid account table for water supply and sewerage for own use".

From table A.1.6 "Government account table for water-related collective consumption services", it can be obtained a value for 'collective' water services financed by the Government trough general taxation and the table A1.8 "Financing account tables", gives information about the financing of water services, including operation and capital expenses.

6 Results

Table 2 presents the standard reporting format for the 2015 Basin Plan revision according to CIS WFD roles. Theoretically all member state should use this table to report the cost recovery exercise. The table gives a detailed description of cost estimation and income collected by all agents that play any role in the water supply and treatment either public (Water Agency, National Government, Regional Government, Cities) collective (WUA) or private (domestic, industry, farmers). The table also presents an estimation of water volume served and consumed.

Table 2. Cost recovery index Guadalquivir Basin (2012).

Water service		Water use		Volume served (hm^3)		Financial cost ($EUR·10^6$)			Collected (EUR·106)	Cost recovery index (%)
				Water served	Water consumed	O & M expenses	Capital AEC	Financial AEC Total	Tariff, price and self supply cost	
				A	B	C	D	E = C + D	I	K = I/E*100
Abstraction, storage, distribution of water	Upper services abstraction, supply & distribution	1	Urban	447,5		56,88	38,13	95,01	70,04	**74%**
		2	Agriculture/livestock	2088,2		24,03	22,11	46,15	29,59	**64%**
		3	Industry/energy	30,9	30,9	3,93	2,45	6,38	4,84	**76%**
	Upper services groundwater abstraction	1	Urban	62,7		12,33	2,71	15,04	15,04	**100%**
		2	Agriculture/livestock	-	-	-	-	-	-	-
		3	Industry/energy	-	-	-	-	-	-	-
	Low service irrigarion distribution	2	Agriculture	2011,6	1861,4	97,1	69,2	166,3	121,36	**73%**
	Urban distribution	1	Domesticc	323,6	64,7	282,51	39,62	322,13	313,9	**97%**
		2	Agriculture/livestock	-	-	-	-	-	-	-
		1	Industry (connected)	31,8	6,4	27,75	4	31,75	30,84	**97%**
	Self supply	1	Domestic	-	-	-	-	-	-	-
		2	Agriculture/livestock	1117,1	1117,1	138,98	92,66	231,64	231,64	**100%**
		3	Industry/energy	36,3	36,3	3,06	0,77	3,83	3,83	**100%**
	Reuse	1	Urban reuse	-	-	-	-	-	-	-
		2	Agriculture/livestock	16,7	16,7	3,8	0,2	4	4	**100%**
		3	Industry/energy	-	-	-	-	-	-	-
	Desalation	1	Urban supply	-	-	-	-	-	-	-
		2	Agriculture/livestock	-	-	-	-	-	-	-
		3	Industry/energy	-	-	-	-	-	-	-
Collection and treatment of used water	Collection outside public networks	1	Domestic	-	-	-	-	-	-	-
		2	Agriculture/livestock	-	-	-	-	-	-	-
		3	Industry/energy	16		6,3	0,7	7,02	7,02	**100%**
	Public networks	1	Domestic	258,9		102,52	19,62	122,14	113,91	**93%**
		1	Industry (connected)	25,4		10,07	2,03	12,1	11,19	**92%**

We apply the method described in previous section, and the initial information starts from table A.1"Standard physical supply and use table for water" where the standard table proposed in the SEEA Handbook by (UN-DE, 2012), is expanded with an additional line that extracts 'Blue water' values from this table and the complementary "Table A2.2 Matrix of flows of water within the economy". With this tables we obtain the volume of water either self supplied or received from other unite, most of them come from sector 36 (Water Agency, utilities and WUA).

From I/O tables and regional accounts we obtain the 'expenses by sector/service that is the 'numerator' of the cost recovery indicator. Our method not use directly the water volumes for neither cost nor income estimation but we report this information to be in line with the reporting standards as some of the alternative methodologies use unit cost/price (EUR/m^3) as the methodology to assess the global collective recovery ratio. The volume is relevant as complementary information about the expenses and it serves as a double check to control the results of using the results of SEEA tables itself.

Table 3 presents a Summary of cost recovery index Guadalquivir for 2012 where all information comes directly from SEEA standard tables that have been extended with the detailed analysis of 'blue water' services and the division of sector 36 into three supply agents.

Table 3: Summary of cost recovery index Guadalquivir, 2012.

		Financial cost recovery index			
Service		Urban	Agrarian	Industry	Total
		1	2	3	
Water supply: abstraction, storage and distribution, surface and groundwater	Upper level surface services	74%	64%	76%	66%
	Collective groundwater abstraction	100%			100%
	Water irrigation distribution		73%(*)		73%
	Urban cycle (distribution of drinking water)	97%			97%
	Self service (surface & GW)		100%	100%	100%
	Reuse		100%		100%
	Desalation	--	--	--	n/a
Collection and treatment of sewage water	Non connected collection	--	--	100%	100%
	Public network collection	93%			93%
		87%	**75%**	**91%**	**78%**

Source: Own elaboration from SEEA tables. (*) Non recovered costs for water irrigation distribution are justified by the reduction in farmer water rights (25% on average).

Table 3 illustrates the interest of a detailed breakdown of income and cost by service and users. The result shows that upper level surface services apparently have a cost recovery around 66% for all sectors. This value should be explained:

Upper level surface services

- According to Environmental Ministry (Libro Blanco del Agua), the capital cost is recovered around 56% according Water Law normative, there is some initiative to change the fiscal regulation that implies this partial recovery. This value is in line with our results.
- Water Agency makes a multipurpose service when regulating water supply, and water utilities pay the 'general water levy' in a ration of 3:1 , that explain the higher recovery ration for industry and urban, but those sectors have also a priority when drought conditions are present (around 20% of the years in the series). The higher tax paid gives the privilege to full guaranteed water supply (99.8% of guarantee against 80% for irrigation users); therefore the higher price gives industry and urban users a higher value of water services (higher reliability). This service has not been included expressly in this analysis.

Water irrigation distribution

- Farmers usually through their WUA receive a subsidy for 'modernization of water networks' and the 'water savings' are kept by the State for environmental use, this implies that farmers to renounce to a volume around 25% of the water rights. Therefore the subsidy justifies the part of cost not recovered.

Rest of use/service are simpler to interpret ate. We should mention that WFD states (Art 5) that only the services of urban, industry and irrigation should be subject to cost recovery analysis and the discussion in the WFD definition levees out of this requirement the navigation and energy sectors that are responsible in Europe of the main impact on water masses (hydromorfological alterations) and the highest percentage of water use (energy accounts for 44% of withdrawals), European Commission (2012).

7 Discussion and concluding comments

As mentioned above previous published cost recovery rates give different figures. Guadalquivir figures give a cost recovery estimation of 99.83% for the supply and sanitation of urban water (MIMAM, 2007, page 201) and 97.70% for irrigation services (MIMAM, 2007, page 189). Krinner (2014) based on an alternative methodology gives 72% the overall global figure for the total national and all the sectors and levels of supply. Finally the EEA (2013) give a misleading figure for Guadalquivir 49.78% quoting CHG sources, but no report from CHG has never give this value.

From a global view, the EEA (2013) report gives values for cost recovery ranging from 20% (lowest in southern Italy) to 80% (highest in northern Italy), with an average of about 50% close to France average (55%) but below the amazing Dutch value of 99%. The problem with EEA report is that each country uses their own methodology, some include groundwater self supply cost, other exclude self supply services, the rate of depreciation of assets is not defined, neither the boundary of the analysis.

The range of estimations is too wide from a low 50% according EEA (2013) for most of the Southern Europe members, to a high index of 97% (Environmental Ministry, 2007). Probably real cost recovery is between both extreme values, in our opinion most robust estimation for Spanish case are:

- Guadalquivir Hydrological Plan estimates a global ratio of 86% for 2015 (CHG, 2013).
- Krinner (2014), based on financial and budget information gives a value of 72% as the average for 2005–2011.

Nevertheless, comparison between different results is not very informative when boundaries for the analysis: a) including self supply; b) including agriculture drainage services; c) rate of assets depreciation; d) rate of interest; e) definition of environmental services; f) definition of public services and other relevant definitions are not shared between members.

Our proposal to use SEEA-W to standardize computation is a step forward that may gives comparable figures that can be called 'cost recovery rates' itself or simply 'cost recovery indicators', but in any case will be an improvement against present chaotic situation in this field.

Some issues need to be defined yet, specially the government expenses in public services (protection of environment, good and human lives). Northern countries usually focus public protection in flood control meanwhile Southern countries need both to protect people and environment against excessive water (flood) and cyclical drought periods, the question maybe: "What is the boundary between water service and public service?, it is not a clear cut question as some issues maybe in the fuzzy border. Another relevant point to discuss is the introduction of environmental and resource cost into the analysis that cannot be done in the present form of SEEA-W but that maybe undertaken as soon as there is a general consensus on the measurement of environmental and resource cost.

To conclude, we believe that our proposal to use SEEA-W as the basis for cost recovery estimation should be explored by other Member States in European Union and other policy makers to evaluate the level of recovery of public investment and expenses in water services provision. The advantage of this methodology is: a) it is based in an international standard methodology, b) definitions have been articulated by consensus, c) it uses official information that is public and updated periodically, d) transparent, e) cost-efficient. All this features allow territorial (inter countries/basins) and temporal evolution analysis.

Besides cost recovery treated in this paper and Water Accounts also gives relevant information for the knowledge of economic and hybrid variables that allow a good characterization of water use. An example is the evaluation of water productivity information that has been addressed by Borrego et al (2015).

Finally, according WFD implementation normative, economic characterization of water use is a critical task in the development of Program of Measures according WFD implementation. The application of SEEA-W for a common methodology applied by all Member States in order to improve and standardize 'reporting procedures' for WFD allowing a better knowledge transfer and results comparability is a possibility that presents SEEA-W. Nevertheless this issue is out of the scope of this paper and should be addressed as an urgent topic by the economic and water management community.

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