Long term cross-border water supply planning and regional drinking water supply economics model

(Report on the finances and economics of the water supply systems in cross-border framework with applicable model – regional drinking water supply economics model)

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DRINK ADRIA

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Introduction

The drinking water supply represents a basic (essential) service for public (communities) which is a part of the so called “services of general interest” and is of key importance for general welfare, public health and common security of populations, economic activities and the protection of environment (Alegre, 2006, p. 3). Providing high-quality potable water ranks among few services that are critical for the well-being of a society (Raftelis, 2014, p. 3).

Commonly used term “water sector” stands for the management of basic resource (storage, transportation, catchment and environmental protection, and infrastructure entailed by this) as well as for the services connected with providing water to consumers and removing wastewater (OECD, 2009a, p. 16). This report focuses exclusively on the part of water sector related to drinking water supply, more precisely on the subject of water supply price in cross-border framework.

The formation of the price for drinking water supply service in the national framework represents a certain challenge (due to legislation, regulation, methodology for tariff setting, etc.). This challenge becomes even greater in the case of cross-border water supply since the price definition in this case is a part of the process of bulk water supply negotiation (between parties from two or more national states) in which beside the “wholesale rate” also different possible scenarios have to be considered in order to assure a sustainable cross-border water supply.

Thus, in order to set the starting point and to provide an overview of the price formation in Adriatic region, an analysis of the prices for water supply in the examples of national and existing cross-border situation, was made. For this purpose, a questionnaire “Water supply system economics (Service charging approach)” was prepared and sent to project partners. The latter presented an attempt to gain an insight into the situation regarding the structure of the water supply price and charging approach in the national (or regional) framework and the price with charging approach in existing cases of cross-border water supply.

The report includes the short presentation of the relevant concepts connected with drinking water supply, the analysis of data collected with the questionnaires and provided by the project partners and a presentation of the case of water supply system

(WSS) with cross-border water supply (CBWS) service together with possible approach to create a basis for definition of wholesale water rate.

1 Drinking water supply – sector description

For environmental goods like clean air, rivers, lakes or forests it is common that it is extremely difficult to define their nominal value. It is possible to measure their surface or volume of environmental goods but they cannot be treated as independent subjects since the lake does not represent only water but also an ecosystem that includes water and numerous living and non-living things. This measuring deficiency prevents the formation of market demand and supply curves. The goods which are associated with the mentioned problem are usually marked as unpriced goods or non-marketable goods and indicate a problem of market failure which represents the inability of market mechanism to perform its function (Thampapillai & Sinden, 2013, p. 25).

1.1 Drinking water supply as a good

Generally, there are four types of goods: private goods, public goods, common resources and club goods which are classified based on two characteristics. First is excludability (can people be prevented from using it) and second – rivalry in consumption (can the use of good by one person reduce the ability of other person to use it) (Mankiw, 2011, p. 218).

Most of the environmental goods cannot be entirely classified as purely public or private goods but as quasi-public or mixed goods (Thampapillai & Sinden, 2013, p. 30). As pointed out in the literature, environmental goods are difficult to evaluate and price due to their public character and externalities, which result from their use. These externalities can be defined as costs or benefits, which are not borne solely by an individual recipient or consumer but by society as a whole (Hebly, 2008, p. 77).

Drinking water supply service is generally viewed as a public good which everybody is entitled to. The reality is that in urban environment, where water is supplied to consumers in unchanged quantities through the pipes, it acquires a character of a private good. The reason for this is the possible exclusion of certain users (those who do not pay for the service) and charging according to different levels of consumption (Aurecon, 2014).

According to economic theory, all urban services could be regarded as private goods but are generally designated as public goods. Urban services have public character when they represent collective services, for example water supply in the form of public standpipe, sanitation in form of public toilets, roads, public lightning, etc.). Those urban services that are aimed at improving and protecting health conditions for a community as well as for individual (water supply, wastewater treatment, waste management, etc.) are regarded as meritory or meritorious goods[1] and are within the scope of government (state) responsibility. Although these services in some part have a public character it is not necessary that they are also performed by a public institution (Winchester, 2005, p. 21).

Even if in most of the cases the drinking water supply is performed by public company or a private company supervised (regulated) by government, water supply represents a quasi-public or club good that is based on the existence of externalities in the form of public health (Agthe, Billings & Buras, 2003, p. 25). The main issue in evaluating water arises from the understanding of what is actually being evaluated. For example, the managers of water utilities can be convinced they are providing services connected with water supply (water treatment, distribution of clean drinking water) while users (consumers) can believe they are paying for the water as a substance (Policy Research Initiative, 2005, p. 4).

The view on drinking water as a meritory good (that everybody should have access to, regardless of the ability to pay the market price) originates from the discussions on water as a human right. From the view of drinking water supply in urban environment it is important for the society to ensure a fair access to drinking water for all income groups. Since the water resources are in most of the cases in public ownership, the charging for drinking water supply service usually accompanies a general impression that the good which was initially public, transforms into private good (Aurecon, 2014).

[1] The term »meriotry« or »meritorious goods« describes private goods that are institutionally transformed into public goods for normative reasons. According to InvestWords (2015): "Goods and services that are perceived to be worth more than their value according to the market".

1.2 Drinking water supply – market structure

The provision of drinking water is characterized by the use of high value assets which indicates that water supply sector is a capital intensive sector. The attribute of the infrastructure is its low mobility since they are constructed for a specific purpose. Additionally, the market of drinking water supply services is characterized by low price elasticity since these services represent basic structural services (Alegre, 2006, p. 3).

The water supply service sector is also characterized by limited competition between the suppliers, entry barriers are very high since the construction of water supply network represents high fixed costs and thus normally one operator supplies one geographic area what enables this operator a dominant position or monopoly. In the case of drinking water supply the market structure represents a natural monopoly in which one company supplies entire market with the good (service) and the economies of scale are present due to larger volume of production (Alegre, 2006, p. 3).

1.3 The price and costs of drinking water

The pricing of water according to Savenije & Van der Zaag (2002, p. 100) represents an important mechanism for breaking the vicious circle of “free water dilemma”. As the authors state, to answer the question how high a price for water should be it is important to consider both the costs and the value of water. If the water supply service is free than the provider of the supply does not receive adequate payment for the provided services and consequently is not able to properly maintain the water supply system (henceforth WSS) and thus the quality of the service decreases. In extreme situation the entire system can collapse and people are than forced to drink unsafe water or to buy drinking water at extremely high prices from private vendors (Savenije & Van der Zaag, 2002, p. 100).

1.3.1 The costs and value of water

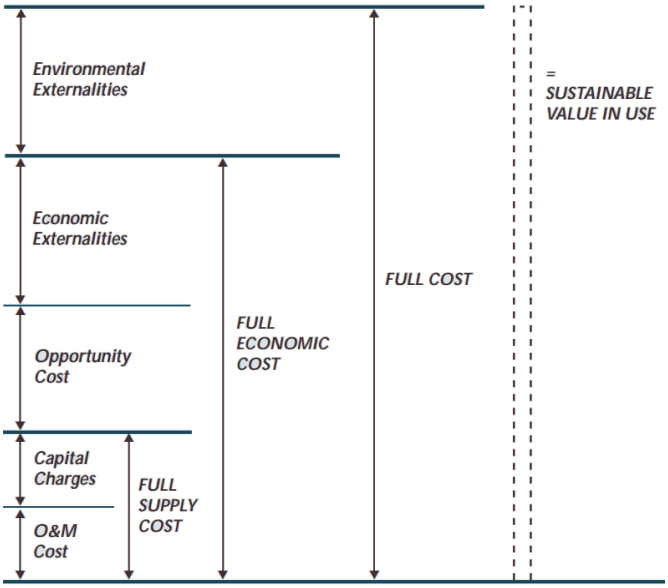
Therefore, the formation of adequate price for water is crucial for the sustainable water supply. As already mentioned, this can be achieved by recognizing the costs and value of water. *Figure 1* shows the principle (schematic composition) for costs of water according to Rogers, Bhatia & Huber (1998, p. 7). The composition shows three important concepts:

1. **Full Supply costs** – include the costs related to water supply to users (consumers) without considering externalities or alternative use of water. They are composed from:
    - *Operation and maintenance cost* - they relate to everyday functioning of the water supply system and include purchased raw water, electricity for pumping, labour, materials for repair and input costs for managing and operating storage, distribution and treatment plants.
    - *Amortization/depreciation* - they should include capital consumption and interest costs of reservoirs, conveyance and distribution systems.

2. **Full Economic Costs** – beside full supply costs they include also:
    - *Opportunity cost* - refer to costs of alternative use of the same water source. They equal zero in the case when there is no alternative present - there is no water shortage. Neglecting these costs decreases the value of water and can lead to investment failure and inappropriate allocation of sources between users.
    - *Economic Externalities* - external benefits or damages that others are exposed to due to water consumption by certain subject. These include externalities connected with the excessive use or pollution of common sources like lakes or underground water sources or production externalities as agricultural production in irrigated areas causing damage to markets for upland non-irrigated agriculture. The externalities can be positive or negative, thus the situation has to be characterized in a given context and estimate these externalities and consider these impacts in the full cost.

3. **Full cost** – represent the sum of full economic costs and environmental externalities. The latter are associated with public health and maintenance of the ecosystem and are usually more difficult to evaluate than economic externalities.

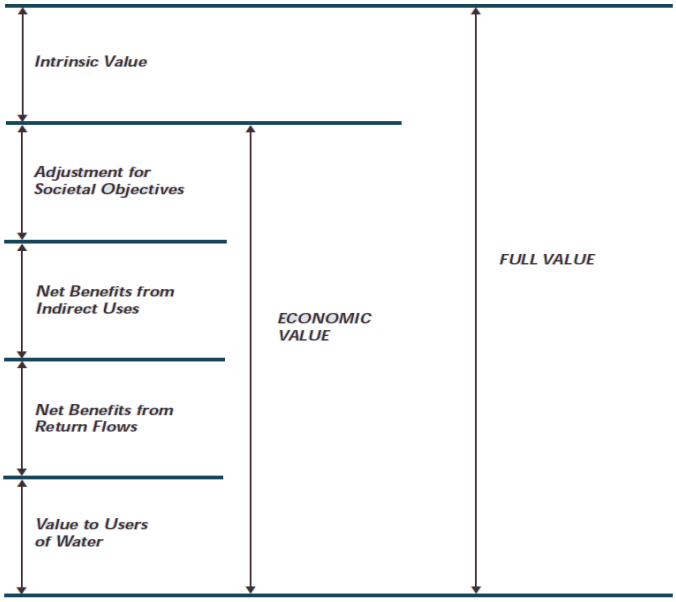
Figure 1: Schematic composition of the costs of water (Rogers, Bhatia & Huber, 1998)



Kanakoudis et al (2011) set the basic methodological approaches for reliable calculation of the full water cost (FWC), the concept that is very similar to full cost described above. The basic cost components, direct – DC, environmental – EC, and resource – RC, are similar to approach used by Rogers, Bhatia and Huber (1998) in terms of disentangling basic cost groups. As these groups are dynamic by nature and vary with time season, geographic regions and population density among others, the full water costs represent a very complicated task. In order to assess the actual level of costs we need to estimate also the water losses and non-revenue water (NRW). As being pointed by Kanakoudis et al (2011) and Kanakoudis et al (2012) the water losses occurring in the pipe network, along with those occurring at private properties, should be handled the same way as they both represent false water use. In order for this NRW to be minimized these costs should be proportionally charged to the users responsible for these water losses. Although this approach is sound at the national level it is hardly implemented in the case of cross border supply.

Similarly, as for the costs of water, Rogers, Bhatia & Huber (1998, p. 13) present a schematic composition for the **Full value of water**, which should equal full costs of water (Figure 2).

Figure 2: Schematic composition of the value of water (Rogers, Bhatia & Huber, 1998)



Following Rogers, Bhatia & Huber (1998, p. 13) the full value of water consists from economic and intrinsic value. The value of water depends upon the user and upon the use which it is put. The full value of water includes two components:

1. **Economic value**:
    - *Value to users of water* - for industrial and agricultural use the value of water to users equals at least the marginal value of the product while for domestic use the willingness to pay for water represents its lower bound of its value,
    - *Net benefits from return flows* - return flows from urban, industrial and agricultural use form an important element of hydrological systems and thus their effects should be included in the evaluation of costs and value of water,
    - *Net benefits from indirect uses* - e.g. irrigation schemes providing water for domestic use - drinking and hygiene and livestock purposes, can result in improved health and higher income for poor rural population,
    - *Adjustment for societal objectives* - for the use of water in household and agricultural sectors, the adjustment can exist for societal objectives, e.g. poverty alleviation, employment and food security.

2. **Intrinsic value** – relates to the concerns like stewardship, bequest values and pure existence values that are difficult to measure but represent valid concepts and reflect real value associated with water use.

To achieve the economic equilibrium, the value of water in use should equal the full cost of water – at this point, the social welfare is maximised. However, in practice, the value of water in use is expected to be higher than the estimated full cost, often due to difficulties in estimating environmental externalities in calculation of full cost (Rogers, Bhatia & Huber,1998, p. 10).

1.3.2 Cost recovery and water pricing

As OECD (2009a, p. 10) states, drinking water supply represents a major business which requires a stable financial basis since the amounts associated with operation and maintenance of water supply infrastructure (including expansion and upgrading) are extremely high.

The price of drinking water supply service should be (after simple definition) formed in such way that would cover all the costs connected with the system, programme or service and ensures long-term sustainability. Traditional cost recovery approach considers only financial costs of project or programme, such as costs of operation and maintaining, capital costs and possible investment for future growth (that include depreciation of assets). It depends on national policy which defines (prescribes) whether only a part or all of these costs should be recovered from users (consumers) which means that the design of the tariff and billing represent a crucial element in the recovery of financial costs (Cardone & Fonseca, 2003, p. 15).

According to European Environmental Agency (2013, p. 8), cost recovery refers to the amount of money being paid for the drinking water supply service. The principle relates not only to the financial costs of the water supply service but also to costs of negative environmental effects as well as abandoned opportunities of alternative water uses (resource cost). As the European Environmental Agency further states, the calculation of the price that reflects the true value of water and thus contribution to long-term sustainability of water resources does not represent a simple task. The European Union Water Framework Directive, more precisely its Article 9 introduces the principle of cost recovery for water services in accordance with the »polluter pays principle«. Article 9 thus promotes the internalisation of environmental and resource costs resulting from existing uses of water resources and aquatic ecosystems (European Environmental Agency, 2013, p. 7).

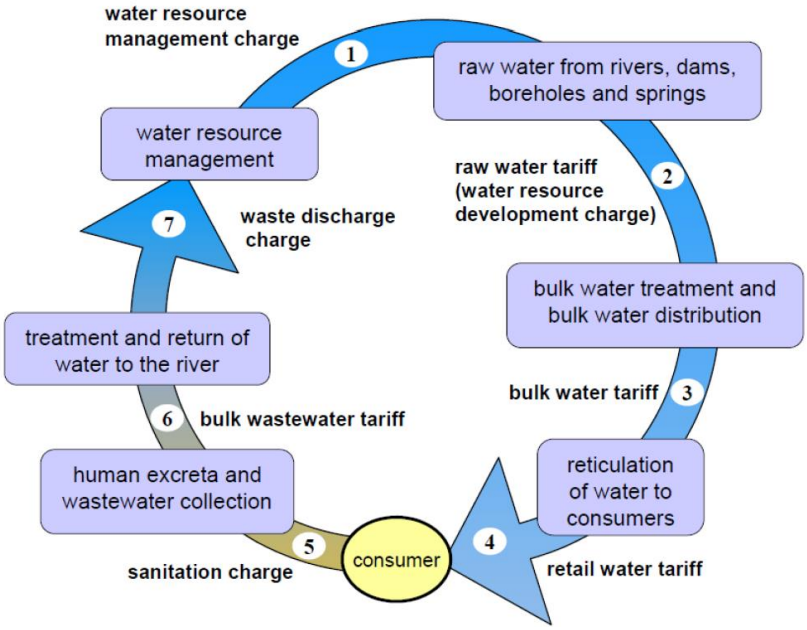
Water pricing refers to the processes that are involved in assigning a price to water, including elements such as utility tariffs (European Environmental Agency, 2013, p. 8).

In the context of this report water pricing refers to the monetisation of abstraction and use of water. Water pricing represents a financial instrument used to cover the costs generated by water supply service and can take different dimension: the actual price (level) tariff structure and accompanying measures (OECD, 2010, p. 18). Pricing is an important economic instrument for improving water use efficiency, enhancing social equity and securing financial sustainability of water utilities (Sustainable Sanitation and water management, 2015).

The important concept of the analysis presented hereinafter, represents the water supply tariff, a commonly used term which represents the price that water utility assigns for the supply of a volume of water (Global Water forum, 2015). Tariff presents the instrument for determining the level of necessary revenue (cost recovery mechanism) that service provider receives from final users. Water tariff can be set at the level of service provider or by local or national authority. Tariff usually has a political connotation since setting of the tariff represents a political process (Cardone & Fonseca, 2003, p. 46).
In the context of water pricing, tariff is presented as a mechanism to mobilize financial resources from users (EUWI, 2012, p. 11). The analysis beside the retail tariffs (tariffs applied by service providers or water utilities for the supplied drinking water to final users) includes bulk water tariffs (applied by service provider or water utility for the supplied drinking water – bulk quantity, to another service provider that distributes the water to final users).

Figure 3 represents the entire water cycle (in this case only water supply is subject of interest) including individual stages of the supply, with bulk water distribution (which is also the case in cross-border drinking water supply), and delivery of water to end consumers retail water tariff.

Figure 3: Water cycle and water pricing (DWAF, 2005 in EUWI, 2012)



2 The analysis of the water supply service in project partners' countries with focus on price structure

Since the cross-border water supply to certain extent reflects some elements of the national (or regional) framework of water supply, the current situation of drinking water supply in each country (region) covered by the project, was analysed from the economic point of view. For this purpose, a questionnaire "Water supply system economics (Service charging approach) was sent to project partners via email (all utility partners and also authority and research partners) and collected in period 6.

The questionnaire had the following structure. The questions (all together 32) were organised in 6 thematic fields: general information (regulatory framework), general information on the price of water supply and charging process, accounting information, investments, subsidies and social correction mechanism. Additionally, the questionnaire contained also a request for some documents regarding the tariff setting methodology, price lists, examples of balance sheets and national statistics.

The information from the questionnaire regarding the prices was used to form a matrix with an overview of the price structures on the examples of selected water utilities (the information for utility project partners was included if it was available otherwise

information for other utilities were used). Some information regarding the prices of cross-border water supply service, were additionally collected from partners.

2.1 Analysis of the questionnaire

The analysis was made in order to compare different aspects of the water supply system directly or indirectly associated with the price of the water supply. The questionnaire was intentionally set as relatively open and descriptive due to the complexity of the water pricing issue.

Its aim was to compare the regulatory frameworks and structures of water prices and to create an overview of the current situation and practices in order to find common dimensions. On the basis of each thematic set of questions a brief summary was made, with interesting facts exposed.

2.1.1 General information about regulatory framework

The first set of questions referred to the general information on water supply system regarding regulatory framework, institutions participating in the process of water provision and their roles (*Table 1*).

Table 1: General information on water supply system – regulatory framework (institutions and their roles)

	Country	Italy	Slovenia	Croatia	Bosnia and Herzegovina	Serbia	Montenegro	Albania	Greece
1_1	**Participants in the process of water supply**	State	State (competent agencies and ministries)	State: Ministry of Agriculture - Water management department and the Croatian waters	Local community or municipality	Municipalities (or cities)	State	State: Ministry of Transport and Infrastructure: • General Directorate of Water Supply and Sewerage • General Directorate of Policies	National Water Commission
		National Regulatory Authority	Municipality	Local governments (cities and municipalities	Water utility	Public water utility companies (PUC) are established by municipalities	Municipality	Water Regulatory Authority	National Registry of Water Abstraction Points (EMSY)
		Regional Administrations	Public water utility company (public service contractor - public or private)	Exceptionally counties			Public water utility	Institute of Public Health/Ministry of Health	National Water Council
		Local Regulators						Ministry of Environment/Water Administration Unit	Ministry of Reconstruction of Production, Environment & Energy
		Entrusted Water Utilities						Local Government Units (Municipality/Commune)	Decentralized Administration and Regional Authorities
								Water Supply and Sewerage Utilities	Municipal Enterprises for Water Supply and Sewerage (DEYA)
1_2	**Owner of the water supply infrastructure**	Water Utility	Municipality which charges the public service company the rent for infrastructure	In most of the cases property of the public companies.	Municipality	Municipality	State	Local Government Unit (Municipality/Commune).	Municipal Enterprises for Water Supply and Sewerage. In some cases, they are also the owners of the water supply infrastructure
		Municipality		No private ownership			Municipality		

(table continues)

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	Country	Italy	Slovenia	Croatia	Bosnia and Herzegovina	Serbia	Montenegro	Albania	Greece
1_3	**Management of the water supply**	Private company chosen through a public competitive tender	Public service company (public or private)	Local government	Public water utility	Management through PPP (with up to 49% private sector ownership) is legally possible but in practice does not exist	Public Water Utility company	Joint Stock Companies/Corporate Structure under the Shareholder Assembly	The Municipal Enterprises for Water Supply and Sewerage
		Public company	Municipality manages it “in-house”	Exceptionally county					Except in the cases of Athens Water Supply and Sewerage Company (EYDAP S.A.) and Thessaloniki Water Supply and Sewerage Company (EYATH S.A.)
1_4	**Regulatory institution**	National Regulatory Authority (Autorità per l’Energia Elettrica, il GAS ed il Sistema Idrico – AEEGSI	The state is the owner of the water source and its agency issues the water permit to municipalities which are the holders of water right.	Croatian waters	Municipality. Municipality approves water supply price proposed by the utility	Ministry responsible for self-government and utilities	No established regulatory organ for price control, service standards, service performance – efficiency, etc.	Water Regulatory Authority (WRA) - independent natural monopoly regulator that reports, by law, directly to the Parliament of the Republic of Albania	The Special Secretariat for Water
		Local Regulator Entities (Enti di Governo dell’Ambito, EGATO)	Water utility company has to report the performance of its services to the Ministry of the environment and spatial planning	Ministry of the Agriculture					The municipal water utilities and the municipalities are the responsible institutions for the determination of the pricing policies in each territory

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	Country	Italy	Slovenia	Croatia	Bosnia and Herzegovina	Serbia	Montenegro	Albania	Greece
1_5	**Price setting/confirming authority**	National Regulatory Authority (AEEGSI	The state forms the methodology for definition of water service price	Public Water Utility company with the prior approval of the Local government units	No general methodology for determining the price of water supply on defined national or any lower level. This process is currently ongoing	Each year Municipalities define price of water. Generally, water prices are not sufficient to cover all costs (sometimes not even regular maintenance	Competent companies propose prices which have to be approved by local authorities.	a) Proposal by water utilities supported by opinion of Local Government Units b) Cost analysis (deduction of unacceptable cost) c) Performance analysis (performance adjustments) d) Setting of tariff level (average tariff) e) Setting of tariff structure (tariff categories)	Each water utility is responsible for the determination of the pricing mechanisms in its territorial coverage
		Local Regulators	The municipality confirms the price of water supply service (proposed by water utility) calculated according to prescribed methodology			In the moment, there is no uniform methodology on tariff setting	Each municipality defines its methodology of determining the price.		The water utilities in Greece that are responsible for the development of domestic water pricing policies, are municipal enterprises (called DEYA)

Regarding the regulatory framework, in most cases the participants in the process of water supply are states (through ministries, agencies or commissions), municipalities (local governments) and water utilities. In some cases, there are also regulatory authorities present (e.g. in Italy there is a National Regulatory Authority AEEGSI - Autorità per l'energia elettrica il gas e il sistema idrico and Local Regulator Entities - Enti di Governo dell'Ambito - EGATO, in Albania – Water regulatory authority).

In most cases the owners of the water supply infrastructure are municipalities. The management of the water supply is in all cases performed by water utility companies (privately or publicly owned). In Croatia, no private ownership is allowed in the case of drinking water supply.

There are certain differences regarding the price setting authorities. In Italy for example, the price setting/confirming authority is defined on national level – AEEGSI and on local level, by local regulators that apply the methods introduced by the National authority. In other cases, public utility companies present the proposal for the price of water to municipalities which than have to approve them.

2.1.2 General information about water supply price formation and charging process

The second set of questions (*Table 2*) was intended to gather information regarding the tariffs and their structures (e.g. uniform volumetric tariff – which represents a structure of the tariff by which the entire quantity of water consumption is charged with the same price for cubic meter or increasing block tariff – tariff with different unit prices for different levels of water consumption – unit fixed for a specified quantity of water). The flat rate tariff which is usually applied in the cases where water metering is not present, was not considered in this case.

This set of questions also intended to gather information about actual prices and the charging approach. The questions tried to comprise the information regarding the price (and their components) that final consumers (users) pay for the drinking water supply service as well as price with the possible negotiation process for larger consumers (e.g. industry) for bulk water supply. Hereinafter, the descriptive part of the analysis is presented while the actual data regarding the prices of water supply is presented after the analysis of the questionnaire.

Table 2: General information about water supply price formation and charging process

	Country	Italy	Slovenia	Croatia	Bosnia and Herzegovina	Serbia	Montenegro	Albania	Greece
2_1	The structure of water rate	Fixed fee	Uniform volume rate	Fixed part	Variable part - volume rate	Flat rate for consumers (households, public institutions, commercial) without water metering	Flat rate - where there is no measurement (6 m3/family member)	Flat rate per habitat (in case of no measurement)	Increasing block rates (most DEYAs)
		Variable fee (€/m3) - Increasing block rates	Fixed part (€/month)	Variable part	Neum: Variable part - increasing block rate	Uniform volume rate for consumers with water metering.	Fixed part - calculated for all users and it is 2m3.	Uniform volume rate	Uniform volume rate
			Variable part (€/m3)				Variable part	Increasing block rate	Including also a fixed charge (calculated either in Euros or in m3), either in the form of a minimum consumption, or as an additional charge.
2_2	The price of water supply service in the region (VAT excluded)	Data analysed in section 3.							
2_3	Water resources charge	Regional tax for water abstraction	Water abstraction charge – set by the governme nt	Yes. Through Water usage fee to the Croatian waters	Water extraction fee	Yes. For PUC, industry and agriculture purposes	Fee for water use (for abstracted water)	The Water Extraction fee is set at 0.008 ALL per cubic meter of water extracted - The majority of water utilities neither report nor pay the water extraction fee to their regional basin agencies.	The present pricing policies in Greece do not cover the WFD requirements, concerning the full water cost recovery and therefore the resource cost.

(table continues)

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	Country	Italy	Slovenia	Croatia	Bosnia and Herzegovina	Serbia	Montenegro	Albania	Greece
2_4	Individual components of the price of water supply service							Fixed fee tariff - based on maintenance and materials costs, number of customers and monthly fixed fee per customer	
								Consumption based tariff based on operating costs (total costs – maintenance and material costs); number of customers and level of volume sold for each category	
2_5	The price of water supply service differentiation. Possible price negotiation process for the industry and similar water consumers – bulk water supply.	Tariffs are different, depending on the type of final user	The volumetric part of the tariff is according to the Decree of tarife system the same for all type of users (households, industry, etc.)	Depending on the type of final user.	Not the same for all types of users	Different, households the lowest, industry the highest.	Different for households and legal entities.	Different price for customer categories	Not the same for all types of users.

(table continues)

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	Country	Italy	Slovenia	Croatia	Bosnia and Herzegovina	Serbia	Montenegro	Albania	Greece
						In some cases, institutions (usually hospitals) do not pay for drinking water or the price is lower.			Negotiation processes for the industry and similar water consumers exist depending on the water utility. Each water utility determines its pricing policy to industrial or other consumers
2_6	Frequency of price consideration/change	Every year - depending on the costs reported by utilities	Once a year	Not regulated by the law. Depending on the annual Business plan	Price change is applied annually	There are no strict legal requirements for regular price change, usually price adjustment is done at the beginning of calendar (fiscal) year.	There is no legally defined price change. The price change is applied in accordance with the increase in the cost of production and distribution of water.	a) The tariff setting procedure starts with the proposal of the licensee, followed by the opinion of the local government units, and ends with the final tariff approval by the Regulatory Authority. b) No tariff, or part of it, is subject to change more than once per year	According to the law, the pricing policies are determined and established under the issue of a Joint Ministerial Decision every five years
						In practice price change is done once every couple of years.			
2_7	VAT applied to water supply service	10%	9,5%	13%	17%	10%	7%	20%	Varies between the water utilities (6%, 13%, 19%).Depends on the region a water utility belongs to, or whether it is located in an island or mainland.

(table continues)

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	Country	Italy	Slovenia	Croatia	Bosnia and Herzegovina	Serbia	Montenegro	Albania	Greece
2_8	Billing period	Cannot be longer than 6 months	Usually once a month. In case of smaller consumers even every two or three months.	Calculation of consumption monthly. Invoice issued every month, bimonthly, twice a year	Monthly	Monthly, every 3 months	Monthly	Monthly	Differs between the water utilities (2, 3, 4, 6, 12) months period
		Macerata: bimonthly or quarterly							
2_9	Water meter reading period	At least every 6 months	At least every 6 months	Usually once a month	Monthly	Monthly, ones in three months, twice a year.	Monthly	Monthly	Usually 2-6 months in small water utilities per year
		Macerata: 6 months	Customers can report their monthly consumption to water utilities						
		Optionally - customers themselves							
2_10	Price correction mechanism in case of limited water supply service	Yes.	No.	No.	No.	No.	No.	No.	No.

(table continues)

(continued)

	Country	Italy	Slovenia	Croatia	Bosnia and Herzegovina	Serbia	Montenegro	Albania	Greece
2_11	Benchmarking scheme applied for water service for comparison of service performance	AEEGSI defined annually "optimal unitary prices" (€/mc) for electricity and for the local regulator	There is no benchmarking sheme for the case of FB4. The water supply systems are very difficult to compare and consequently even costs. The differences are too big.	Not yet applied. The value of performance indicators as a tool for the improvement is recognized	No standardized benchmarking scheme on national level applied in BiH	Few Benchmarking schemes in initial stages of implementation, for example Benchmarking programme within Danube Water Programme of European Benchmarking Cooperation, coordinated in Serbia by IPN - Inter-institutional professional network in water sector of Serbia, url: http://www.ipm.org.rs/home/index.php?lang=en	There is none.	Republic of Albania has been managing a Performance Monitoring and Benchmarking Program for its water supply and sewerage sector since 2005, and has completed eight annual data cycles as of 31 December 2013. The Program includes all fifty-seven (58), corporatized water supply and sewerage utilities across the country	There is not a benchmarking scheme applied for water supply service in Greece
2_12	Water price (charge) - exclusively the price for provided water service	Exclusively the cost of provided water service. Environmental costs are included			Yes, water price represents exclusively the price of the provided water	Generally, just for the provided water service (provided volume of water in m3)	Water charge is the price for provided water supply service.	Only the cost for providing of the water services	Exclusively the price of the provided water service and it is not used for the financing of other public services.

The second set of questions, which was also the most extensive one, directly referred to the prices of the drinking water supply (without sewerage and wastewater treatment) and the charging approach. It included questions regarding the tariff structure, price of water supply, other charges and components of the price of drinking water supply. Regarding the structure of the tariff, partners reported several different approaches. In the case where water consumption is not measured, a flat rate tariff is applied. In the cases where water metering is present, the uniform volumetric tariff or increasing block tariff (e.g. Utility Neum and in the case of APM Spa for “Macerata area”) is applied. For Greece it was reported that most of the DEYAs (municipal enterprises) apply increasing block rates. This type of structure was also reported to be present to some extent in Albania.

It was reported that prices differ between the types (groups) of users (e.g. households, industry, institutions, etc.). The differences in prices of water supply were common for variable as well as for the fixed part (component) of the price. For example, in Italy (Municipality of Macerata) both variable and fixed part of price vary for different types of use (e.g. domestic, public, condominium use, etc.). Variable part of the price is also defined for different levels of consumption expressed in cubic meters. In Croatia for example, the variable price is defined for households, socially vulnerable households, industry and institutions. Similarly, the variable prices differ in other observed cases. Except in Slovenia, the variable (volumetric) part of the price is the same for all types of consumers, but the fixed part differs depending on the size (DN - Diamètre Nominal in mm) of water meter. For example, the households are usually classified within the first group (DN ≤ 20).

The price of the water supply is in all cases usually changed once a year. Among all partners, only Italian partners reported the existence of price correction mechanism for the case of limited water supply service. This means that utilities guarantee service standards set by law. In case provider fails to reach the standard, the customers (users) are entitled to compensation.

2.1.3 General information regarding the accounting practices

The third set of questions focused on general information about the accounting practices. The questions were related to the practices of water utilities, such as separate accounting for different public services, possible transfers between utility and the owner of water supply system and standardization of costs per unit (Table 3).

Table 3: General information regarding the accounting practices

	Country	Italy	Slovenia	Croatia	Bosnia and Herzegovina	Serbia	Montenegro	Albania	Greece
3_1	Is separate accounting provided in case of "multiutilities". Distribution of overhead costs.	Separate for each public service. No standardized methodology to allocate and input overhead costs. Usually allocated based on staff working hours, etc. to match the revenue for each service	In case a public utility provides several public services it has to provide a separate accounting information on each public service (e.g. for water supply, sewage and wastewater treatment, waste management, cemetery service, etc.)	The public "multiutilities" have to provide a separate accounting for every public service	Separate accounting for individual public services is not obligatory, but it exists in practice. PUC Neum: separate accounting is applied. Overheads are divided in equal parts for both of the services.	On those WSS who are »multiutilities« (generally smaller WSS) one INVOICE is issued.It contains separate amounts for water supplying, waste water, and other public services.	There are separate companies for each public service	No. WSS utilities don't have to provide separate accounting for different services	Further analysis is required.
3_2	Separate accounting for public water supply and water supply which is not considered a public service (i.e. large industrial. Consumers). Is accounting information public for all type of Public Utility Company (henceforth PUC).	No separate accounting provided for water supply which is not considered a public service. Accounting information is public for all types of water utilities.	Separate accounting is provided for the costs of cross-border supply, but not for other types of supply. The prices are publicly available, except for the export of drinking water.	There is, according to law, no possibility of private ownership of the water supply system or a spring	No separate accounting for public and non-public water supply	National statistic has some data about industrial consumers with their water resources (separate from Public water supply). But these data sometimes are not enough reliable.	The disclosure reports have to be prepared and it is legally defined	No there are not applicable separate accountings. Public is informed only for the public services.	The accounting depends on the policy of each water utility (municipal water utilities, EYDAP, EYATH). The accounting information (balance sheets) is public for all type of water utilities.

(table continues)

(continued)

	Country	Italy	Slovenia	Croatia	Bosnia and Herzegovina	Serbia	Montenegro	Albania	Greece
3_3	Possible transfers between PUC and the owner of water supply infrastructure	In case of public or private companies, part of eventual profits is transferred from Water utility to the owners and part is used for investments.	There is no such case for VIK Nova Gorica. Theoretically, eventual profit should lower the price of the water and vice versa.	Public companies are unprofitable. In the case of profit or losses, company is transferring them on the next accounting year.	BIH: There are transfers between the water utility and the municipality regarding the utility's profits. Neum: There is no data regarding any gained profits in the Utility Neum and no transfers recorded between the Utility and its owner – the Municipality of Neum. The same applies to losses.	Water Utilities in Serbia do not generate profit due to low water prices and other factors. PUC are often subsidized by Municipalities.	Public utilities (water utilities) are non-profit companies in Montenegro.	No. Neither the profits or the losses are transferred	Public water utilities are non-profit organizations in Greece
3_4	Water utilities have to prepare disclosure reports	According to the legislation utilities have to prepare disclosure reports attached to the annual budget	Yes, utilities are obliged by law to prepare the disclosure reports.	According to Regulations all Utilities have to prepare them.	Yes, disclosures are prepared as requested by law.		The disclosure reports have to be prepared and it is legally defined.	Every end of the year WSS utilities are obliged to prepare disclosure reports and deliver it to Local Government	Water utilities in Greece are obliged to prepare and publish disclosure reports every year within three months from the ending of each fiscal year (Greek Law1069/80, Article 6).

(table continues)

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	Country	Italy	Slovenia	Croatia	Bosnia and Herzegovina	Serbia	Montenegro	Albania	Greece
3_5	The range of services for the provision of drinking water standardized. Range of costs defined.	The range of services strictly defined by law and standardized on national level. The range of costs per unit is not defined as it is strictly dependent on specific local features, raw water availability and quality.	.	Based on the Act on Water for Human Consumption (NN 56/13), the Ministry of Health prescribes the Regulation on compliance parameters and methods of analysis of water for human consumption (NN 125/13, 141/13).	There is no standardization of services for the provision of drinking water and the range of costs per unit defined.	Not sure.	Yes.	No the services for the provision of drinking water are not standardized in Albania and also the costs per unit is not defined by a Law or by a Standard	The range of services for the provision of drinking water is standardized according to the provisions of Greek law 1069/80 and is being institutionalized through the drafting of the water utilities internal organizational manual. The range of unit costs is defined by the board of directors of each water utility and the municipal council
				The range of costs per unit is defined according to the Regulation of the lowest basic water services price (NN 82/10, 83/12) that is coming from the Financing Water Management Act					

This set of questions intended to collect basic information regarding the accounting practices of utilities. Different practices were reported regarding the provision of separate accounting in case of “multiutilities”. The latter refer to utilities performing several public services (e.g. water supply, sewerage, wastewater treatment, waste management, etc.). Separate accounting was reported in the case of Italy, Slovenia and Croatia. For Montenegro it was reported that each public service is performed by separate company while in Albania utilities don’t have to provide separate accounting for different public services.

In all cases utilities are obliged (by law) to prepare disclosure reports and information is public for all types of water utilities. Regarding the standardization of the range of services for the provision of drinking water the situation has local specifics. In Italy for example, it was reported that the range of services is strictly defined by law and standardized on national level. For Greece, it was reported that the range of services is standardized according to the Greek law and is institutionalized through the drafting of the water utilities internal organizational manual.

2.1.4 General information regarding investment

The fourth set of questions was associated with general situation regarding the investment (Table 4). The questions included the description of investment process from the point of view of involved institutions, the financial sources for investment and replacement of water supply infrastructure and the approach for determining and charging the depreciation of the infrastructure.

Table 4: General information regarding the investment

Country	**4_1 The investment process, involved institutions and their roles**
Italy	Regional Administration is responsible for long term planning of WSS needs Local regulators' duty is that of programming the investment to be realized by the Utilities, also taking into account their impact on applied water tariffs Utilities are responsible for WSS design, construction, financing (through water tariffs) and operation. EU, State and Regional Administration may support water Utilities by providing grants
Slovenia	1) Investment enlistment, including: DIIP documents for the identification of investment project, PI pre-investment scheme, CBA cost benefit analysis, IP investment program, 2) The assessment of the investment, 3) Allocation of the financial sources, 4) Technical documentation, 5) Public tender, 6) Implementation and acquiring, 7) Activation of the infrastructure According to the Decree of tariff system for public service (Uradni list RS, št. 87/12 in 109/12) that entered into force on 1.1.2013, a fixed part of the water price (tariff) was introduced in order to cover the infrastructure costs of the water supply system
Croatia	PUC investments are coming from investments at the water utility company level (Credits and mortgages), Croatian waters (Water usage fee), European Union funds, Local Governments and National investments
Bosnia and Herzegovina	Programming and planning: Ministry in charge of water management prepares a strategy on water management on national/entity level, which defines general investment process. At the local level, municipalities prepare 5-year local action plans All subject of public procurement. Local budget and state level budget. In case of insufficient funds, the gap is compensated through loans from financial institutions and co-financing scheme with the Environment Protection Fund (national level).
Serbia	Due to very limited funds available, PUCs plan and implement only limited scope of new investments. Usually municipality implements all larger investments (through municipal agencies for land development) or by the State.
Montenegro	If the Investor is local government- municipality, then it is responsible for planning and construction supervision while the water utility designs and executes the works. If the water utility is the Investor, then it is responsible for the entire scope of operations.
Albania	WSS utility budget Financing from donors and IFIs is the main source of capital investment in Albania's water and wastewater sector Local government financing (excluding competitive grants) represents a small portion of investment in water and wastewater systems. These funds typically go to minor works, such as repairs, in the distribution system
Greece	Members of the board of directors and the municipal council of each water utility are responsible of the investment process
	4_2 Financial source for the investments and replacement of WS infrastructure
Italy	Water tariff is the main (and often only) financial source for the investment in new facilities and rehabilitation of existing infrastructure EU, National or Regional financing schemes represent just a small percentage of the total investment amount (more relevant in the South of Italy)
Slovenia	The reconstruction of water supply network is also financed with the assistance of European Investment Bank and European Bank for Reconstruction and Development and other financial institutions offering financial help to EU member states
Croatia	Financial source for the investments and rehabilitation of water supply infrastructure are investments at the water utility company level (Credits and mortgages), Croatian waters (Water usage fee), European Union funds, Local Governments, National investments (National Budget), Development fee, Connection fee.

(table continues)

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Bosnia and Herzegovina	Financial sources include: • Connection charge – paid by the consumers, • Municipal budget, • National budget (also includes co-financing scheme with the Environment Protection Fund), • Financial institutions (European Bank for Reconstruction and Development – henceforth EBRD, World Bank), • Donations (EU-funded projects such as Drink Adria). It is not possible to determine standardized structure (%) of financial sources.
Serbia	PUC ask their Municipality or State. In the last twenty years, they also could find funds under some international programmes (donations or credit).
Montenegro	Connection charge (the competence of the water utility), land charges (the competence of the local authorities) and donations, EBRD, World Bank, etc.
Albania	The financial source of the investments for big utilities - mostly their budget and foreign donators. The only contribution that state gives, is by covering VAT, real estate tax, and all the required cost for providing necessary documents for project implementation permission.
Greece	Public investment program (35% of the costs for studies, construction costs for water supply and sewage works. The water supply and sewage fees are used for personnel costs, operational costs, costs of network maintenance, fixed assets depreciation and loan interests. The special charge (80%) is used for the study, construction, reconstruction of water and sewage works Fixed charges, connection charges, VAT, private investments - public-private partnerships, municipal budget.
	4_3 How the depreciation (amortization) costs of the infrastructure are determined and charged
Italy	Determined and based on Assets value and associated “Useful life” (set by specific financial legislation). Such costs have to be taken into consideration in water tariff calculation process, and represent a relevant part of it.
Slovenia	The infrastructure costs should be covered through the fixed charge. The latter is determined annually based on water meter – the size has prescribed factor for the fix charge. The entire sum of annual infrastructure costs is divided by the sum of factors for the fix charge. The quotient is then multiplied by each factor according to the size of the water meter.
Croatia	Amortization is defined according to the Profit tax act (NN 177/04, 90/05, 57/06, 146/08, 80/10, 22/12, 148/13, 143/14)
Bosnia and Herzegovina	Depreciation method is defined by the national accounting provisions for fixed assets. These provisions classify fixed assets into adequate groups and define depreciation periods for different groups. Water utilities in BiH mostly use linear depreciation method
Serbia	Generally, no amortization costs are defined (recovered) in the water price in the moment. Great majority of WSS were in quite good conditions 30 years ago. When rehabilitation is needed, PUC do that. When some bigger reconstruction is needed, they ask for funds.
Montenegro	The depreciation costs of the infrastructure are determined based on legislation and they are charged through the price of water services.
Albania	According to the Albanian legislation (depreciation of assets can be calculated separately in a straight line or based on a pooling system method. Depreciation rates vary from 5 % to 25% according to different categories of assets.
Greece	Further analysis is required.

Regarding the financial sources for new investments and replacement of the water supply infrastructure some common practices were identified. In Italy the water tariff represents the main (and as reported often only) financial source for the investment in new facilities and replacement of existing infrastructure. Just a small part of the total investment amount represents EU, National or Regional financing schemes (reported as more relevant in the South of Italy).

In Slovenia the new Decree of tariff system for public service that entered into force at the beginning of the year 2013, introduced a fixed part of the price (tariff). The latter is intended to cover the infrastructure costs of the water supply system. The reconstruction of water supply networks in Slovenia is also financed with assistance of European Investment bank, EBRD and other financial institutions that offer financial help to EU member countries.

It was reported that municipal and national budgets still represent important financial sources in almost all cases. Foreign donators were also mentioned as an important source for replacement of infrastructure (Albania). For Greece it was reported that the structure of funding resources depends on the policy of each water utility.

Regarding the depreciation costs of the infrastructure, the following situation was described. In Italy such costs have to be considered in the process of the water tariff calculation and represent a relevant part of the tariff. As mentioned, in Slovenia after new decree on methodology for tariff system, the fixed part was introduced to cover the depreciation costs of the infrastructure.

2.1.5 General information about the subsidies

The fifth set of questions was about the general situation regarding subsidies in the case of drinking water supply service (Table 5). This set included questions connected to the possibility of subsidizing the water supply price, use of subsidies to cover the costs of the water supply service and problem with non-payment.

Table 5: General information on subsidies

	Country	Italy	Slovenia	Croatia	Bosnia and Herzegovina	Serbia	Montenegro	Albania	Greece
5_1	Is there a possibility for the price of water to be subsidized	According to legislation, water rates should cover ALL the costs of service. No subsidies are foreseen	The price can be subsidized by municipality only in the case of households. The level of subsidies is defined by municipality. In case the subsidies are used, they are approved for entire population served by water utility, not just economically deprived.	Ministry of Regional Development and EU Funds implemented measure - Water consumption benefits for the islands: Subsidized price of water, up to 20 m³ per month, or 150 m³ of total annual consumption for those who are not connected to the water supply system. Not a case for Water utility of Istria – FB7	Water price can be subsided and support system exists. Subsidies are provided on local level	Subsidies are defined on local (municipality, city) level, and there are significant variations between municipalities Usually there are subsidies for low income families, for disabled, etc.	The price of water service cannot be subsidized and that is defined on the level of local government.	Water supply and sewerage sector has been one of the sectors mostly subsidized. A part of the direct subsidy provided by state has been allocated to cover the difference between the prices and costs of services being provided.	The price of water service cannot be subsidized
5_2	Are general subsidies commonly used to cover the costs of water supply service	No, the costs of water supply service can't be covered by general subsidies, nowadays	No, the subsidies are not commonly used.	Yes, general subsidies are commonly used to cover the costs of water supply service. In the case of Water utility of Istria – FB7: They are not receiving any subsidies	Depends on the municipality.	Since water prices are not sufficient to cover all costs of the services, municipalities often subsidy PUCs.	No.	Yes, for the small WSS utilities that are not able to cover the Direct Operational Cost, are given subsidies from state mostly as payment of the electricity bill	Not applicable

(table continues)

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	Country	Italy	Slovenia	Croatia	Bosnia and Herzegovina	Serbia	Montenegro	Albania	Greece
5_3	Problem with non-payment of water services. Extent of unpaid services in case of households and industry. Who covers the unpaid services? Recovery of unpaid bills	Water tariffs are quantified in order to cover a foreseen set percentage of unpaid bills (in central Italy that is 3,6 % of the total revenue).	Problem is present. For the households: approx. 3 %, industry: 5 %. In the case of leakage of large quantities after water meter, it is written off on the basis of consumer's request. The customer pays only average amount of consumption until the damage is identified.	In the case of the Water utility of Istria – FB7: Water utility has around 7% (60% - Industry and 40% Household) of unpaid charges	Yes. The extent of unpaid services amounts to 0 – 30% (households + industry). No one covers the unpaid services. The unpaid bills are recovered by filling charges against debtors in court.	Rate of collected water bills is approx. 80-90% (sometimes it can be higher).	The problem with non-payment of water supply services is present. Unpaid services in case of households are 25%, and in the case of industry 10%. Unpaid services are the cost of the water utility.	Yes, non-payment of the water services remains one of the major problems of the water sector in Albania	Usually the Water Utility disconnects the water meter when either the unpaid water consumption exceeds the average annual use, or after one year of the last payment (when either comes first)
		In case of "non-payment" of water service, the Utility could interrupt the water supply to the user, according to predefined contract rules.	It can be partly or entirely covered by social services (center for social services, organizations like Red Cross, etc.).	In a case of non-payment, water supply for that consumer will be shut down and the meter will be removed. Unpaid bills are recovered according to The Distraint act (NN112/12, 25/13, 93/14).		The households are generally no problem - not present too much, this problem is solving from case to case. Industry and public Institutions are somewhere problem. PUC sometimes recovers the funds (with deal with consumer, or municipality covers expenses) recently through court cases.		Law in force establishes a system of penalties and fines for all the consumers that don't pay the water bills. Partially the cost of unpaid service is reflected in the water tariff and automatically paid by other consumers.	

Regarding the subsidies in case of the water supply service, diverse situation could be observed. For the case of Italy, it was reported that according to the legislation, water tariffs should cover all the costs of the service and that no subsidies are foreseen. In Slovenia, the municipality can approve price subsidizing, but only in the case of households. The subsidies are in this case approved for the entire population of users served by utility, not only a group of users (e.g. economically deprived). In Croatia, the subsidy system exists. The government implemented a measure for islands (certain quantity of water per month is subsidized for population not connected to the water supply system).

In Bosnia and Herzegovina, the price can be subsidized and are provided on local level. Similarly, in Serbia, subsidies are defined on local (municipality or city) level and are granted for low income families, disabled, etc. In Montenegro the price of water supply cannot be subsidized what is also defined on the level of local government. In Albania, the water supply sector represents one of the most subsidized sectors. On the other hand, in Greece, the price of water service cannot be subsidized.

As reported, general subsidies are commonly used to cover the costs of water supply service in Croatia, Serbia and Albania.

2.1.6 General information about the social correction mechanism (regarding the price of water supply)

The sixth and the last set of questions focused on the existence of possible mechanism in the case of socially vulnerable consumers (users) not being able to pay for the water supply service. In other words, we tried to identify whether there exists a special price category for the economically deprived population and what are the requirements for such price to be charged (Table 6).

Table 6: General information about social correction mechanism (regarding the price of water supply)

	Country	Italy	Slovenia	Croatia	Bosnia and Herzegovina	Serbia	Montenegro	Albania	Greece
6_1	Problems with price affordability at the household level. Reason for such situation.	Including sewage and waste water treatment, the cost actually represents only 0,9% of the average monthly expenditure of a family in Italy. Water price is one of the lowest in Europe. Tariffs would better be higher, in order to facilitate investments.	In some cases, the price affordability could be questioned at the household level since the prices have increased after the introduction of new tariff system.	Price of the water is affordable at the household level (7% of unpaid charges for Water utility of Istria – FB7).	Yes. The main reason is bad economic situation	Yes. Economic situation in the country, big unemployment, etc.	The price of water supply service in Montenegro is still a social category.	Yes. The main reason for such problems is low incomes for family. Also level of economic assistance and aid from the state is very low	The reason is the economic crisis
6_2	Special price for economically deprived population	No uniform approach on national level. The local regulator can apply a discount for disadvantaged users.	No.	There is a special price of water supply for economically deprived population	No. Economically deprived consumers are assisted through subsidies	Just in some cases, and details are defined at each municipality	No.	Legislation foresees the possibility to apply a special tariff for economically deprived population but currently this practice is not applicable in Albania, due to the absence of a proper and defined scheme of reimburse of the tariff difference from local government units to WSS Utilities	There are also social pricing policies developed. It depends on the policy of each DEYA (Municipal Enterprises for Water Supply and Sewerage).

(table continues)

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	Country	Italy	Slovenia	Croatia	Bosnia and Herzegovina	Serbia	Montenegro	Albania	Greece
6_3	Possibility to request the help from social service to assist in paying the water service	local regulator (A.ATO) might define specific discount or special price for deprived users	A person can request the help from social service office.	Usually Local Government through the Social service office assists in paying of the water service.	Yes. The municipality may require a list of consumers unable to pay water supply service from its social service office. These consumers are classified according to different criteria of economic deprivation (unemployment, low income, health issues, housing issues, etc.) and further subsidized by the municipality	Not in this manner, but social grants payments for those below poverty line. Municipalities have the power to introduce such payments.	Each water utility has the option to give subsidies for socially vulnerable persons. Social services provide an opinion on the social status of these persons, and if there is a social need, the water supply service is reduced by 30%.	This practice is not used in Albania, the Local and Central governments have never subsidies the water bills for the economically deprived population.	It depends on each government's social policy
6_4	Requirements for the customer to be granted the "special tariff".	The user usually has to provide the "ISEE level declaration" which is a report that defines the social-economic situation of the family	There is no special tariff	Centre for Social Care on the basis of public authority has permission for issuance of the documents about the deprived status. On the national level (if Water supply company has agreement with Government) the payment can be written off; Water utility of Istria – FB7 does not have agreement currently.	There are no special tariffs granted to particular customers who meet certain requirements	Social card, which is updated each year.	The customer can be granted a special tariff upon the opinion of the social service office. The application is renewed annually.	The population in need applies in local government levels to gain the economically deprived status and economic assistance. This part of population with a document form Local government can come at the utility and profit a special tariff.Even that special tariff is foreseen in the legislation, no application was made in Albania	

The last set of questions concentrated on the price affordability at the household level and existence of special price for economically deprived population. For Italy it was reported that price of water supply (including with sewage and wastewater treatment) represents only approximately 1 percent of average monthly expenditure of a family and that the price for water supply is one of the lowest in Europe. It was also reported that tariffs should be higher in order to facilitate investments. For the Croatian case (water utility of Istria) the price of water supply was reported as affordable, mentioning only 7 percent of unpaid charges. For Bosnia and Herzegovina, the problems with affordability were reported, mentioning poor economic situation and low incomes per family, similarly in Serbia, Albania and Greece which was severely hit by global financial crisis.

Regarding the special price for economically deprived population, in Italy no uniform approach was reported on national level, but on local level, regulator has the possibility to apply a discount to disadvantaged users. In Slovenia no special price for disadvantaged users is present. On the other hand, in Croatia there is a special price (separate category) for deprived population. In Serbia, such price exists just in some cases, depending on the municipality. As reported, in Montenegro the price of water supply service currently represents a social category. In Albania, legislation foresees the possibility for application of special tariff for economically deprived population. For the Greek case it was reported that social pricing policies are developed but they depend on each local government's social policy.

3 Comparative analysis of the prices in selected cases

This section presents the analysis of prices of drinking water supply (without other related services, for example wastewater treatment etc.) from the cases of partner utilities or other utilities reported by partners. First subsection analyses the prices for end users and the second subsection focuses on prices for bulk water supply (wholesale prices). It has to be mentioned that the aim of the analysis was not to compare the total amounts since utilities have different (unique) operating costs and follow different processes for defining the water supply rates for their users, but to create a simple overview of their price structures.

3.1 Analysis of the water supply price for final users

Within the analysis of the questionnaire, more attention was paid to the actual prices of the drinking water supply (non-cross-border delivery) in the cases of partner water utilities or other cases of utilities that were reported by partners. Some information was also collected directly from the utilities websites or publicly available decrees on price of water service. For the purpose of creating an overview of the current price structures in partner countries, we collected the recent data on prices that final users pay to providers (Table 7) – water utilities for the drinking water supply. The data represents the prices for the drinking water supply service and all charges and fees that are applied according to national regulation.

The price categories in Table 7 represent the elements of the drinking water supply price, charged to final users – and depending on the consumption (measured in m^3) they together form the total billed amount for the service. The data in Table 7 were extracted from the price lists, decrees on the price of water supply and other documents provided by project partners or (if necessary) found on the internet. All categories were converted to Euro currency[2] to enable a comparison and do not include value-added tax.

The categories entered in the spreadsheet show the prices for different types of use (e.g. domestic use – households, industry, socially vulnerable households, etc.), for different levels-ranges of consumption (e.g. price for the consumption up to 80 m^3 and higher subsequent levels) and different time period that charges relate to (e.g. one month – which is most common, three months, one year, etc.). Respecting all differences in the charging approaches or the tariff structures, a considerable complexity of the issue could be observed. Therefore, we applied the comparison of the prices for the same quantity of consumption (10 m^3). The quantity was selected to enable a simple comparison of the price components. Namely, the analysed categories of the price reflect different tariff structures.

[2] Exchange rate on 1.3.2015 (Bank of Slovenia)

Table 7: Prices of the water supply for final users by components in selected cases of water utilities

Country	Italy	Slovenia	Croatia	Bosnia and Herzegovina	Serbia	Montenegro	Albania	Greece
Selected Water utility	**Azienda Pluriservizi Macerata S.p.A.**	**Vodovodi in kanalizacija Nova Gorica**	**Istarski vodovod Buzet**	**J.P.Komunalno Neum**	**JKP Beogradski vodovod i kanalizacija**	**J.P. Vodovod i kanalizacija Nikšić**	**Korça Water Supply and Sewerage Company**	**Municipal Enterprise for Water supply and Sewerage of Corfu**
Selected city/municipality	Municipality of Macerata	Municipality Nova Gorica	Municipality Grožnjan	Municipality Neum	Beograd city	Nikšić	Korçë	Municipal district of Corfu
Variable part - volumetric charge for provided drinking water service in EUR per m3	€/m3	€/m3	€/m3	€/m3	€/m3	€/m3	€/m3	€/m3
Domestic use (residents and non residents) 0-80 per year (0-6,7 m3 per month)	0,6558							
Domestic use (residents and non residents) 81-150 m3 per year (6,8-12,5 m3 per month)	0,9785							
Domestic use (residents and non residents) 151-250 m3 per year (12,6-20,8 m3 per month)	1,5615							
Domestic use (residents and non residents) over 250 m3 per year (over 20,8 m3 per month)	2,0820							
Public use	1,4054							
Condominium use	1,4054							
Agriculture/Zootechnical use	1,4054							
Firefighting use	1,4054							
Households		0,8067	0,5748		0,3878	0,3550	0,4269	
Socially vulnerable households			0,3446					
Industry		0,8067	1,4447	0,9184		1,1880	0,7827	
Institutions		0,8067	1,4447			1,1880	0,9962	
Sport and recreational centres - swimming pools					0,3878			
Other Consumers					0,6418			
Households (<30 m3)				0,5612				
Households (>30 m3)				0,9184				
Consumption 13-25 m3								1,1850
Consumption 26-50 m3								1,3500
Consumption 51-75 m3								1,8000
Consumption 76-100 m3								2,7350
Consumption 101-500 m3								3,3000
Consumption over 501 m3								3,4500

(table continues)

(continued)

Country	Italy	Slovenia	Croatia	Bosnia and Herzegovina	Serbia	Montenegro	Albania	Greece
Selected Water utility	**Azienda Pluriservizi Macerata S.p.A.**	**Vodovodi in kanalizacija Nova Gorica**	**Istarski vodovod Buzet**	**J.P.Komunalno Neum**	**JKP Beogradski vodovod i kanalizacija**	**J.P. Vodovod i kanalizacija Nikšić**	**Korça Water Supply and Sewerage Company**	**Municipal Enterprise for Water supply and Sewerage of Corfu**
Selected city/municipality	Municipality of Macerata	Municipality Nova Gorica	Municipality Grožnjan	Municipality Neum	Beograd city	Nikšić	Korçë	Municipal district of Corfu
Fixed part (EUR per unit)	€/unit	€/unit	€/unit	€/unit	€/unit	€/unit	€/unit	€/unit
Domestic use - Residents (per month)	1,9953							
Domestic use - Non residents (per month)	4,8580							
Public use (per month)	3,0363							
Condominium use (per month)	4,3375							
Agriculture/Zootechnical use (per month)	3,0363							
Firefighting use (per use)	3,0363							
Firefighting use (per nozzle)	1,9085							
Households (per month)			1,1704					
Socially vulnerable households (per month)			0,7022					
Industry (per month)			2,0806					
Institutions (per month)			2,0806					
Consumption 0-12 m3 (per month)								6,0833
DN ≤ 20 (per month)		5,1373						
20 < DN < 40 (per month)		15,4119						
40 ≤ DN < 50 (per month)		51,3730						
50 ≤ DN < 65 (per month)		77,0595						
65 ≤ DN < 80 (per month)								
80 ≤ DN < 100 (per month)		256,8650						
100 ≤ DN < 150 (per month)		513,7300						
150 ≤ DN (per month)		1027,4600						

(table continues)

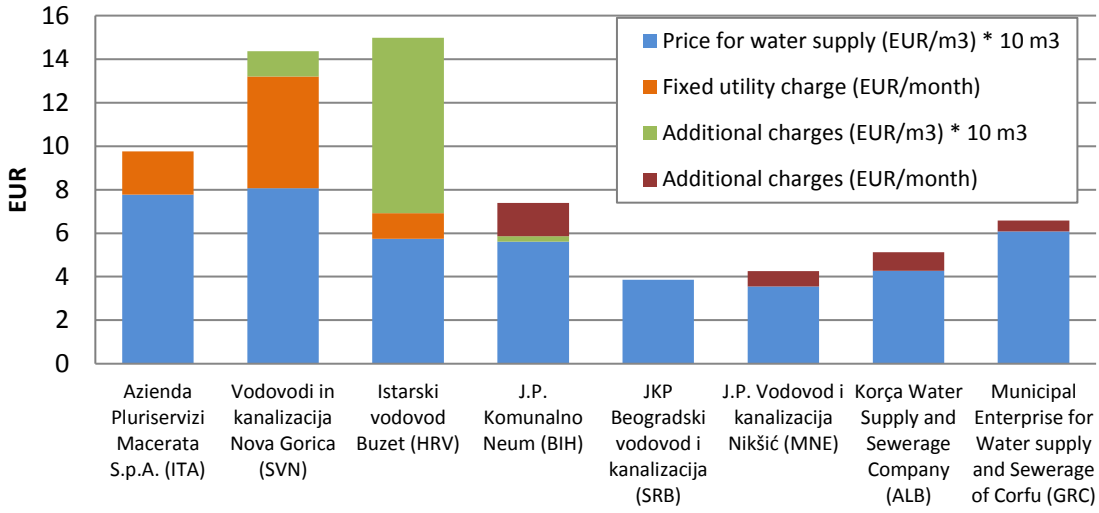
(continued)

Country	Italy	Slovenia	Croatia	Bosnia and Herzegovina	Serbia	Montenegro	Albania	Greece
Selected Water utility	**Azienda Pluriservizi Macerata S.p.A.**	**Vodovodi in kanalizacija Nova Gorica**	**Istarski vodovod Buzet**	**J.P.Komunalno Neum**	**JKP Beogradski vodovod i kanalizacija**	**J.P. Vodovod i kanalizacija Nikšić**	**Korça Water Supply and Sewerage Company**	**Municipal Enterprise for Water supply and Sewerage of Corfu**
Selected city/municipality	Municipality of Macerata	Municipality Nova Gorica	Municipality Grožnjan	Municipality Neum	Beograd city	Nikšić	Korçë	Municipal district of Corfu
Additional charges								
VAT is applied								
Water abstraction (usage) fee (EUR per m3)		0,1160						
VAT not applied								
Water abstraction (usage) fee (EUR per m3)			0,3706	0,0051			0,0000569	
Istrian water protection system development fee (EUR per m3)			0,1300					
Water protection fee (EUR per m3)			0,1756	0,0200				
Water supply development fee (EUR per m3)			0,1300					
Records of water consumers (EUR for 2 m3)						0,7100		
Service fee (EUR per client per month)							0,8538	
Water meter maintenance fee (EUR per unit)				1,5306				
Water meter maintenance fee (EUR per month)								0,5000
Price for 10 m3 of supplied drinking water for household user (in EUR, VAT excluded)	7,77	9,23	5,75	5,61	3,88	3,55	4,27	6,08
TOTAL COSTS for 10 m3 of supplied drinking water for household user PER MONTH (in EUR, VAT excluded)	**9,76**	**14,36**	**14,98**	**7,39**	**3,88**	**4,26**	**5,12**	**6,58**
Value Added Tax Rate	10%	9,50%	13%	17%	10%	7%	20%	
Price reference date	2014	1.03.2015	28.02.2015	31.08.2014	1.12.2014	28.02.2015	1.01.2014	1.01.2013
Currency	EUR	EUR	HRK	BAM	RSD	EUR	ALL	EUR
Exchange rate for 1 EUR			7,69	1,96	120,4		140,54	

To get a better insight into the price for the non-cross-border delivery and its components, a price comparison was made for the example of 10 m^3 of supplied drinking water to households (**Error! Reference source not found.**). The comparison r epresents the total billed amount, i.e. the price that household users have to pay for 10 m^3 of drinking water, per month. Thus all charges and fees (fixed and variable) which could be related to water supply and price for 10 m^3 of drinking water per month for household users, were included in the amount.

Regarding the ***Error! Reference source not found.*** presenting prices for the case of 1 0 m^3 of delivered water per month it has to be specifically mentioned that it was not supposed to compare the prices (the actual amounts) of the selected water utilities (after all, the used examples represent different water supply systems, operating in different circumstances and thus simple comparison cannot be performed), but was focused on the structure of the water supply tariff, therefore on the components that form the total price for final users, in this case households.

Figure 4: Prices for 10m^3 of supplied drinking water per month for household users in selected cases, last available data, without VAT



The prices (and their components) for final consumers for 10 m^3 of delivered water reflect the pricing policies of the analysed cases. For example, **Error! Reference s ource not found.** shows that total price that households pay for water supply (in the selected cases) consists from different components. In some cases, price beside variable utility charge includes also fixed utility charge or additional charges like taxes and fees, which could be charged per each cubic meter of delivered water or on monthly basis. In case of Istarski vodovod Buzet (CRO), water abstraction charge and other related taxes (charged per cubic meter of delivered water) represent a

considerable share of the total billed amount. On the other hand, in the case of Belgrade water utility (SRB), the billed amount represents exclusively the variable utility charge for the consumed quantity of water.

3.2 Analysis of the prices in cross border water supply

Beside collecting relevant data on non-cross-border water supply the questionnaire also aimed at gathering the information about the applied approaches and possible price negotiation processes for the industry and similar water consumers – bulk water supply. The latter has some common dimensions with cross-border drinking water supply since drinking water is usually supplied cross-border in large (bulk) quantities to another utility. It is also referred to as wholesale service which represents a situation where water is sold to a wholesale customer at one or more major delivery points for resale to individual retail customers within the service area of the wholesale customer (Public Utility Commission of Oregon, 2015). Bulk water supply (wholesale service) also represents one of the main research subjects in our project.

Wholesale rates (prices) are usually applied by service providers (water utilities) for the supplied drinking water (bulk quantity) to another service provider (utility) that distributes the drinking water to retail users. Wholesale water rate represents the rate that one water utility (the seller or wholesaler) charges another utility (the purchaser or retailer) for supplied water (WaterKY, 2015).

In the same way as in section 3.1, we collected data on wholesale prices. The summary of information is represented in **Error! Reference source not found.** which includes t he price categories in the case of cross-border drinking water supply. We have to note that only 4 project partners are involved in cross border bulk water supply between two countries. Within the DrinkAdria project the cross-border systems in the countries participating in the project were identified. Thus in the table are presented also data for the case of water utility from Slovenia (Komunala Ilirska Bistrica) which is not a project partner but was included in this analysis since it represents an example of CBWS between Slovenia and Croatia.

The table is organised in a way that the columns contain the information about the water utility that is supplying (selling) the drinking water (i.e. wholesaler) and the rows contain the information about the utility that the water is delivered to (i.e. purchaser). In case that the wholesale price contains additional charges, they are stated in the

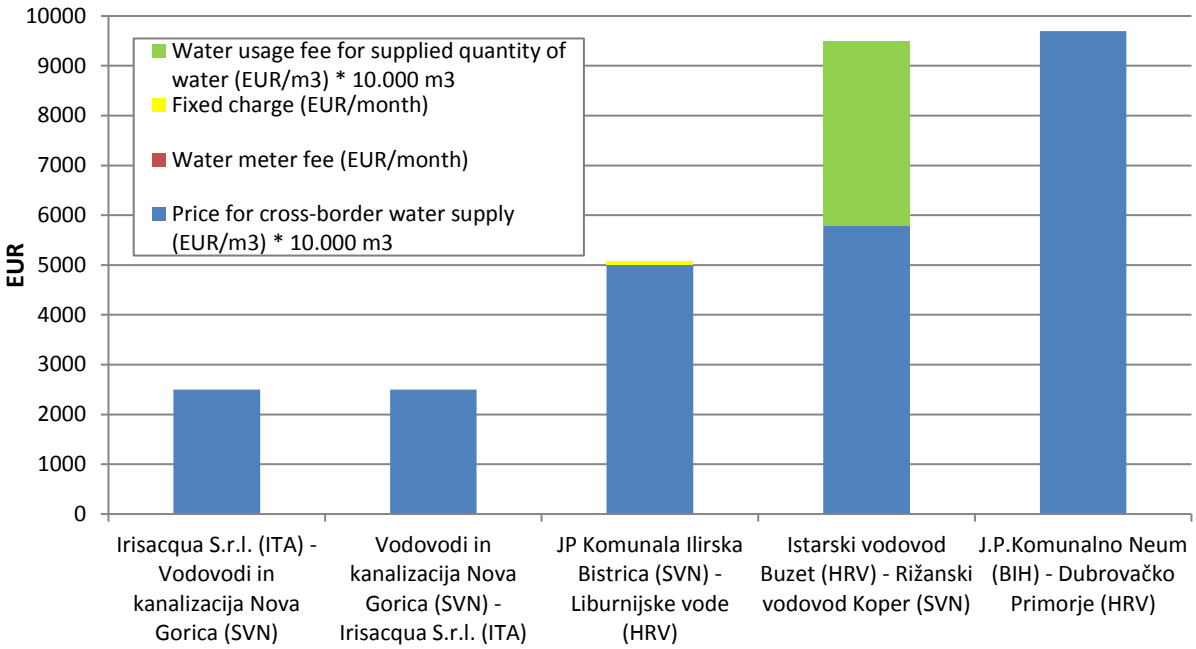
same column and is specified whether they are fix charges (monthly) or charges that depend on the consumption.

Table 8: Price of the CBWS by components in selected cases, last available data

Country (origin side)	**Italy**	**Slovenia**	**Slovenia**	**Croatia**	**Bosnia and Herzegovina**
Water utility company (supplier)	**Irisacqua S.r.l.**	**Vodovodi in kanalizacija Nova Gorica**	**JP Komunala Ilirska Bistrica**	**Istarski vodovod Buzet**	**J.P.Komunalno Neum**
Drinking water supply - CBWS price (in EUR, VAT excluded)					
Variable part - volumetric charge for provided water service in EUR/m3					
Water supply company Vodovodi in kanalizacija Nova Gorica (SVN)	0,25				
Water supply company Irisacqua S.r.l. (ITA) (per m3)		0,25			
Water supply company Liburnijske vode (HRV)(per m3)			0,50		
Water supply company Rižanski vodovod Koper (SVN)(per m3)				0,58	
Municipality Dubrovačko Primorje (HRV) (per m3)					0,9694
Municipality Ravno (BIH) (per m3)					0,9694
Fixed part (EUR per unit) per month					
Export of water			59,35		
Additional charges (EUR)					
Water meter fee			13,02		
Water usage fee (EUR per m3)				0,37	
CBWS price refference year/validity	2015	2015	2014	1.4.2015 -	1.4.2012 -
Price for 10.000 m3 of supplied water (in EUR, VAT excluded)	2500	2500	5000	5800	9694
TOTAL PRICE for water supply service for 10.000 m3 per month (in EUR, VAT excluded)	**2500**	**2500**	**5072,37**	**9500**	**9694**

In the same way as for the comparison of the prices for final users in public water supply, the comparison for bulk water supply in case of CBWS was made (*Figure 5*). The CBWS price comparison was made for the example of 10.000 m3 of delivered drinking water in the cross-border situation for the cases where DrinkAdria project partner utilities are involved and one case identified within the DrinkAdria project (Komunala Ilirska Bistrica from Slovenia which delivers drinking water to Liburnijske vode in Croatia).

Figure 5: Prices for 10.000 m^3 of CBWS, last available data, without VAT



The CBWS price comparison reveals different price structures between public utilities companies (PUC) and different types of users (national vs cross border). In the case of CBWS between Italy and Slovenia it can be observed that the water utilities which participate in cross-border delivery (in this case drinking water is supplied in both directions) charge each other the same price 0,25 €/m^3. If we compare the latter with the price that Vodovodi in kanalizacija Nova Gorica charges its national users per supplied m^3 of drinking water (0,92 €/m^3), we figure out that CBWS price is considerably lower.

In the second case of CBWS “Komunala Ilirska Bistrica” (Slovenia) similarly charges a relatively lower price (0,50 €/m^3) for cross-border delivery to “Liburnijske vode” (Croatia) compared to the price (almost 1,50 €/m^3) that is charged to the national users per supplied unit (m^3) of drinking water. Beside the price for the delivered water “Komunala Ilirska Bistrica” (Slovenia) charges also a fixed (utility) charge per month

and water meter fee for the delivered drinking water to “Liburnijske vode” (Croatia). The latter two charges are relatively small compared to the price for cubic meter of drinking water (cannot be properly seen from the figure 5).

The third case of cross-border water supply presented in the figure 5 is the delivery from Istarski vodovod Buzet (Croatia) to Rižanski vodovod Koper (Slovenia). In this case, the total price (beside the price for delivered quantity of water) includes also a water usage fee (0,37 €) which is defined by the government decree and charged for each supplied cubic meter of drinking water. Wholesale price for the delivered drinking water (0,58 €/m^3) is in this case the same as the price for final users, precisely category households, suggesting that the price for cross-border drinking water delivery is defined based on the price for household users.

Similarly, in the case of water supply from Bosnia and Herzegovina to Croatia, the water supply provider “Komunalno Neum” (BIH) charges for delivered quantity of water to “Dubrovačko Primorje” (CRO), a price per cubic meter which is slightly higher compared to the price for end users (households) for the second block of consumption (>30 m3).

4 Proposed CBWS pricing model

One of DrinkAdria project tasks was to develop pricing model for determining the price of cross-border water supply. Since the price represents an important component of CBWS contracts and in negotiation processes, the use of the pricing model offers a better insight into the costs of cross-border water supply. The latter is often (as is the case in most DrinkAdria project partner utilities) described as a separate activity to the supply of national (regional) end users. The price of the water supply in national (regional) framework is usually based on national legislation and the methodology for price calculation is defined by government decree or regulatory authorities.

On the other side, the price of CBWS is, as could be observed from the price analysis of wholesale water supply, set in the similar way as for other user categories serviced by the operator. Price mechanisms for cross-border water supply are usually not defined in national legislation and there is a lack of methodological approach for wholesale water price calculation.

4.1 The issues of determining the price of cross-border water supply

Within the project, the existing approaches and methods to water supply pricing in the literature were researched. The following chapter provides the description and some of the issues related to the topic.

4.1.1 Average cost pricing approach

Carter & Milon (1999, p. 3) refer to American Water Works Association when they explain the average cost pricing approach. As they mention, the traditional strategy used in water supply service pricing is to set water rates, which ensure the revenue from water sales is sufficient to cover the total costs of the system. Since this ensures that total revenues equal total costs, average revenue or the price will equal total cost. Simplified, the average cost price represents the annual revenue requirements divided by the annual total quantity of water delivered (Carter & Milon, 1999, p. 18). Kim (1995, p. 323) discussed pricing of water services for water utilities in United States and mentioned that at the time, existing practices were generally performed on the basis of average costs rather than marginal costs.

4.1.2 Marginal cost pricing approach

There exists an extensive literature on marginal costs and marginal cost pricing approach (e.g. Turvey, 1969, 1976, 2000; Saunders, Warford & Mann, 1977; Hanke, 1981; Renzetti, 1992; Hall, 1996; Hall, MacEwan, Garcia & Norris, 2006, Zieburtz & Staff, 2012 etc.). The marginal cost as explained by Hall, MacEwan, Garcia and Norris (2006, p. 4): »Refers to the incremental change in cost resulting from an incremental change in output«. As stated by Turvey (2000, p. 2): »Marginal cost is an estimate of how economic cost would change if output changed«. In theory, the marginal cost pricing means that the price for product or service is equal to the cost of producing the next unit of supply (Zieburtz & Staff, 2012, p. 221).

AWWA (2000, p. 120) mentions that marginal cost estimation represents a forward-looking process which includes forecasting future costs and use. They add that marginal cost of water can vary with time (peak versus off-peak demand) and location (consumers located at different points of the serviced area). The calculation of marginal

costs includes forecasting operating costs, capacity costs and demand in future time periods. Water rates, which are based on marginal costs, are forward-looking and reflect future costs to be incurred or avoided in supplying water (AWWA, 2000, p. 120-124).

In the case of cross-border (bulk water supply), the supply is agreed and represents a part of the system of the public water supply and cannot be regarded as the sale of excess or surplus amounts of water. The use of marginal cost approach requires the definition and estimation of the cost function based on several assumptions.

4.1.3 Cost distribution in cross-border water supply

As mentioned by Conti & Wright (2014, p. 254) when utility provides (serves) only users within its jurisdictional area, the cost that it incurs are generally considered as common to all users within its service area. Thus in situation when utility provides wholesale water service it may incur costs that cannot be appropriately allocable to the users in its service area and similarly when utility provides wholesale service the costs related to its (retail), users (e.g. distribution mains, customer service lines) cannot be allocated to wholesale customers (Conti & Wright, 2014, p. 254).

The question that arises in the case of cross border water supply system service is how to ensure a transparent procedure of cost calculation and consequently a fair price agreement which is very important component of a sustainable water supply.

Within public water supply the costs of the operation of entire system are usually averaged. When discussing the CBWS the specific costs related only to the CBWS should be identified since the users which consume large quantities of drinking water (bulk quantities) should pay the economic price but should not bear the cost that arise due to water supply to other users. Thus, a separate accounting approach should be introduced in order to enable a transparent approach to the cost analysis.

The price of CBWS should therefore be calculated based on the costs related to a specific part of the water supply system used for cross-border water supply. This could be reached by applying a proportional approach to cost distribution. CBWS service should cover the operating costs that occur by performing CBWS and infrastructure costs that relate only to the specific part of the water supply infrastructure used for CBWS. In connection with the costs of wholesale water service Conti & Wright (2014, p. 254) mention several factors which should be considered such as regarding the

assets for wholesale service (e.g. how did the utility fund them, does the utility have a detailed information about the fixed assets used to provide wholesale water supply, etc.).

In order to enable a fair cost allocation and transparent wholesale rate calculation, a distribution of the costs of the water supply between (national) public water supply for end users and bulk water supply for large users (in this case water utilities) should be made. The important issue in allocation of the costs of bulk water supply (wholesale) is which costs should (could) be allocated to the purchaser of bulk drinking water. As stated by Zieburtz & Staff (2012, p. 162) in wholesale water supply it is important to understand which facilities are needed to provide the service (e.g. certain facilities as transmission line can be built specifically for wholesale user). Thus, the methodology for the wholesale user should take into account who built and financed the specific facility in order to enable a more transparent approach.

As mentioned by Beckley (2014, p. 218), there is no single way or approach to how the wholesale rates should be defined and utility should observe all specific conditions of the wholesale customer and determine what is relevant (suitable) in defining the rate within the framework of the cost of service.

4.1.3 Determination of revenue requirements

Utility has to determine the revenue requirements to cover their operation and maintenance costs and to assure sustainable water supply service in order to define the wholesale rate. Zieburtz & Staff (2012, p. 12) describe two methods of accumulating costs for revenue requirements: "**cash-needs approach**" and "**utility-basis approach**".

As Crea (2014, p. 151) explains, the so called **cash-needs approach** is used by municipally owned water systems and is structured in a way that enables the recovery of specific requirements for operation and maintenance costs and capital. As illustrated by Zieburtz & Staff (2012, p. 39) this represents the case when water utility functions as a part of municipal government or as a separate company. In this case, budget defines the use of funds needed to cover the capital related costs, principal and interest payments on debt, portion of capital replacement and improvements not financed by debt. Total capital needs' projections should identify the contributions such as government grants, other non-utility sources, etc. (Zieburtz & Staff (2012, p. 39).

The **utility approach** is used by investor-owned water utilities and also by regulated governmental utilities. This approach is based on idea that water utility recovers its operating and capital costs as defined by generally accepted accounting principles, which means that budget requirements represent the base for revenue requirements (Crea, 2014, 151–153). Operating and capital costs are identified for the historical base year (for the most recent accounting period). In this approach the capital costs depend on utility depreciation and rate of return (Zieburtz & Staff (2012, p. 43).

As explained by Twort, Ratnayaka and Brandt (2000), depreciation represents an accounting term for the practice of annually writing down the initial cost of an asset. The amount of depreciation of an asset (which depends on accounting practice) represents an amount of money that should be set aside and allocated to depreciation fund in order that it could be later used for renewing the asset when it becomes worn out.

OECD (2009b, p. 96) defines depreciation or consumption of fixed capital as the loss in assets' value due to physical deterioration (wear and tear) and due to normal obsolescence. OECD (2009b) also mentions that consumption of fixed capital represents a cost of production. Regarding the depreciation OECD (2009b) mentions the following functional forms of the depreciation pattern: straight line model of depreciation (which represents a common model) and geometric or declining balance model of depreciation.

In context of water supply it is mentioned by Perks and Kealey (2006, p. 150) that depreciation of assets with long life periods (such as water supply systems) is often calculated using straight-line depreciation method which represents the simplest method where the depreciable amount (cost of asset minus residual value) is divided by estimated years of useful life to get the annual depreciation. Another method mentioned in the literature is accelerated depreciation where the asset is written off faster in first years with gradually smaller increments in last years. Public Utility Commission of Oregon (2015) mentions three major types of accelerated depreciation: sum of the year's digits, double declining balance and units of production.

The annual depreciation enables water utility to recover its capital investment over the useful life of the assets and therefore it is fair that the depreciation expense would be borne by the customer (in this case wholesale customer) who benefits from the use of an asset during the asset's useful life (Zieburtz & Staff, 2012, p. 36). As further explained by mentioned authors, the depreciation expense should represent the

depreciable infrastructure investment which is in use (in service) in the period for which the rate is determined. By including the depreciation expense in calculation, the utility provides funds to be used as a source of capital for improvement, replacement or expansion of the system or for debt repayment (Zieburtz & Staff, 2012, p. 36).

As explained by Zieburtz & Staff (2012, p. 36) in case of wholesale situation the utility-basis approach is often used, but also a hybrid approach (combined cash-needs and utility-basis approach). Within the hybrid approach two variations are mentioned: utility basis with cash residual and utility basis with rates of return differential.

4.2 Proposed pricing model

The proposed pricing model primarily enables a better understanding of the cost structure to both parties involved in cross-border water supply. It also helps understanding CBWS situation, which is in a way unique if compared to national water supply systems and provides a possible path for more accurate and fair division of costs between supplying and receiving party.

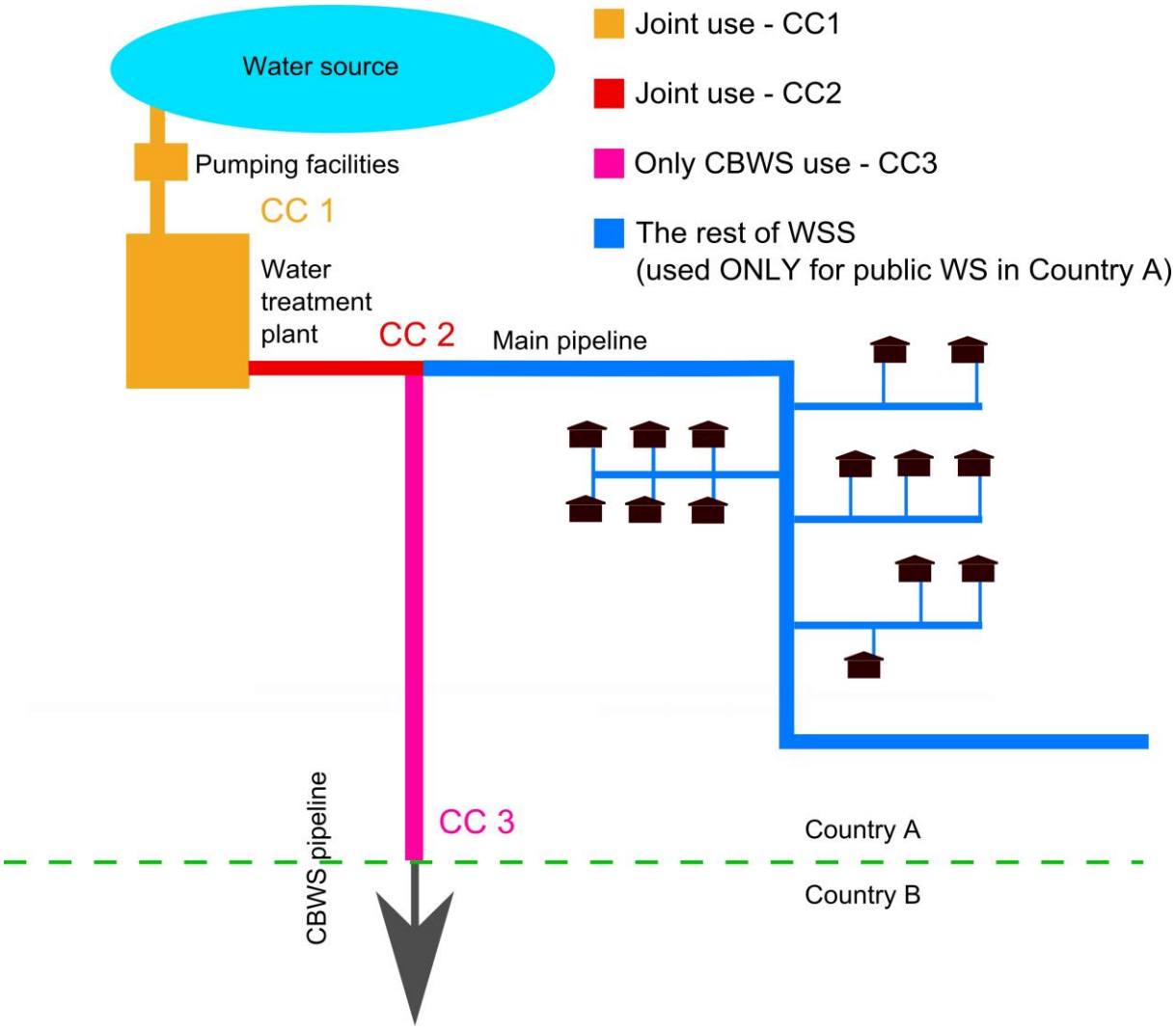
The model uses average cost pricing approach and requires a certain level of decentralised organisation with cost centres[3] as important units. The identification of the cost centres (hereinafter CC) is a necessary predisposition (in the case where they are not defined, the best estimate should be used).

There are three typical situations (cases) how the CBWS can be performed:

1.) Case 1 (*Figure 6*): Abstracted and treated water intended for CBWS is transported to the recipient with separated pipeline (located between water source and before the network of supplier's domestic users).

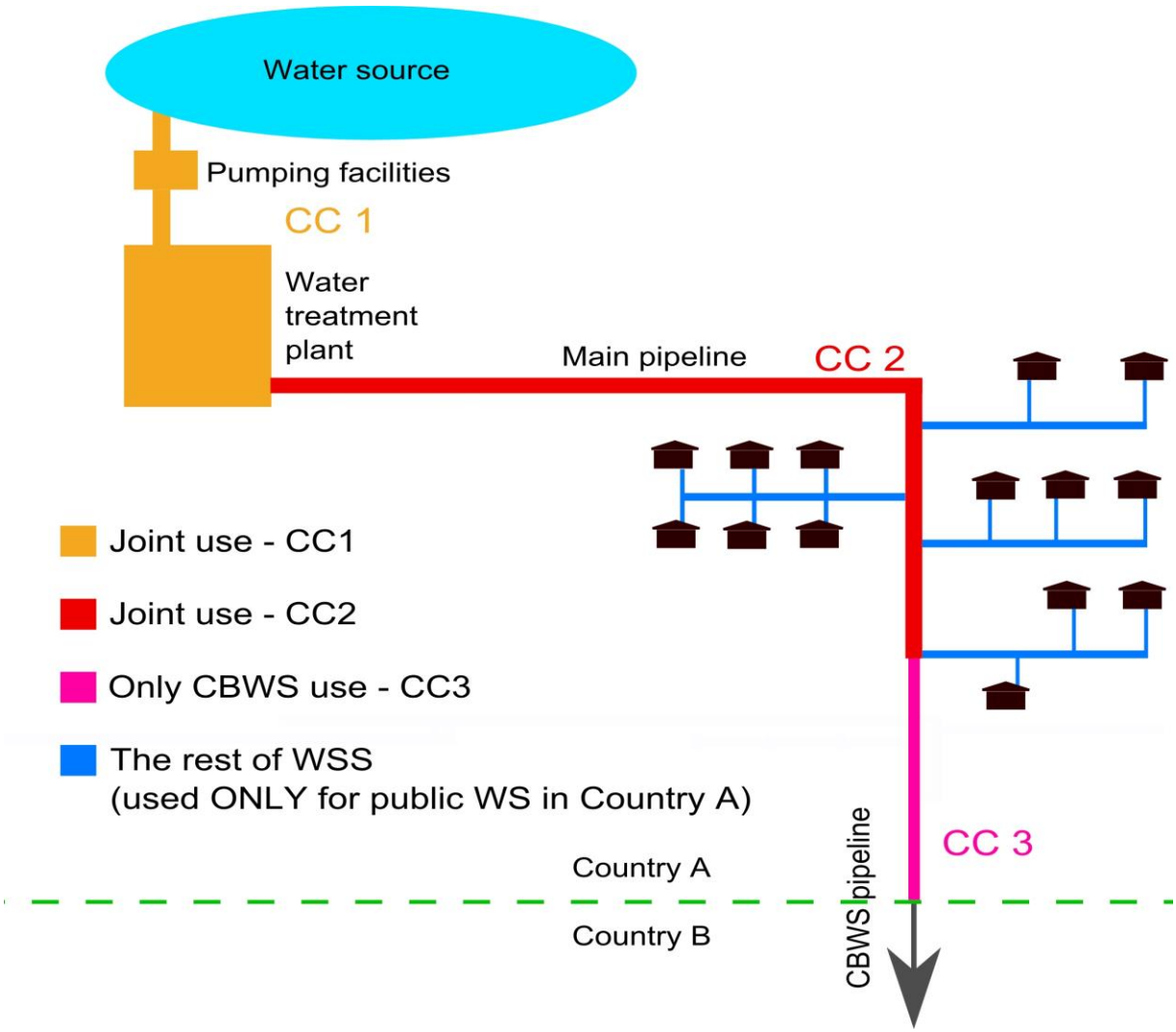
Figure 6: CB WSS Case 1

[3] According to Kaplan (2006) standard cost center resembles »a production or operating unit in which someone other than the local manager determines the outputs that will be produced as well as the expected inputs required to produce each unit of output. Industrial engineers and cost accountants specify the quantity and price standards for the materials, labour, energy, and machine time required to produce each widget, the generic term for a manufactured good. Standard cost centres are also found in service industries, such as the fast-food business, banking, and health care, where cost accountants establish standard costs for producing hamburgers and milk shakes, processing checks and deposits, or performing laboratory and radiological tests«. In our case we don't disentangle between standard cost centres and the discretionary expense centres.



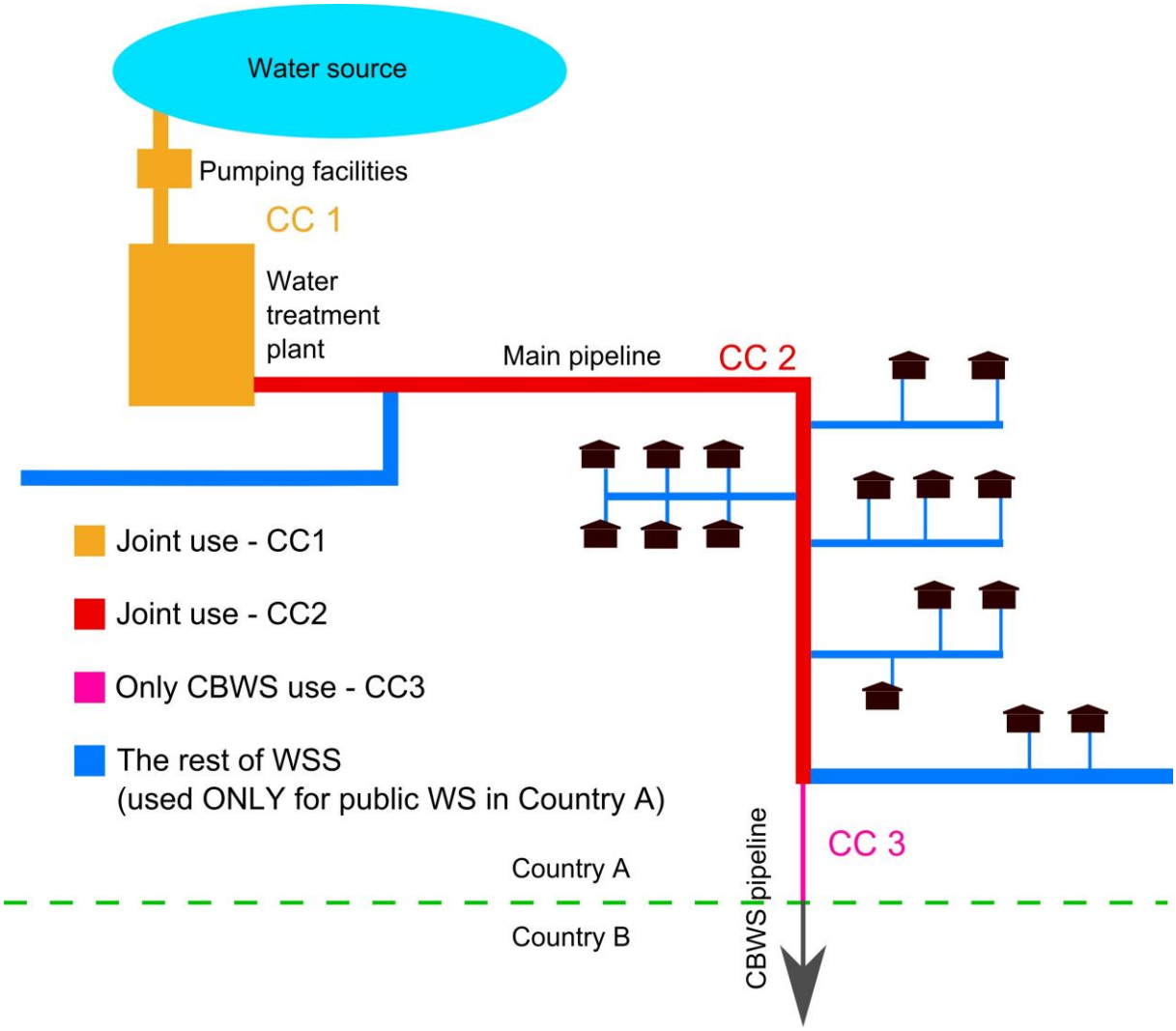
2.) Case 2 (Figure 7): Abstracted and treated water intended for CBWS is transported to the recipient using the same pipeline as for supplier's domestic users (CBWS pipe is located at the "end" of the WSS - water is delivered to the CBWS recipient after it has been delivered to all of the supplier's domestic users).

Figure 7: CB WSS Case 2



3.) Case 3 (*Figure 8*): Abstracted and treated water intended for CBWS is transported to the recipient using the part of the same pipeline as for supplier's domestic users (junction with CBWS pipe is located somewhere in the "middle" of the WSS - water is delivered to the CBWS recipient after it has been delivered to a part of the supplier's domestic users).

Figure 8: CB WSS Case 3



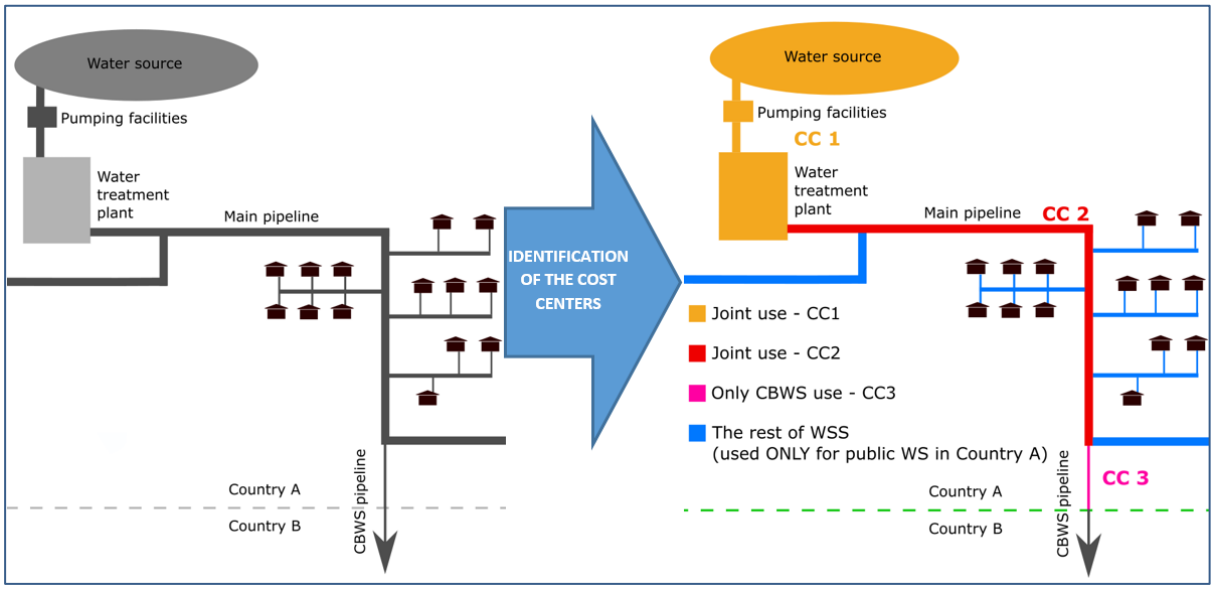
The procedure on how to apply Pricing model to the CB WSS is described for the situation or Case 3. All analysed cases of CBWS can be identified as Case 3 (*Figure 8*) which is the most complex of all three Cases. The procedure is applicable to other two Case (and Figure 7).

First step represents the identification of parts of the main water supply system being involved in the CBWS (*Figure 9*). Often water utilities manage several water supply systems. Proposed pricing model requires the identification of the specific part of the WSS used for CBWS. In determining the costs of public (national) water supply and CBWS it is important to understand and recognize the facilities that are used for the wholesale water service (Zieburtz & Staff, 2012, p. 167). The recognition of the required facilities for wholesale water supply and their fair distribution in the analysis

of costs of wholesale service represents a certain challenge (Zieburtz & Staff, 2012, p. 167).

It requires the identification of the part of WSS that is in »joint use«, i.e. the part which is used to supply both utility's end users and bulk (wholesale) water user (e.g. another water utility), and the part only used to supply bulk water user (or in this case CBWS). Examples of the parts of WSS in joint use could be pumping station, water treatment plant, main water line, etc.) and the examples of parts of WSS only for CBWS could be export water line, water meter, etc.

Figure 9: An example of identification of cost centres (CC) that represent the part of system needed for CBWS



After all CC of necessary parts of WSS are identified, variable and fixed component should be defined for each CC. For the part in joint use only a part of the costs should be allocated to CBWS and for this purpose the costs' allocation coefficients need to be used. The coefficients are proposed to be calculated in the following way:

1) In case of variable costs, the ratio between quantity (m^3) of water delivered for CBWS in the past year to the total quantity (m^3) of water delivered in the past year is used.
2) In case of fixed costs, the ratio between contract quantity to »design capacity« is used. For example, if a CC represents water treatment plant with design capacity Y m^3, and the annual contracted quantity is X m^3, the coefficient is X/Y. Similar for main water line, pumping station, etc.

Variable costs represent costs that vary with the levels of water production (e.g. electricity costs, materials) and fixed costs relate to the costs that are not proportional to the production (e.g. infrastructure depreciation). Individual cost items can be added based on the agreement between parties, but should not include general, administrative or other non-production costs.

Wholesale customers should not bear the costs which are associated with service for utility's (national) public water supply users (e.g. smaller distribution mains only used by utility's public water supply users) (Zieburtz & Staff, 2012, p. 162). As suggested by Zieburtz & Staff (2012, p. 162) wholesale water rates should cover the costs of providing service to wholesale customer.

The variable and fixed component approach suggests that the user bears the part of the variable costs accordingly to the consumption and that in case user requires no water in particular year, still bears a part of the fixed costs that ensure availability of the service in the long run.

Essential Services Commission (2011) which is a utility services regulatory body, established by the state government of Victoria, Australia, prefers bulk water charges with a two-part charge comprising fixed charge and volumetric component to recover a bulk supplier's revenue requirement from its customers.

The data required for calculation of the CBWS costs include: quantity of water delivered cross-border, total quantity of water delivered in the observed water supply system, variable and fixed costs for each identified CC, design capacity of the parts of water supply system which should ideally be related to one cost centre (e.g. CC1 water treatment plant, etc.), agreed annual amount of water delivered.

The required data (yellow coloured cells) regarding the quantities of the water in the observed cross-border water supply system are presented in the ***Error! Reference s ource not found.***. This data is used to calculate the variable and fixed coefficients.

Table 9: Required data for calculation of coefficients

Reference Year:	
OBSERVED WATER SUPPLY SYSTEM:	
Quantities of delivered water (m3)	Quantity water delivered (m3)
WSS - National and cross border	**0**
National water supply - supplier's end users	*0*
Cross-border water supply	*0*

Agreed annual amount for CBWS (m3)	*0*

The quantities of delivered water from the observed system represent the basis for the calculation of variable coefficient, while the calculation of fixed coefficient requires data on agreed annual amount of CBWS and design capacities (e.g. of pumping station or treatment plant). This is presented in *Table 10*.

For the part of WSS in joint use, the total variable and fixed costs of each cost centre are multiplied by allocation coefficients which represent ratios between quantity of delivered water CBWS to total quantity of water delivered (for variable costs) and agreed annual amount to design capacity (for fixed costs). In the case that part of WSS is used only for CBWS, the coefficient for fixed costs equals one. By using the coefficients, a proportional share of the costs is allocated to CBWS.

Table 10: Required data for calculation of the fixed costs coefficient

Cost centre Cost centre description	CC1 Example - water source, pumping and treatment plant	CC2 Example - Main water line	CC3 Example - transport pipeline - (only for Cross border)	CC4 [add description]	CC5 [add description]
Design capacity (m3)	*0*	*0*	*0*	*0*	*0*
Fixed costs allocation coefficient					

Table 11 presents the required data regarding the variable costs that can be related to the part of the system used for CBWS (yellow coloured cells) such as electricity costs, costs of material, etc. Table includes the sum of variable costs by individual costs centres, variable costs coefficients used in distribution of costs and the calculated variable costs of CBWS (orange coloured cells).

Table 11: Calculation of variable costs of CBWS

Cost centre Cost centre description	CC1 Example - water source, pumping and treatment plant	CC2 Example - Main water line	CC3 Example - transport pipeline - (only for Cross border)	CC4 [add description]	CC5 [add description]
electricity costs	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*
costs of material (provide attachement) - due dilligence	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*
costs of services	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*
labour costs	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*
other variable costs	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*
Total variable costs	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**
Variable cost coefficients					
Variable costs of CBWS	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**

Table 12 presents the required data regarding the fixed costs that can be related to the part of the system used for CBWS (yellow coloured cells), in this case infrastructure depreciation. Table includes the sum of fixed costs by individual costs centres, fixed costs coefficients used in distribution of costs and the calculated fixed costs of CBWS (green coloured cells).

Table 12: Calculation of fixed costs of CBWS (I)

Fixed costs (EUR)	CC1	CC2	CC3	CC4	CC5
Depreciation - facilities provide methodology (attachement)	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*
Depreciation - equipment	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*
Other fixed costs	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*
Total fixed costs	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**
Fixed costs allocation coefficient					
Fixed costs of CBWS					

When the revenue requirements don't depend on depreciation expense recovery but budget defines the use of funds needed to cover the capital related costs principal and interest payments on debt, portion of capital replacement and improvements not financed by debt, fixed costs should be calculated based on capital improvements (Table 13). Usually this is the case when water utility functions as a part of municipal government or as a separate company. Agreed scale of capital improvements is part of negotiation process between utility managers.

Table 13: Calculation of fixed costs of CBWS (II)

Fixed costs (EUR)	CC1	CC2	CC3	CC4	CC5
Capital improvements	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*
Total fixed costs	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**
Fixed costs allocation coefficient					
Fixed costs of CBWS					

After the calculation of CBWS costs, the total sum of annual variable and fixed CBWS costs is made (Table 14). Both variable and fixed costs are than divided by quantity of water delivered CBWS in order to have the information about the amount of EUR per m3. Important note should be made here: fixed costs of CB WS per m3 are only informative and should be defined per billing period (e.g. monthly). Finally, assessment of CBWS price is calculated from two components: variable (EUR/m3) and fixed (EUR/m3).

Table 14: Calculation of the CBWS price

	CC1	CC2	CC3	CC4	CC5	**Costs of CBWS**	**Costs (EUR per m3)**	**Costs (EUR per month*)**
Variable costs of CBWS								
Fixed costs of CBWS								
					Total sum of costs			

It has to be mentioned that the use of the model is based on the assumption that the WSS is well maintained and that represents a very simplified approach to calculation of cross-border water supply costs which serves as a base when determining and negotiating the price of CBWS. In order to guarantee a fair and transparent price agreement, both parties should have a detailed insight into the cost structure of CBWS.

To support such process separate accounting should be introduced for the CBWS. As mentioned by Zieburtz and Staff (2012, p. 169), calculation of wholesale water rates represents a challenging process since utilities providing wholesale water service may face certain more complex accounting issues and record-keeping issues.

5 Analysis of the prices and costs of drinking water supply in WSS with CBWS service – the case of water utility of Nova Gorica

This section includes the analysis of the prices and costs of drinking water supply in a case of water utility that beside water supply for several municipalities, also performs cross-border water supply. To present the economics of WSS with CBWS service the partner utility FB 4 - Vodovodi in kanalizacija Nova Gorica d.d. (henceforth VIK NG) was used as an example.

5.1 Short description of the case

The water utility represents a public company (from Slovenia) which manages public water supply for the municipalities Nova Gorica, Šempeter – Vrtojba, Renče-Vogrsko, Brda and Miren - Kostanjevica. Beside the public water supply service for the mentioned Slovenian municipalities it also delivers drinking water for the part of Nova Gorica's neighbouring municipality Gorizia in Italy. The drinking water supply to Gorizia has a relatively long tradition and is based on a Paris Peace Treaty from 1947 and other agreements that followed between the Government of at that time Socialist Federal Republic of Yugoslavia (after 1991 Government of Slovenia) and the Government of the Republic of Italy on water supply of the municipality of Gorizia.

In 1979 the representatives of both sides have set the price for m3 of supplied water with the price changes being based on the electricity price and labour costs indices.

5.2 The prices of public water supply service and CBWS service – case of VIK NG

The case of VIK NG is presented on accounting data being published in firm's annual report for accounting year 2013 (VIK NG, 2013) and price elaborate (BM Veritas, 2014). In 2013 the price of drinking water supply for water utility users consisted of variable part (approximately 0,94 €/m^3) which was the same for all types of utility users (households, industry, institutions, etc.) and a fixed part. The latter depends on the water meter size (DN - Diamètre Nominal) and amounted to approximately 3 € per month for DN≤20 and approximately 600 € per month for DN≥150.

When forming the price for the public drinking water supply service, water utilities in Slovenia have to follow the "Decree of tariff system for public service on the environmental field" (slo. *Uredba o metodologiji za oblikovanje cen storitev obveznih občinskih gospodarskih javnih služb varstva okolja, Uradni list RS, št. 87/12 in 109/12*) (henceforth Decree) that provides the methodological framework for the formation of prices of public services, including water supply service.

According to the Decree, the price of drinking water supply should consist of variable and fixed part. Variable part should cover the costs related with daily functioning of the water supply system such as the direct costs of the material and services, labour costs, indirect costs, general costs etc. In this case Decree defines that variable part should cover also the costs of water abstraction charge (slo. *vodno povračilo*). Water abstraction charge represents a government tax that water utility users pay for the m^3 of abstracted water from the water source. According to the Decree, until 2018 the variable part should cover all costs of the water abstraction charge. Fixed part should cover the depreciation (amortization) costs of the infrastructure, the replacement and maintenance costs, etc.

On the other hand, the price of cross-border water supply service from Slovenia to Italy is set based on bilateral agreements between the representatives of both sides (representatives of both Governments and between operators) and doesn't refer to any specific methodological framework.

Currently, the Decree on tariff system in Slovenia defines the procedure for the water supply service price formation which is regarded as a public water supply while the bulk water supply is defined as a "special service". According to the Decree, the "special services" are regarded as services that are not provided to the users of the

public service. The special service in this case represents the service of drinking water export to the water utility company Irisacqua S.r.L. in Italy. The revenue from this special service is, in accordance to Decree, used to lower the costs (operating or variable costs and the infrastructure or fixed costs) of the public water supply service for Slovenian users.

The most recent change of price dates in the year 2007 when the wholesale price for a m^3 of drinking water was set fixed at 0,25 €/m^3.

5.3 Cost analysis of the public water supply service

To analyse the costs of the public drinking water supply, price elaborate (BM Veritas, 2014) and annual report of VIK NG for the year 2013 (VIK NG, 2013) was used. The costs were analysed in two parts, first the costs of the operation or the variable costs and second the infrastructure or the fixed costs.

Table *15* presents the breakdown of the costs for the year 2013 with individual categories such as direct costs (consisting from the electricity costs, costs of the material, costs of services, labour costs and other direct costs), indirect production costs, general costs etc.

Table 15: Costs of the operation of the water supply in 2013 (in EUR), water utility VIK NG, BM Veritas, 2014

	Total costs	Costs per **3.074.144** m3 (quantity delivered to utility users)	Costs per **5.048.247** m3 (quantity including CBWS)
Direct costs	**1.501.753**	0,4885	0,2975
electricity costs	383.926	0,1249	0,0761
costs of material	131.222	0,0427	0,0260
costs of services	313.852	0,1021	0,0622
labour costs	534.370	0,1738	0,1059
other direct costs	138.383	0,0450	0,0274
Indirect production costs	**597.735**	0,1944	0,1184
Depreciation of fixed assets excluding infrastructure	103.495	0,0337	0,0205
indirect production costs	460.130	0,1497	0,0911
revaluation/other	34.110	0,0111	0,0068
General costs	**731.318**	0,2379	0,1449
procurement costs	13.008	0,0042	0,0026

(table continues)

(continued)

general costs	514.176	0,1673	0,1019
costs of sales	204.133	0,0664	0,0404
Interest costs	**103.978**	0,0338	0,0206
Other business expenses	**2.350**	0,0008	0,0005
Correction for opportunity cost of capital	**83.538**	0,0272	0,0165
Total costs of the drinking water supply	**3.020.672**	**0,9826**	**0,5984**
Revenue decreasing the costs	**-484.116**	-0,1575	
revenue from the export of water	-447.900	-0,1457	
other revenue	-36.216	-0,0118	
Total costs of the drinking water supply	**2.536.557**	0,8251	
Water abstraction costs	342.020	0,1113	
Total	**2.878.576**	0,9364	

Second table's column presents the total costs by category. The third column includes the costs per total quantity of drinking water delivered to the VIK NG water utility users (approximately 3.000.000 m^3) It could be observed that the largest part of the costs of the operation of water supply service per unit represent the direct costs (0,4885 €/m^3 or approximately 50 % of total costs).

In the table a special category can be observed, the "Revenue decreasing the costs" which includes revenues achieved from special services (water export) since the part of the revenue from the export of water is used to cover a part of the operating costs.

The fourth column represents a situation where the costs are divided by total quantity of drinking water delivered to the utility users including the total quantity delivered cross-border (approximately 5.000.000 m^3). This situation should be avoided since the costs of the entire system should not be allocated to the wholesale water purchaser in order to avoid cross subsidisation and unfair cost distribution.

The Table *16* shows the infrastructure costs or the fixed costs of the drinking water supply service in 2013. The largest part of the infrastructure costs is represented by the costs of infrastructure depreciation and the costs of the replacement and maintenance of the connections. The depreciation costs of the infrastructure related to the cross-border water supply are (according to the BM Veritas (2014) price elaborate) excluded from the calculation of public infrastructure fixed costs.

Table 16: Infrastructure costs of the drinking water supply service in 2013* (in EUR), water utility VIK NG, BM Veritas, 2014

	Total
Depreciation (infrastructure)	728.998
Insurance costs	10.158
Compensations	282
Compensations for limited agricultural production	0
Payment for water right	0
Interest on construction financing	0
Replacement and maintenance of the connections	458.080
Total costs - public water supply	**1.197.518**

*In 2013 the water utility has not fully adopted the prices according to the Decree which entered into force on 1.1.2013.

The contract for bulk water supply or CBWS from Slovenian to Italian water utility defines that the annual quantity of water delivered is 2.000.000 m^3 and the price is 0,25 €/m^3. In 2013 the total quantity of CBWS amounted to 1.974.103 m3. Thus, the revenue from CBWS in 2013 was 493.526 € (BM Veritas, 2014). The part of this revenue from the special service or CBWS service is according to the Decree used to cover the fixed costs of the infrastructure used for CBWS.

5.4 Example Case Study for CBWS pricing model - case of CB WSS: Mrzlek (Slovenia) to Gorizia (Italy)

To acquire a rough estimate of the costs of bulk water supply, water utility VIK NG was used as a case in an attempt to divide the costs of the water supply service into the costs for end users (national public water supply users) and the costs of the wholesale of drinking water to a water utility in neighbouring country. Based on the information about quantities of water delivered, design capacities and costs of the observed water supply system, a very rough approach was tested using the presented model.

Firstly, the WSS, which is used to provide bulk water supply, was identified (Mrzlek). Within this observed system a certain specific part is used for CBWS which can also be divided in the part that is in joint use (for national public water supply and bulk water supply) and the part which is only used for bulk water supply (in this case CBWS). The specific part of the system could mean for example pumping station, water treatment plant, water supply mains, water meter, etc. In this case the specific part relates to pumping station, water treatment plant, main water line and CBWS line.

Available data regarding the cost centres related to this specific part of the observed system were used for a simplified calculation of the costs of the bulk water supply. The example includes direct operating costs and infrastructure depreciation.

Table 17 represents the quantities of water delivered from the observed WSS (VIK NG 2014). It shows the total quantity of water delivered from the system, broken down by quantities delivered to end users of utility (in this case national users from Slovenia) and bulk quantity delivered cross-border. It can be seen that quantity for CBWS represents a considerable part in total water delivered. The table includes also the design capacities of the part of WSS.

Table 17: Quantities of drinking water delivered from the observed WSS, VIK NG

Reference Year:	*2014*
OBSERVED WATER SUPPLY SYSTEM:	*Mrzlek*
Quantities of delivered water (m3)	Quantity water delivered (m3)
WSS - National and cross border	**3.801.451**
National water supply - supplier's end users	*2.302.158*
Cross-border water supply	*1.499.293*

Agreed annual amount for CBWS (m3)	*2.000.000*

From the table above it could be seen that in the observed year CBWS represented almost 40 % of total quantity of water supplied from the observed WSS.

Table *18* represents the variable costs of the part of observed WSS in 2014 by cost centres. The cost centres related to the part of observed WSS in joint use and part which is only used for CBWS. For example, cost center "Mrzlek" relates to pumping station, water treatment plant, the second cost center to the main distribution line and the last one to the transport pipeline only used for CBWS (water export). The variable costs are summed and by using variable cost coefficients (defined based on data about delivered quantities from the WSS) variable CBWS costs are calculated. For the part used only for CBWS, the variable coefficient equals one.

Table 18: Variable costs, part of the observed WSS VIK NG, 2014

Cost centre	CC1	CC2	CC3

Cost centre description	Mrzlek - water source, pumping and treatment plant	Main water line - Mrzlek - Nova Gorica	transport pipeline - (only for Cross border)
electricity costs	*193.998,97*	*0,00*	*179,78*
costs of material	*31.043,45*	*655,49*	*0,00*
costs of services	*114.583,10*	*0,00*	*0,00*
labour costs	*201.616,00*	*965,74*	*582,55*
other variable costs	*343,96*	*0,00*	*0,00*
Total variable costs	**541.585,48**	**1.621,23**	**762,33**
Variable cost coeeficients	0,39	0,39	1,00
Variable costs of CBWS	**213.601,42**	**639,41**	**762,33**

Table 19 includes the necessary data for definition of fixed costs coefficient. As already explained in the model's description, this requires data about design capacity of the parts of WSS that can be related to the individual cost center. The agreed quantity is divided by design capacity in order to define fixed costs coefficient. For the part used only for CBWS, the fixed coefficient equals one.

Table 19: Calculation of the fixed costs coefficient

Cost centre Cost centre description	CC1 Mrzlek - water source, pumping and treatment plant	CC2 Main water line - Mrzlek - Nova Gorica	CC3 transport pipeline - (only for Cross border)
Design capacity (m3)	*7.000.000*	*7.018.258*	*2.000.000*
Fixed costs allocation coefficient	0,29	0,28	1

Similarly, to previous, *Table 20* includes fixed costs (in this case infrastructure depreciation) by cost centers. In this case the infrastructure depreciation is separated for the facilities and equipment. Fixed costs are summed and by using fixed cost coefficients (definition explained above) the fixed CBWS costs are calculated.

Table 20: Fixed costs, part of the observed WSS VIK NG, 2014

Fixed costs (EUR)	CC1	CC2	CC3
Depreciation - facilities provide methodology (attachement)	*46.108,17*	*0,00*	*0,00*
Depreciation - equipment	*55.870,18*	*32.446,17*	*1.515,80*
other fixed costs	*0,00*	*0,00*	*0,00*
Total fixed costs	**101.978,35**	**32.446,17**	**1.515,80**
Fixed costs allocation coefficient	0,29	0,28	1,00
Fixed costs of CBWS	**29.136,67**	**9.246,22**	**1.515,80**

Table 19: Calculation of the fixed costs coefficientTable 19 and Table 20 include the sums of costs by cost centers and coefficients calculated as described above (using data regarding quantities and design capacities). For the part of WSS in joint use the calculated coefficients are applied while for the part only used for CBWS the coefficient equals one. At this point it has to be mentioned that the presented way for definition of the coefficients represents only one of possible approaches to distribute the costs between the national public supply and CBWS.

The calculation gives the variable and fixed costs that could be related to CBWS *(Table 21*). Divided by quantity of water supplied cross-border we get the information of CBWS costs per m^3 (cost price) which can represent a basis for final price formation. The variable component presents the price for the cubic meter of CBWS while the fixed component presents the price which does not depend on the consumption and is usually charged per month.

Table 21: Calculation of CBWS cost price, part of the observed WSS, 2014

	CC1	CC2	CC3	**Costs of CBWS**	**Costs (EUR per m3)***	**Costs (EUR per month)**
Variable costs of CBWS	213.601,42	639,41	762,33	215.003,16	0,14	
Fixed costs of CBWS	29.136,67	9.246,22	1.515,80	39.898,69	0,03	3.324,89
			Total sum of costs	254.901,85	0,17	

*Fixed costs of CBWS per m3 are only informative. It should be noted that fixed costs should be expressed per accounting period (e.g. amount per month).

It has to be specifically mentioned that the approach based on the used data represents a very rough calculation aimed primarily at presenting the complexity of the issue of defining a fair CBWS (wholesale) price. The issue requires further research

and considerations, which are beyond the current scope of the project. However, it needs to be mentioned that the price in CBWS covers all fixed and variable costs of cross border supply. What remains open are environmental and resource costs. If water permits represent a good proxy for environmental costs, this increases variable costs by 6,7 cents. Therefore, the “fair” price would amount to 23,7 cents (0,237 €/m3).

For a transparent definition of wholesale rates, a separate accounting approach should be provided for public water supply to end users and for bulk water supply (cross-regional and cross-border water supply). The specific part of the WSS infrastructure (assets) used for CBWS should be identified and precisely listed. The (capital) investment plans should be prepared. Also the cost items for bulk water supply should be properly defined and agreed and other procedures related to CBWS that would enable transparent procedure for wholesale rate definition and most importantly for both seller and purchaser, a sustainable and long-term water supply.

6 Analysed Study Cases from partners on proposed CBWS pricing model

The proposed CBWS pricing model was discussed with partners on regular DrinkAdria meetings (Corfu, Macerata, Venice) and on Technical meeting in Ljubljana held on May 11, 2016. The proposed model was sent via email (March 4, 2016) to utility partners involved in cross-border water supply (cross country or cross regional/municipal border) in order to receive their feedback. It was sent in a form of an excel file with prepared spreadsheet together with the instructions on how to fulfil the spreadsheet with necessary data inputs. The latter represented the data regarding the quantities of water delivered from the WSS providing CBWS service and costs related to the parts of WSS used for providing CBWS. It has to be mentioned that the partners were also informed about the possibility of fulfilling the model on DrinkAdria web platform where the same data inputs could be inserted in a prepared form and saved in a form of report.

6.1 Analysis of Case Study: CR WSS Niš

FB 10 (Institut Jaroslav Černi) provided the data for example of CR water supply for the case of the water supply system of Niš from Serbia (NIški Vodovodni Sistem). The operator of this WSS performs a CR WS to municipality of Babušnica, also in Serbia.

Table *22* includes the inputed data for CR WSS from which can be seen that the system provided approximately 5 mio m^3 of water, of which 1 mio m^3 represented the quantity that was delivered to the municipality Babušnica.

Table 22: Input data (quantities) for CR WS - case of water utility of Niš

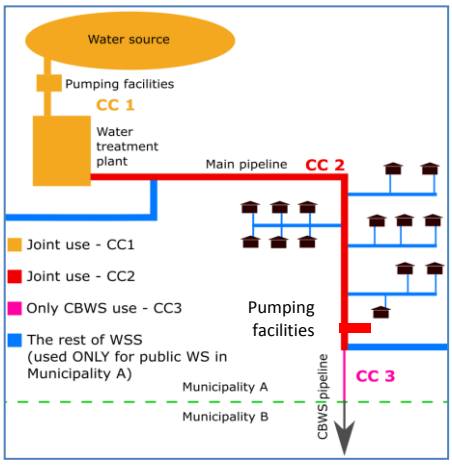
1. CURRENCY

In case your national currency is not EUR, add Exchange rate and Date.		
National currency (NC)	**Exchange rate (1 EUR = ? NC)**	**Date**
DIN	*121,32*	*31.12.2014.*

2. Calculation of Variable Cost Coefficient

Reference Year:	*2014*
OBSERVED WATER SUPPLY SYSTEM:	*LJUBERADJA*
Quantities of delivered water (m3)	Quantity water delivered (m3)
WSS - Public and regional	**5.252.225**
Public water supply - supplier's end users	*4.033.367*
Regional water supply for town (Babusnica)	*1.218.858*

Variable costs allocation coefficient - part of WSS use in joint use (in reference year)	0,23
Variable costs allocation coefficient - only RWS use	1



The variable costs of the part of the system are presented in *Table 23*. This table also includes the calculated fixed coefficients based on the design capacity of system's parts. Here, a relatively large design capacity could be observed (compared to the agreed annual amount for cross-regional supply) which has an impact on the amount of allocated fixed costs.

Table 23: Input data (variable costs) for CR WS - case of water utility of Niš

3. Total Variable Costs in EUR per Reference Year

Cost centre Cost centre description	CC1 Water source, pumping facilities, water treatment plant LJUBERADJA	CC2 Main pipeline LJUBERADJA - BABUSNICA and pumping facilities	CC3 CBWS pipeline BABUSNICA and water meter
electricity costs	*149.679,27*	*144.793,27*	*0,00*
costs of material (provide attachement) - due dilligence	*23.668,49*	*3.313,59*	*0,00*
costs of services	*7.462,86*	*1.044,80*	*0,00*
labour costs	*100.320,14*	*14.044,82*	*0,00*
other variable costs	*19.290,20*	*2.700,63*	*0,00*
Total variable costs	**300.420,97**	**165.897,11**	**0,00**
Variable cost coefficients	0,35	0,50	1,00
Variable costs of RWS	**105.147,34**	**82.948,56**	**0,00**

4. Calculaton of Fixed Cost Coefficient

Agreed annual amount for RWS (m3)	*1.440.000*

Cost centre Cost centre description	CC1 Water source, pumping facilities, water treatment plant LJUBERADJA	CC2 Main pipeline LJUBERADJA - BABUSNICA and pumping facilities	CC3 CBWS pipeline BABUSNICA - BELE VODE and water meter
Design capacity (m3)	*18.290.880*	*18.290.880*	*15.042.672*
Fixed costs allocation coefficient	0,08	0,08	0,10

Table *24* includes other costs and fixed costs. These relate to depreciation of the infrastructure used in providing cross-regional water supply. The data regarding the depreciation of equipment is zero, suggesting that in this case the supply mains – pipes have been fully depreciated.

Table 24: Input data (other costs and fixed costs) for CR WS - case of water utility of Niš

5. OTHER COSTS (e.g. Legal services handling for regional issues)

Other costs	Costs (EUR per year)
Description1 + provide attachments	213.920,19
Other costs of RWS	213.920,19

6.A METHOD 1: Infrastructure Depreciation *(table continues)*

(continued)

Total Fixed Costs in EUR per Reference Year

Fixed costs (EUR)	CC1	CC2	CC3
Depreciation - facilities provide methodology (attachement)	*15.108,44*	*2.115,18*	*0,00*
Depreciation - equipment	*0,00*	*0,00*	*0,00*
Other fixed costs	*0,00*	*0,00*	*0,00*
Total fixed costs	**15.108,44**	**2.115,18**	**0,00**
Fixed costs allocation coefficient	0,08	0,08	0,10
Fixed costs of CBWS	**1.189,45**	**166,52**	**0,00**

Table *25* represents the calculated cost price for the water supply to municipality Babušnica.

Table 25: Calculated cost price for CR WS - case of water utility of Niš

Calculation of Water Price (Cost - EUR per m3)

	CC1	CC2	CC3	Costs of RWS	Costs (EUR per m3)	Costs (EUR per month*)	
Variable costs of RWS	105.147,34	82.948,56	0,00	188.095,89	0,15		
Fixed costs of CRWS	1.189,45	166,52	0,00	1.355,98	0,00	113,00	**
Other costs of RWS				213.920,19	0,18	17.826,68	**
			Total sum of costs	403.372,06	0,33		

* Accounting period is done per month
**IMPORTANT NOTE: Fixed costs of RWS per m3 is only informative.
It should be noted that Fixed costs should be charged per accounting period.

Regarding the model and the calculation, FB 10 sent the following comments (UL FGG, 2016):

1. We agree that DRINKADRIA (DA) project give just a Frame and Recommended Methodology for solving relations between two CB DWS.

2. We agree that should be recommended that in each particular case should establish one Common Body (with the members of both sides-PUCs, and maybe one outside respectable expert), which could have permanent or role just in unexpected and unsolving situations.

3. We agree with Full recovery principle for water price.

4. We want to suggest that Economic water price has two level and one separate cost: General level, Detail level, and Cost for unexpected situations.

a) General level you have done: Water price has fixed and variable costs, each of them cover very generally *that, that and that*.

b) Detail level has the same approach as General level, but it is in more detail: it considers what is *that, that and that.* We agree that DA cannot consider all details, but probably should numerate them and maybe for some of them could give recommendation (as example see point 6.)

c) Cost for unexpected situations are applicable just when such situation is happened (restriction of water, quality of drinking water is above the limits, accident pollution, etc. It could happen due to objective situation or mistake of one side).

5. We comment situation related to confidence: It should be at one acceptable level for both sides (probably this level is not the same in different cases) - it cannot be without limit, but also it cannot be that by ex. each measurement is done with representatives of both sides (maybe in some cases even that could be arranged, but not recommended from DA project).

6. We want to comment some specific issues:

a) 1 year cannot be representative for variable costs. It should be taken or one average of 5 or 10 years, or to calculate in detail real depreciation of one system or part of the system (which should not be done in DA, but just left opportunity).

b) How to calculate part of water price for new Investment (Funds planned for unusual, but needed activities in the next period or next year): probably just recommendation in DA should be given, like "Common Body will make decision according to accept recommendation which is the relevant additional amount of water price for both sides."

c) Following discussion on Technical meeting, we comment/agree that cost for water resource protection zones should be included, but probably split in fixed cost on detail level, and Cost for unexpected situations (accident situation).

6.2 Analysis of Case Study: CB WSS Neum Bosnia and Herzegovina) to Dubrovačko primorje (Croatia)

FB 13 (JP Komunalno Neum) provided the data for the case of CBWS that the operator Komunalno Neum performs. It is the case of CBWS from Neum (Bosnia and Herzegovina) to Dubrovačko primorje (Croatia).

Table 26: Input data (quantities) for CBWS - case of water utility of Neum

1. CURRENCY

In case your national currency is not EUR, add Exchange rate and Date.		
National currency (NC)	**Exchange rate (1 EUR = ? NC)**	**Date**
BAM	*1,96*	*1.01.1900*

2. Calculation of Variable Cost Coefficient

Reference Year:	*2014*
OBSERVED WATER SUPPLY SYSTEM:	*Gabela -Hutovo-Neum*
Quantities of delivered water (m3)	Quantity water delivered (m3)
WSS - Public and cross border	**227.101**
Public water supply - supplier's end users	*210.000*
Cross-border water supply	*17.101*

Variable costs allocation coefficient - part of WSS use in joint use (in reference year)	0,08
Variable costs allocation coefficient - only CBWS use	1

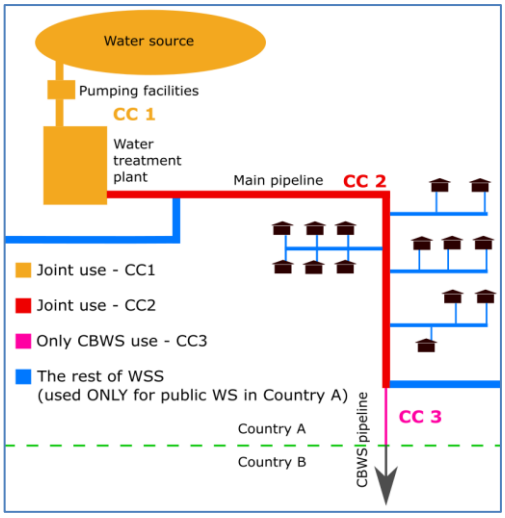


Table *26* shows the data regarding the quantities supplied from the observed system. It can be seen from the table that relatively small quantity (less than quarter of a million m^3) of water was delivered from the WSS (compared to other observed cases of WSS involved in CBWS) of which less than 10 percent represented quantity for CBWS.

Table *27* shows the variable costs related to CBWS. The largest amount is accounted for by labour costs. Surprisingly, there are no costs of material reported for the CBWS.

Table 27: Input data (variable costs) for CBWS - case of water utility of Neum

3. Total Variable Costs in EUR per Reference Year

Cost centre Cost centre description	CC1 Gabela - water source, pumping facilities, water treatment plant	CC2 Main pipeline-Gabela-Neum	CC3 Dubrovačko primorje - CBWS pipeline, water meter
electricity costs	*5.650,45*	*43.061,26*	*0,00*
costs of material (provide attachement) - due dilligence	*0,00*	*0,00*	*0,00*
costs of services	*12.017,86*	*36.053,58*	*5.879,86*
labour costs	*29.589,87*	*77.792,50*	*0,00*
other variable costs	*0,00*	*0,00*	*0,00*
Total variable costs	**47.258,18**	**156.907,34**	**5.879,86**
Variable cost coefficients	0,08	0,08	1,00
Variable costs of CBWS	**3.780,65**	**12.552,59**	**5.879,86**

4. Calculaton of Fixed Cost Coefficient

Agreed annual amount for CBWS (m3)	*473.000*

Cost centre Cost centre description	CC1 Gabela - water source, pumping facilities, water treatment plant	CC2 Main pipeline - Gabela-Neum	CC3 Dubrovačko primorje - CBWS pipeline, water meter
Design capacity (m3)	*4.700.000*	*7.250.000*	*473.000*

Table *28* shows the other costs which in this case equal zero. The depreciation amounts in case of equipment equal zero, suggesting the part of pipeline has been fully depreciated. The agreed annual amount of water for CBWS compared to design capacity of the WSS is relatively small. Thus approximately 10 percent of fixed costs are allocated to CBWS.

Table 28: Input data (other costs and fixed costs) for CBWS - case of water utility of Neum

5. OTHER COSTS (e.g. Legal services handling for CB issues)

Other costs	Costs (EUR per year)
Description1 + provide attachments	0
Description2 + provide attachments	0
Other costs of CBWS	0

6.A METHOD 1: Infrastructure Depreciation
Total Fixed Costs in EUR per Reference Year

(table continues)

(continued)

Fixed costs (EUR)	CC1	CC2	CC3
Depreciation - facilities provide methodology (attachement)	*24.972,88*	*74.918,64*	*0,00*
Depreciation - equipment	*0,00*	*0,00*	*0,00*
Other fixed costs	*0,00*	*0,00*	*0,00*
Total fixed costs	**24.972,88**	**74.918,64**	**0,00**
Fixed costs allocation coefficient	0,10	0,07	1,00
Fixed costs of CBWS	**2.513,23**	**4.887,80**	**0,00**

Table *29* represents the calculated cost price for CBWS. The cost price is higher than existing price for wholesale or CBWS. As explained by FB 13 (Komunalno Neum), the inserted data are not exact but represent the best possible estimations.

Table 29: Calculated cost price for CBWS - case of water utility of Neum

Calculation of Water Price (Cost - EUR per m3)

	CC1	CC2	CC3	Costs of CBWS	Costs (EUR per m3)	Costs (EUR per month*)	
Variable costs of CBWS	3.780,65	12.552,59	5.879,86	22.213,10	1,30		
Fixed costs of CBWS	2.513,23	4.887,80	0,00	7.401,02	0,43	616,75	**
Other costs of CBWS				0,00	0,00	0,00	
				29.614,13	1,73		

* Accounting period is done per month

**IMPORTANT NOTE: Fixed costs of CBWS per m3 is only informative. It should be noted that Fixed costs should be charged per accounting period.

6.3 Analysis of Case Study: CB WSS Buzet (Croatia) to Koper (Slovenia)

Information regarding the case of CBWS to Slovenia was provided by FB 7 (Istarski vodovod Buzet).

Table 30: Input data (quantities) for CBWS - case of water utility of Istria

1. CURRENCY

In case your national currency is not EUR, add Exchange rate and Date.		
National currency (HRK)	**Exchange rate (1 EUR = HRK)**	**Date**
EUR	*7,48*	*4.5.2016.*

2. Calculation of Variable Cost Coefficient

(table continues)

(continued)

Reference Year:	2015
OBSERVED WATER SUPPLY SYSTEM:	Gradole
Quantities of delivered water (m3)	Quantity water delivered (m3)
WSS - Public and cross border	**6.027.922**
Public water supply - supplier's end users	5.460.644
Cross-border water supply	567.278

Variable costs allocation coefficient - part of WSS use in joint use (in reference year)	0,09
Variable costs allocation coefficient - only CBWS use	1

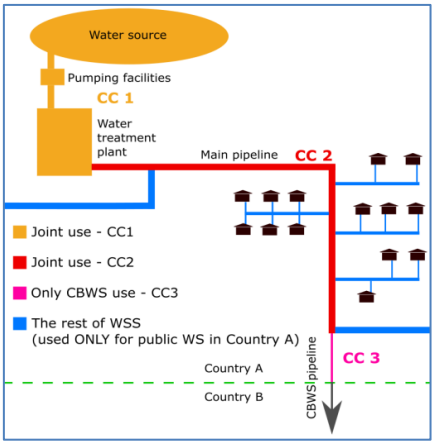


Table *30* includes information about quantities delivered from the observed system in the case of CBWS. The total quantity of water delivered amounts to approximately 6 mio m^3, of which almost 10 percent represents CBWS quantity.

The variable costs related to CBWS are presented in *Table 31*. It can be seen from the table that the largest part of costs represents the electricity and labour costs. The latter are relatively high compared to the labour costs in other observed cases, especially those that can be related to the main pipeline (CC2). There are also other variable costs included which according to FB 7 refer to: costs of the concession fee, financial costs, cost of value adjustment.

Table 31: Input data (variable costs) for cross-border water supply - case of water utility of Istria

3. Total Variable Costs in EUR per Reference Year

Cost centre Cost centre description	CC1 Example - water source, pumping facilities, water treatment plant	CC2 Example - main pipeline	CC3 Example - CBWS pipeline, water meter	CC4 [add description]	CC5 [add description]
electricity costs	789.293,00	87.700,00	0,00	0,00	0,00
costs of material (provide attachement) - due dilligence	13.286,00	134.340,00	0,00	0,00	0,00
costs of services	250.470,00	375.705,00	0,00	0,00	0,00
labour costs	625.660,00	1.459.873,00	0,00	0,00	0,00
other variable costs	24.280,00	56.654,00	0,00	0,00	0,00
Total variable costs	**1.702.989,00**	**2.114.272,00**	**0,00**	**0,00**	**0,00**
Variable cost coefficients	0,09	0,09			
Variable costs of CBWS	**153.269,01**	**190.284,48**	**0,00**	**0,00**	**0,00**

4. Calculaton of Fixed Cost Coefficient

(table continues)

(continued)

Agreed annual amount for CBWS (m3)	*500.000*

Cost centre Cost centre description	CC1 Example - water source, pumping facilities, water treatment plant	CC2 Example - main pipeline	CC3 Example - CBWS pipeline, water meter	CC4 [add description]	CC5 [add description]
Design capacity (m3)	*34.000.000*	*30.000.000*	*0*	*0*	*0*
Fixed costs allocation coefficient	0,01	0,02	0	0	0

Table *32* includes other costs and fixed costs of CBWS. The agreed annual amount of CBWS relatively low compared to the design capacity (similarly as in the case of Niš). In the case of FB 7 (water utility of Istria) this could be explained by high seasonal demand in summer due to tourism.

Table 32: Input data (other costs and fixed costs) for cross-border water supply - case of water utility of Istria

5. OTHER COSTS (e.g. Legal services handling for CB issues)

Other costs	Costs (EUR per year)
Description1 + provide attachments	2000
Description2 + provide attachments	0
Other costs of CBWS	2000

6.A METHOD 1: Infrastructure Depreciation
Total Fixed Costs in EUR per Reference Year

Fixed costs (EUR)	CC1	CC2	CC3	CC4	CC5
Depreciation - facilities provide methodology (attachement)	*415.736,00*	*1.151.937,00*	*0,00*	*0,00*	*0,00*
Depreciation - equipment	*103.943,00*	*60.628,00*	*0,00*	*0,00*	*0,00*
Other fixed costs	*500.000,00*	*96.172,00*	*0,00*	*0,00*	*0,00*
Total fixed costs	**1.019.679,00**	**1.308.737,00**	**0,00**	**0,00**	**0,00**
Fixed costs allocation coefficient	0,01	0,02	0,00	0,00	0,00
Fixed costs of CBWS	**14.995,28**	**21.812,28**	**0,00**	**0,00**	**0,00**

There are also other fixed costs which are according to FB 7: cost of water meter reading, cost of data processing and delivery of invoices, cost of calibration and repair of water meter, cost of current maintenance and investment (municipal water structures), cost of regular maintenance of functional correctness (municipal water structures), cost of testing water and maintenance safety of water.

Table 33: Calculated cost price for cross-border water supply - case of water utility of Istria

Calculation of Water Price (Cost - EUR per m3)

	CC1	CC2	CC3	CC4	CC5	Costs of CBWS	Costs (EUR per m3)	Costs (EUR per month*)
Variable costs of CBWS	153.269,01	190.284,48	0,00	0,00	0,00	343.553,49	0,61	
Fixed costs of CBWS	14.995,28	21.812,28	0,00	0,00	0,00	36.807,56	0,06	3.067,30 **
Other costs of CBWS						2.000,00	0,00	166,67
					Total sum of costs	382.361,05	0,67	

* Accounting period is done per month

**IMPORTANT NOTE: Fixed costs of CBWS per m3 is only informative. It should be noted that Fixed costs should be charged per accounting period.

Table 33 shows the calculated cost price for CBWS. The calculated cost price (variable part) is slightly higher to the existing wholesale (CBWS) price (0,58 € per m^3). At this point it has to be mentioned again that the calculations are very rough and represent only one of the possible approaches. Furthermore, all cost items included in the calculation should be clearly defined and agreed by both parties (due diligence).

Table 34 includes the fixed costs and the calculated cost price for CBWS according to second method - capital requirements.

Table 34: Calculated cost price for cross-border water supply - case of water utility of Istria (II)

6.B METHOD 2: Investment according to capital requirements (agreed investment plans)
Total Fixed Costs in EUR per Reference Year

Fixed costs (EUR)	CC1	CC2	CC3	CC4	CC5
Capital improvements	*200.000,00*	*500.000,00*	*0,00*	*0,00*	*0,00*
Total fixed costs	**200.000,00**	**500.000,00**	**0,00**	**0,00**	**0,00**
Fixed costs allocation coefficient	0,01	0,02	0,00	0,00	0,00
Fixed costs of CBWS	**2.941,18**	**8.333,33**	**0,00**	**0,00**	**0,00**

Calculation of Water Price (Cost - EUR per m3)

(table continues)

(continued)

	CC1	CC2	CC3	CC4	CC5	Costs of CBWS	Costs (EUR per m3)	Costs (EUR per month*)
Variable costs of CBWS	153.269,01	190.284,48	0,00	0,00	0,00	343.553,49	0,61	
Fixed costs of CBWS	2.941,18	8.333,33	0,00	0,00	0,00	11.274,51	0,02	939,54 **
Other costs of CBWS						2.000,00	0,00	166,67
					Total sum of costs	356.828,00	0,63	

* Accounting period is done per month

**IMPORTANT NOTE: Fixed costs of CBWS per m3 is only informative. It should be noted that Fixed costs should be charged per accounting period.

As explained by FB 7, in case of water utility of Istria, the accounting is not organized in a way that the information regarding the costs corresponding to cost centres as proposed in the model could be presented. Thus in this case, the inserted data represent only the estimations.

It was also explained that the capacity of water treatment plant and pipeline was dimensioned for the seasonal consumption. Beside, according to FB 7, the entire water supply system managed by water utility of Istria is relatively large and specific due to the geographical space in which it operates and that the systems (sources) are connected, thus defining the costs centres represents a demanding task.

6.4 Brief overview of the situation regarding the reported data in the model

Table 35 shows an overview of the situation regarding the before presented data provided by partners. Table includes the most common issues faced by partners when fulfilling the model. The situation regarding the data in individual categories of the model is marked with green, orange and red coloured circles. As it can be seen from the table, for the calculation of variable coefficient, utilities were not confronted by any challenges since the data regarding the quantities of delivered water to its public water suppliers and CBWS should be general available.

The situation was more complicated when information regarding the costs related to individual cost centres was required. Utilities that don't use separate accounting or

don't have accounting organized in a way that corresponds or is similar to the proposed model faced certain challenges with estimating costs.

Table 35: Overview of the situation regarding the data for pricing model for the reported cases

	VIK Nova Gorica	NIVOS - CR WSS Niš	Komunalno Neum	Istarski vodovod Buzet
Calculation of Variable Cost Coefficient	No problems regarding the data on quantities delivered from the WSS to public water supply and CBWS	No problems regarding the data on quantities delivered from the WSS to public water supply and CBWS	No problems regarding the data on quantities delivered from the WSS to public water supply and CBWS	No problems regarding the data on quantities delivered from the WSS to public water supply and CBWS
Total Variable Costs in EUR per Reference Year	More detailed data (explanations) on individual cost categories	More detailed data (explanations) on individual cost categories	More detailed data (explanations) on individual cost categories	Challenges by identifying/estimating data for individual cost centres More detailed data (explanations) on individual cost categories
Calculaton of Fixed Cost Coefficient		Relatively large discrepancies between system's design capacity and agreed quantities for CBWS	Relatively large discrepancies between system's design capacity and agreed quantities for CBWS	Relatively large discrepancies between system's design capacity and agreed quantities for CBWS
Other costs	No data reported	description missing	No data reported	description missing
Total Fixed Costs in EUR per Reference Year METHOD 1: Infrastructure Depreciation	More detailed data (explanations) on individual cost categories	More detailed data (explanations) on individual cost categories	More detailed data (explanations) on individual cost categories	Challenges by identifying/estimating data for individual cost centres More detailed data (explanations) on individual cost categories

Legend	Situation regarding the reported data from partners
	Reported data complete/no problems, challenges
	Data partially reported/some minor problems, challenges
	No data reported/greater problems, challenges

The calculation of fixed costs coefficient didn't represent a major issue, but a relatively large discrepancy between the system's design capacity and agreed quantity for CBWS could be observed. In some cases, the large design capacities were explained by being designed based on projections of growing population and larger demands for water or by high seasonal demand (tourism). This issue should also be further addressed.

Other costs were not reported in all cases. Regarding all costs – cost categories should be accompanied by more detailed information or explanation (due diligence necessary in case of CBWS). Similar as in the case of variable costs, there were certain challenges in estimating fixed costs related with the observed part of the WSS.

6.5 General comments from Italian partners

Hereinafter are presented the comments of Italian partners regarding the pricing model (UL FGG, 2016).

General Overview

DRINKADRIA Italian Partners agree with the idea of defining the wholesale tariff based on the "full cost recovery" principle, including both operating costs and capital costs, consistent with the guidelines laid down at national level by the Italian Regulatory Authority for Electricity Gas and Water.

The general approach, consisting in identifying different cost centers through which the system as a whole can be outlined, is also shared.

According to the proposed model, as far as concerns the cost centers corresponding to part of the WSS used to supply water both to supplier's end users and to bulk water recipient (joint use), variable costs allocation is based on the ratio between wholesale (CBWS) and total supplied water.

With regard to fixed costs, the allocation coefficient is based on the ratio between the agreed wholesale supply (CBWS) and the "design capacity" associated to each part of the system (corresponding to a given cost center).

It is important to put in evidence that the proposed mode *"has proven to be adequate, but serves only as a starting point for negotiations of the final price of cross border supplied drinking water"*, as already reported in the drafted WP5 brochure.

Strenghts

The computational tool developed by the University of Ljubljana (FB5) for the definition of the unit price to be applied to bulk water supplies across borders (CBWS) is well built, easy to use and of secure methodological interest.

Especially referring to the assessment and fair allocation of capital costs, the tool is designed in order to provide realistic and effective results in case of construction of a new system designed since its origin to guarantee cross-border water supply.

In such case the investment to be made will be properly calibrated on the basis of the annual volume estimates of wholesale supplied water, so that the corresponding rate will ensure coverage of the capital costs for a share calculated based on the ratio between "agreed volumes" in the contract and the whole system "design capacity".

It should be emphasized that the proposed model and the consequent computational tool final purpose is and must remain that to provide a general explanation of the applied methodology and a broad indication of the fair price to be considered in the negotiations relating CBWS.

Without claiming to be in any way binding for the contracting parts, the proposed pricing model can be seen as draft proposal of technical protocol concerning CBWS management addressed to competent Authorities on national (e.g. AEEGSI) and international level (e.g. bilateral commissions for water management).

Weak points

Given the need for flexibility and ease of use in different situations, the computational tool can't obviously take into account the peculiarities characterizing each specific system. Specificities must necessarily be analysed in details and make it necessary sharing further information and data and *"ad hoc"* agreements between the parties.

Necessary data for the application of the model are very often not directly or easily available, making it necessary a re-adaptation of the proposed formulas. In the absence of an adequate and common system of accounting separation, the budget

breakdown and costs allocation in the different cost centers is always questionable. No drivers, suggestions or guidelines concerning the criteria according to which allocating the common costs are provided. Transparency of business partners, to be considered very important as it also enables the implementation of control over the incurred costs can't be guaranteed. There is no mention of evaluations based on benchmarking systems, with the aim of ensuring management efficiency, which is a crucial point in water management regulation and drinking water supply economics models.

The proposed model substantially tends to ensure the coverage of total declared costs with no evaluation about the compatibility of the tariff quantification with and adherence to the latest binding methods issued by the competent national authorities (e.g. MTI-2, recently issued by AEEGSI in Italy), mainly focused on accountability and cost management, in order to minimize the costs incurred by each operator having reflections on the applied charges.

Each single CBWSS, especially the existing ones, has a past history of agreements, compromises, decisions taken in and related to a specific historical and socio-political context, based on evaluations that probably still need to be taken into account when updating the price of the supply. In the specific case of existing CBWS and wholesale transaction systems, the proposed allocation method of capital costs does not appear reasonable, and is not applicable. Very often, in fact, the agreed annual amount of wholesale water is the result of political agreements which do not take into account actual assets conditions. Also very often the design capacity, in terms of flow rates, of the involved mains had been defined regardless of the wholesale supply, maybe activated later on.

In the above mentioned cases, the proposed model is likely to cause a distortion of the price to be considered "fair" and appropriate correction mechanisms are to be defined "ad hoc" and agreed between the parties.

Further considerations

The model does not take into account water losses. Losses on the network are heavily affected by water pressure in the pipes and its variations. The supplier will necessarily have to maintain higher flow and pressure levels, in order to allow adequate supply to the recipient, with predictable effects on losses in the involved part of the network. With the proposed model the cost of the losses entirely lies on the supplier and has no reflection on the wholesale charge. This inevitably leads to an unfair costs allocation

between the parties. It is therefore suggested the introduction of a specific correction coefficient.

With regards to the environmental costs associated with the abstraction of water, to be taken into account in the tariff definition, according to Dir. 60/2000/EC, they may fall under "other costs", and should be allocated the same way as variable costs.

6.6 General conclusions regarding the pricing model

Regarding the pricing model certain points were mentioned at the Technical meeting (held on May 11, 2016 in Ljubljana). These included the importance for parties involved in CBWS to first harmonize all the definitions (e.g. what is resource cost, environmental cost, fixed cost, etc.) in order to avoid misunderstandings. Also for every part of the costs or cost items, descriptors should be written. Due to specific conditions ruling the CBWS, bilateral commissions should be established and involved in the negotiations between parties (authorised to decide on specific tasks). They should also agree and confirm the methodologies and recommendations that should be used in CBWS.

As it was already mentioned, the model can be applied in three different situations depending on how CBWS is organized (from technical perspective). For example, (1) in situation when the water source is close to country's (municipality's) border and there is a separate pipeline that connects the source and delivery point. Second situation (2), the "CBWS branch/junction" of the pipeline is located after the network which supplies the users (residents). Thus, the water from the source has to "cross" entire network until it is finally supplied cross border. The third situation (3), which is also the situation in observed DrinkAdria cases is that "CBWS branch/junction" is located somewhere "in the middle" of the WSS and thus after water is abstracted and treated it is first delivered to some users and then supplied cross border and also to other users that are connected after "CBWS branch/junction". Obviously, the most demanding is the application in the third case, due to the complexity related to identifying and "separating" the costs of CBWS (this is especially challenging in the case of water losses).

Regarding the **sharing of the data between parties** it is strongly recommended that the due diligence principle is used to increase transparency, in order for the recipient to have an insight and possibility of validation of the costs related to the part of WSS used in CBWS (costs applicable in CBWS) and to check the definitions of cost centres.

Regarding the **fixed costs** (e.g. depreciation, maintenance, investments), there are two “ways” for the calculation: (1) depreciation of the WSS infrastructure (usually involves depreciation plan) and (2) planned/performed investments (investments according to capital requirements. The latter represents a more “real life” approach. The accounting mechanisms should be observed but the plan should be made according to scenario of repair and replacement. Investments should be paid one time by recipient or the amount should be distributed over longer period of time. Before agreeing on costs, it is important to see the technical details (repair and replace principle).

Regarding the **environmental costs**, it was proposed that they should be defined as damage avoidance and damage restoration costs. In case of CBWS only damage avoidance costs are applicable. They should be identified and included in direct costs. In some countries, there is a “fee” on abstraction of water from the water source. The question that arises regarding such fee is if it represents a general taxation principal of a country to raise revenue (the use of which is not specified) or is the revenue used for the restoration of damage made to the source – meaning that it is actually a resource cost.

According to OECD (1997) the environmental costs are costs connected with the actual or potential deterioration of natural assets due to economic activities. By definition these costs include damages to humans, ecosystems and resources (Bickel and Friedrich, 2005). The lack of information on interactions in the ecological system leads to limited and biased results, due to high complexity of ecosystems not to mention the irreversibility of damages once a critical threshold is reached (Pindyck, 2000).

Beyond these limitations assessing use values through monetary indicators is relatively easy when they are connected with market prices but become significantly challenging in the case of non-market, long term or hidden benefits. To estimate non-monetary benefits three types of valuation methods can be used (Barbier et al, 2009):

- Cost-based methods: Methods based on costs estimation for preservation of environmental goods or services.
- Methods based on revealed preferences including methods such as hedonic pricing or different behavioural models based on estimation of the intrinsic value of specific activities.

As being pointed by Feuillette et al (2016) and Heinzerling (2011), the stated preference methods represent the only way to capture non-use values in monetary values in order to assess how much people are willing to pay for conserving a component of the environment from which they do not benefit but has value by virtue of people expressing intrinsic value to its existence. To facilitate the implementation of these conventional valuation methods, the benefits transfer method is increasingly used in order to carry out cost benefit analyses (CBA). Some authors, however, argue that their actual utilization remains limited in practice (Laurans et al, 2013, Nyborg, 2014). Feuilette et al (2016) provide a concrete example of economic valuations applied to an environmental policy in France. High variation in estimates creates areas of uncertainty, which enables many different interpretations that can be used by stakeholders with vested interests. As being pointed by Thompson (2002) this became the reality in USA. Therefore, the future research will probably highlight the non-monetary assessment of non-market benefits using quantitative and qualitative indicators and analysis based on expert opinion (Blancher et al, 2013). At the end the final decision is the political one.

Resource costs refer to foregone profits (benefits) of alternative use of water (competitive water users). If the water demand for all users is covered adequately, the resource cost is zero. The resource costs start to increase in the case when water shortages occur for certain water users. In case that the sum of water withdrawal of competitive users (e.g. industry, agriculture, public water supply, etc.) exceeds the water resource availability (withdrawal exceeds renewal of water quantity in the resource), resource costs should not be applied for drinking water as it should have priority over other uses. Thus, question regarding the implementation of resource cost should not be related to the use of water but only whether enough water is available or not, meaning if withdrawal of water does not exceed renewal of water quantity in the resource, there should be not resource cost. Where resource costs are applicable parties and bilateral commissions should negotiate them by specified methodology with having the possibility to review the environmental and resource cost applicability changes through the years.

Regarding the **water losses**, water balances should be developed with and without bulk water (CBWS) – to stop bulk water supply and check the water balance for that condition to identify the real effect of bulk water supply in water losses percentage in the network (through simulation). This would increase recipients understanding that buying water from supplier negatively affects supplier's customers. If water losses are not included in pricing policy for supplier's customers, then there should also not be included in CBWS pricing. Thus, to identify the system's losses, scientific tools should

be used, concepts defined to define various water balance sheets (e.g. with and without bulk water, etc.). To assign the CBWS distribution system specific losses optimal distribution of the correction factors regarding water losses for the specific DMA (district metering area) should be done.

When we discuss different pricing practices around the globe one should not forget that the most important characteristics of the water sector is its long lasting dependence on governmental funding either through financing the public infrastructure or price subsidies to the customers. These indicates that the participation of the service users on the recovery of water costs is being reduced substantially and is not in line with Article 9.1 of WFD that determines the pricing policy of "*adequate contribution of the different water uses*."

Conclusion

The price of drinking water supply represents a challenging subject within the national framework since the price of drinking water has to be socially, politically and economically accepted. By considering the drinking water supply in cross-border situation, this challenge becomes even greater.

Regarding the price for water supply service, the individual existing price structures in countries (regions) participating in the project, were presented (with prices for bulk water supply) in order to find common elements.

As could be seen from the analysis, approaches vary (depending on the national frameworks). The current cross-border drinking water supply agreements are very simplified (i.e. based on simple and short contracts). As it could be observed in some cases the wholesale prices (cross-regional or cross-border) are defined based on prices for end users of public water utility.

The price of the CBWS sometimes includes also resource fees (taxes) which are usually aimed at covering the costs related to protection and development of water resources. Clear methodology for the resource fee (tax) is usually not available or is simply defined by a government decree. The issue with fees (taxes) in CBWS is that usually their implementation lacks a clear argumentation and methodology.

Bulk water supply agreements are relatively simplified. Beside a clearly defined approach for wholesale water rates also other elements should be considered, for example limitation or abundancy of water resources, minimum and maximum consumption requirements, seasonal changes in water requirements and emergency water requirements and alternative water supply in the consumption side, etc. Certain aspects (water flow, water quality, water supply volume, measurement, etc.) should be defined.

In order to ensure a fair price for drinking water for CBWS the price should cover the full economic cost of the water supply with the emphasis on proper cost allocation. The latter should be implemented in a way that CBWS service is allocated the specific (exact) costs that occur in a specific part of WSS system. The issue is that average cost approach (for the entire system or all systems) which is usually applied in public water supply cannot be practiced in order to avoid cross-subsidization. Thus, a separate accounting should be enabled to support the distribution of the costs of public water supply and costs of CBWS service.

All these aspects should be considered for a transparent cross-border water supply and to provide a basis for a fair bulk water supply agreement and above all a sustainable cross-border drinking water supply.

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Appendix