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Urban water services public infrastructure projects: Turning the high level of the NRW into an attractive financing opportunity using the PBSC tool

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ABSTRACT

Today, the public sector worldwide is facing many difficulties in financing several public infrastructure projects. Therefore, the public-private partnerships (PPPs) became a very popular project-providing-tool. One of the sectors where this tool is being rapidly expanding today is the environmental sector. This sector is very important for the public health and the protection of the environment (especially projects concerning water supply, sanitation and solid waste management). Such projects are being implemented through PPPs all over the world. These projects have to do with the reduction of the non revenue water (NRW) and the provision of better services regarding water supply and sanitation. The present paper is a discussion paper about successful and not successful examples of PPPs implementation in the environmental sector. After introducing the basic principals of PPP projects, several problems concerning their implementation are discussed in this paper. Although the PPPs are implemented in big projects today, the challenge is their implementation in small-medium projects. Finally, a number of key factors are being identified and analysed regarding the performance based service contracts (PBSC), being the latest introduced tool regarding the implementation of PPP projects concerning the urban water services sector.

Keywords: Public-private partnership; Performance based service contracts

1. Introduction

Public-private partnership (PPP) projects are types of cooperation projects between the public and the private sector, to finance, manufacture, renovate, manage and maintenance public infrastructure and provide services, in those sectors of national economy, where the market liberation is either impossible or undesirable. PPPs are actually partnerships that bring public and private sectors together in long term partnership to carry out a project for mutual benefit. Through the PPP contracts the public and the private sector collaborate in a long term partnership resulting in their mutual benefit. The main reasons why the public sector is turning to PPP contracts are: (a) his funds are limited or redirected to other priorities; (b) the private sector can provide the same work cheaper, or a better result with the same budget; and (c) the private sector is a better manager and takes better account of the risks involved. The outcomes are that the provided services are improved and the assets are being better utilized through PP partnerships. PPPs can deliver services in a more cost-effective way by taking advantage of private sector innovation, experience and flexibility. Finally, the money savings can then be used to fund other needed public services. This paper is a discussion and review paper trying to present successful and unsuccessful ex-

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amples of PPP contracts, especially in the environmental sector. At the same time the PBSCs are discussed focusing on some of their successful implementation case studies around the world.

Today PPP projects are mostly large-scale infrastructure projects or services. The challenge is to expand this product providing tool to medium-scale projects [1–3]. A large-scale project is defined as having a very high construction cost and a very long construction period (e.g. 6–10 years), the revenues' inflow starts only after the project is completed and finally the project financing will only succeed with the participation of both public and private sector, as the financing by only the Public or the Private is either unaffordable or unprofitable [4].

2. PPP types

The PPP types vary according to the size of risk included and its distribution among the partners; the required degree of each partner's specialization in contracts negotiations; the potential consequences for taxpayers; and finally the financing details. There are three basic PPP types: *Concession, Joint Venture and Hybrid*. Their common contents are the long-term legitimate relationship, the full or partial private financing in complex patterns and the presupposition that the main role of the private sector partner is to assure the project financial parameters. The public sector's competence is to assure the public interest determining goals quality and pricing policy, the risk transfer from the public to the private sector partners, combining their best capabilities for mutual benefit.

In *Concession*, the private partner is in charge of the project exploitation, maintenance and management for the whole concession period; is responsible for every construction/renovation/expansion; is self-financed during the concession period; is responsible for the provided services; determines their value and directly collects the money from the services users; and finally may initially pay an amount of money to the state. On the other hand the public sector is responsible for the configuration of the performance criteria, reassures that the above criteria are respected by the private sector, sets the prices and the quality and finally holds the ownership of the public assets. The concession period (which lasts more than 25 years) is based on the contract requirements. Concession is the most common PPP type/category in everyday life. In *Joint Venture*, the partners are equally responsible and owners of the provided services/projects. Joint venture represents an alternative to the pure privatisation, as private sector participation is less than 100%. The partners form a new company or they are co-owners of an existing one that is independent from the public sector. The public sector represents the final regulator and an active shareholder of the company, can participate in the profits distribution of the project, and reassures the greater political efforts acceptance, while the private sector often takes the responsibility to deal with everyday project management. The *Hybrid* PPP forms (BOT, OM, OMM) are the following.

During the last 25 years of PPP projects implementation experience on international level, various PPP forms have been developed. Their differences mainly derive from the "job allocation" between the public and the private partner, the distribution of the risks among them and who finally owns the property of the assets-service (Tables 1–3). The most common PPP forms are the BOT (Build–Operate–Transfer), the BOOT (Build–Own–Operate–Transfer), the DBFO (Design–Build–Finance–Operate), the BTO (Build–Transfer–Operate), the BOO (Build–Own–Operate), the BBO (Buy–Build–Operate), the LRO (Lease–Rehabilitate–Operate), the BOLT (Build–Own–Lease–Transfer) the OM (Operation & Maintenance Private Services Contract) and the OMM (Operation, Maintenance & Management Private Services Contract). In BOTs (or BOOT) the project belongs to the public (or the private), the private partner builds, maintains and operates the project, there is a predefined contract period by the end of which the private partner transfers the project operation (and the ownership) to the state and finally the private partner is responsible for a part or the whole of the project financing. In DBFOs the private partner designs, builds, maintains and operates the project, while is responsible for the whole of the project financing, there is a predefined management period, the state pays the private partner for the provided services during the contracting period and finally the private partner transfers the ownership to the state (this is the common contracting model for infrastructure and public assets development, when the commercial exploitation potentials are initially unknown and limited). In BTOs the private partner designs, builds, maintains and operates the project, is responsible for the whole of the project financing, after the project completion, its ownership is transferred to the state and finally there is a predefined leasing period. In BOOs the project is of social character and belongs to public entities while the private partner designs, builds, maintains and operates the project and is responsible for the whole of the project financing. Finally, there is a predefined long operation period. In BBOs the state sells existing public utilities to the private partner, aiming at further investments (renovation, expanding) on these utilities, the private partner is responsible for the whole of the project financing and operates the project in the form of a state supervised profit-making public utility. In LROs the state owns the project, while the private partner rents existing utilities from the state, is responsible for the whole of the project financing, is responsible for the project operation and exploitation. Finally, there is a predefined leasing period. In BOLTs the private partner is responsible for project financing, rents the project from the state by leasing, while the state regularly pays the private sector in order the project ownership to be

Table 1
Alternative forms of PPPs (World Bank, 1997)

Choice	Financing	Operation–Maintenance	Commercial risk	Property owner	Duration (y)
Service contract	Public	Public & private	Public	Public	1–2
Management contract	Public	Private	Public	Public	3–5
Concession	Private	Private	Private	Public	25–30
PFI/DBFO	Private	Private	Public & private	Public & private	20–30
Privatisation	Private	Private	Private	Public & private	—

Table 2
Roles allocation between public & private partners [1,5]

Project phases	Traditional way	PPPs
Project planning and specifications' determination	Public	Public
Preparation of the necessary studies	Public	Private
Construction	Public	Private
Financing	Public	Private
Operation	Public	Private
Provided services' responsibility	Public	Private in the public

Table 3
Risks and their distribution [1,5]

Base risks	Background risks	Expenditure risks (construction, maintenance, operation)	Implementation methods	Risk transfer degree (Public → Private)
Technical Economical Financial Management Income	Political, legal, regulatory, monetary, macro-economic, force majored	Preparation, social acceptance, planning, construction, repair, replacement, management, technical operational risks	Traditional Outsourcing PPP Privatisation	Min ⇩ Max

gradually transferred to the state, as at the end of the contracting period the state owns the project or it buys it in a predefined (in the leasing contract) price. Finally, during the leasing period the public or the private partner is in charge of the project operation. In OMs the state owns the project, assigns the private partner to operate and maintain the project but holds the ownership and the management. Finally, in OMMs there is an integrated services contract, where the state owns the project and assigns the private partner to operate, maintain and manage the project while holds the ownership.

While there are enough differences among the various PPP forms, all of them maintain a least common content with the following elements: (a) long term relationship; (b) total or partial private financing, often with complex forms; (c) private sector primary role ensuring the economic parameters of the project in contrast to the public sector role ensuring the public interest (determining the goals, the quality and the pricing policy); (d) risks allocation between the public and the private sector, to whom the management of precarious factors is being moved to. In the traditional "public projects" the management of these factors burdens the public sector [1,4,5].

3. PPPs implementation: Succesful and failed cases

3.1. PPP successful cases

Although many PPP cases around the world have been successful, there are others that failed. In Sao Paolo the water utility has undergone a big reform using outsourcing. In 1995 positive results were reported such as the increase in water supply coverage (from 84% to 91%) and the reduction of operating costs by 45% [6]. Another successful example of management delegation of water supply, sanitation and electricity to the private sector is

the case of Casablanca, Morocco [7]. Positive results reported [7] consist of better customer service, an increase of more than 20% of the population served with water and electricity, and a saving of 24 million m^3 of water per year (which corresponds to the water supply of a city with a population of 700,000 inhabitants). The key success factor is the trust developed between the partners (customers, the government sector and the private operator) [7]. Al-Jayyousi [8] sets out the reasons of the beneficial involvement of the private sector in water services: (a) private utilities want to reduce losses because they lose money; (b) private utilities can utilize better international experience and know-how; (c) private utilities work harder to prove that privatization is not a bad thing; and (d) for governments it is more easy to criticize and control the private operator. Lee [9] states that private water utilities provided water services to 38% of the total population in China in 2008. At the same time the expansion of PPP projects in urban water services increasingly accelerates. Seppala et al. [10] argue that private sector participation in the provision of water services "is definitely necessary and should be encouraged". They argue that both public and private sector should have distinct roles in the partnership. The public sector should maintain a strong political commitment to the service and integrate environmental considerations in the planning and decision-making process. Private partners should provide skills, management expertise and financing for utility investment needs. Kingdom et al. [11] suggested that to help facilitate PPPs, there is a need to provide potential partners with reliable information. One way of providing information is infrastructure asset management through a comprehensive asset management plan (AMP). Seppala et al. [10] argue that privatization in the form of private ownership and management of water utilities may not be the best solution. A successful model is the Nordic countries one, where the ownership is maintained by the public sector and the municipalities run the utilities [10]. In Finland PPPs are formed as follows: municipal water utilities manage the operations and the private sector provides support services [10]. Seppala et al. [10] conclude that it is public sector responsibility to provide water services. The private sector can interfere in the accomplishment of specific tasks. They argue that it is not important the service being public or private, but it is important the utility to fulfill its objectives [10]. Afeikhena Jerome from the Johannesburg-based National Institute for Economic Policy (NIEP) mentions that "the results of water privatisation present a mixed picture with some improvements in the reliability and quality of services and population served, but instances of much higher water charges and bouts of public opposition leading to cancelled schemes" [12]. World Bank research shows several cases where more people received basic services following private participation in water and sanitation provision in developing countries [13].

3.2. PPP failures

One major PPP infrastructure failure was Metronet (London's underground) [14]. Vining and Boardman [14] suggested eight rules that the governments should follow based on the reasons of the Metronet failure. These include: (1) establishment of a jurisdictional PPP institution; (2) separation of the analysis, evaluation, contracting/administrating and oversight agencies; (3) assurance that the bidding process is reasonably competitive; (4) awareness of projects that exhibit high asset-specificity, are complex or involve high uncertainty and where in-house contract management effectiveness is low; (5) inclusion of standardized, fast, low-cost arbitration procedures in all PPP contracts; (6) avoidance of stand-alone private sector shells with limited equity from the real private sector principles; (7) prohibition to the private sector contractor from selling the contract too early; and (8) have a direct conduit to debt the holders [14]. One of the main failure causes reported in the literature is the appearance of inefficient contracts giving no incentives for good quality services and governments shrinking their regulatory duties [8].

Regarding the water sector, Lee [9] identified a number of risks in the Chinese water market being socio-political, institutional and regulatory, revenue and foreign exchange, and project construction and operation risks. The critical success factors in this case are the institutional platform provided by the authorities and the change of role of the government being a regulator [9]. Prasad [15] argues that there is no guarantee that the private sector participation in the provision of water services will benefit the poor. It is argued that social policies should complement such participation. Prasad [15] states that mixed results have been reported from the private sector participation. In several cases the private sector seems to be no more efficient that the public sector. Al-Jayyousi [8] argues that the unaccounted-for water (UFW) index values in public utilities are low (Singapore case: UFW = 6% in 1996), where UFW values in private utilities are high (UK-all utilities are private: UFW goes up to 38% [16]). In general Al-Jayyousi [8] concludes that ownership status does not matter for the provision of good water services to the people. In terms of performance and water coverage the best utilities are those "that are run as self-sustaining commercial enterprises and accountable to the people".

3.3. PPPs implementation key success factors

Leavitt and Morris [17] argue that in certain cases partnerships are the only way out. These cases involve projects needing an adequate number of resources (both in quantity and quality) in order the project goals to be accomplished [17]. In such cases the question is not which sector can produce better work. Kettl [18] argues that PPPs have expanded very quickly while the public sector could not manage them. He continues by arguing

that first the public sector has to determine how to make the PPPs successful. Such factors include a clear objective, agreement on the risks allocation for the mutual benefit, set of performance standards and unbiased and competitive partners selection process [18]. A number of significant challenges have been raised wishing to conduct successful PPPs [19]. The complexity of such arrangements and the high costs involved should cause governments to take a careful approach to PPPs. They should also recognise that PPPs pose many of the same problems inherent in procurement or privatisation and are not a panacea for development. The principles that underlie PPPs as affordability, cost effectiveness, value for money, transparency and risk management should form part of the way that they approach service delivery in general. Such partnerships are a means towards the goal of better service delivery and improved infrastructure [19].

Table 4
Summary of PPP activity in Europe by country/sector [5]

		Main PPP sectors						Secondary PPP sectors				
	Country	Roads and bridges	Urban (light) railway	Intercity (heavy) railway	Schools	Health and hospitals	Public housing	Airports	Housing	Ports	Public order installations	Water supply and sewage
01	Austria	▲		▲	○	▲	○	○			○	○
02	Belgium	▲	○	○	○			▲	▲			▲
03	Cyprus	▲						•		▲		▲
04	Czech Rep.	▲	○	○	○	○		○	○			•
05	Denmark	▲		▲	▲		○			▲	○	
06	Estonia	○			○	○						
07	Finland	▲	○	○	▲	○	○					○
08	France	►	►	▲	○	▲	▲	▲		▲	▲	►
09	Germany	•	•	•	•	○	▲	○			▲	••
10	Greece	•					○	►				
11	Hungary	•	○		•	▲			○		▲	•
12	Ireland	••	▲		•	▲	○		▲			••
13	Italy	••	•			•	○	▲	○	▲	○	▲
14	Latvia	○							○			
15	Lithuania		○									
16	Luxemburg							○				
17	Malta					▲			○			
18	Netherlands	•		•	▲	○	○		○	○	○	•
19	Poland	▲	○	○			○	○	○	▲		▲
20	Portugal	►	•	○	○	▲		○	○	○	○	•
21	Slovakia	○						○				○
22	Slovenia											•
23	Spain	►	•	○	○	▲	○	○		►		•
24	Sweden	○	○	○		○						
25	UK	►	►		►	►	►	►	►		►	►
26	Bulgaria	○						○				•
27	Romania	•				▲			○			•
28	Turkey	○	○	○				•				•
29	Norway	•		○	▲	▲	○				○	

Source: European Investment Bank, 2008

Legend
○ Discussions ongoing
▲ Projects in procurement
• Many procured projects, some projects closed
•• Substantial number of closed projects
► Substantial number of closed projects, most of them in operation

4. PPP implementation in Europe

4.1. PPP implementation areas across Europe

The main PPP implementation areas in the EU are oil mining and exploitation, natural gas, electric power production and distribution, water recourses management/distribution, telecommunications, road infrastructure, rail infrastructure and finally subway network. While there is an interest in PPPs in all member states, experience of the procurement of PPPs is limited. UK stands out as having the longest and most substantial experience of PPPs.

The progress of countries appears to have more to do with the interest in PPPs, and the political will to promote them shown by individual governments, than any other factor. Some countries have been reviewing the use of PPPs and developing pilot procurements for some time, but with limited results in terms of projects procured and financed. Others, which have only recently adopted PPPs as a valid method of procuring public services, have moved rapidly and have procured pilot projects within relatively short time scales. Table 4 provides a high level summary of PPP activity across Europe by country and sector. Table 5 summarizes two elements of institutional development, which are often associated with the progression of PPPs, the setting up, of one, or more, PPP units at a central government level and the promotion of generic PPP legislation. Of course, there are limitations involved. However, this analysis gives some insight into the efforts made by European governments to develop the 'institutional capacity' and 'enabling environment' for PPPs.

Table 5
Summary of PPP institutional development

	Country	PPP unit	PPP law
01	Austria	***	▬
02	Belgium	*	■
03	Cyprus	▬	▬
04	Czech Rep	**	■■
05	Denmark	**	▬
06	Estonia	*	▬
07	Finland	▬	■
08	France	*	■■
09	Germany	**	■■
10	Greece	***	■■■
11	Hungary	**	■
12	Ireland	***	■■■
13	Italy	**	■
14	Latvia	**	■
15	Lithuania	▬	▬
16	Luxemburg	▬	▬
17	Malta	*	▬
18	Netherlands	***	▬
19	Poland	**	■■
20	Portugal	**	■■
21	Slovakia	▬	▬
22	Slovenia	▬	▬
23	Spain	▬	■■
24	Sweden	▬	▬
25	UK	***	▬
26	Bulgaria	*	■
27	Romania	*	■■
28	Turkey (non EU)	▬	■■■
29	Norway (non EU)	*	▬
30	Slovakia	▬	▬

Legend

PPP unit	*	Need for PPP unit identified and some action taken, or only a regional unit exists
	**	PPP unit in progress (or existing but in a purely consultative capacity)
	***	PPP unit existing (actively involved in PPP promotion)
PPP law	■	Legislation being proposed
	■■	Comprehensive legislation being drafted/some sector specific legislation in place
	■■■	Comprehensive legislation in place

4.2. PPPs in water sector across Europe

During Aqualibrium project a comparative study of national strategies for private sector involvement within the water sector in 14 EU member states has been conducted [20]. The project results showed that private sector participation exists in most European countries. Table 6 shows the trend to private sector involvement in water management in the 14 EU countries. In Luxembourg are there no private companies or PPPs. In England and Wales there is no public management as the water sector has been privatised since 1996. The project results showed that there is an increasing trend for private sector involvement or more concentration (Table 6). The main reason for this trend is water utilities financial concerns. Table 7 shows the urban water management operational status in 19 European countries [21].

One of the Aqualibrium targets was to record the rising issues during the debate on private sector involvements in the EU countries. These issues include: (a) water charges; (b) quality of service; (c) adaptation to the new EU framework directive: and (d) competition [20]. For example, southern European countries argue about resources availability. The debate about private sector involvement in water management varies a lot among EU countries. In some cases there is no debate at all (Luxembourg) or the debate exists only among professionals (e.g. Finland, Sweden and Portugal). Since private participation is already implemented in the water management, there are countries where the debate does not exist at all

Table 6
Water management status trends in EU countries [20]

Trend delegation contracts	Trend to PPP	Concentrate	Maintain public	No variation
Spain	Austria	Denmark	Luxembourg	Finland
France (in water supply the public sector's share is decreasing)	Belgium	Greece	Sweden	England and Wales (private since 1989)
	Ireland	Netherlands		
	Germany			
	Italy			
	Portugal			
	Scotland and Northern Ireland			

Table 7
Urban water management operational status [21]

Countries	Private companies	Public and private companies	Public and decentralised local management	Public
Austria		■		
Finland			■	
Belgium		■		
Germany			■	
Denmark			■	
UK	■			
Luxembourg		■		
Holland				■
Sweden			■	
Poland				■
Estonia				■
Latvia				■
Malta			■	
Spain			■	
Italy			■	
Cyprus				■
France			■	
Greece				■
Portugal		■		

(e.g. Great Britain, Spain and France) (Table 8). A debate in favour of private sector participation exists in Italy, Greece, Belgium, Ireland, Denmark and Germany. The present situation outlines a future trend in most of the EU countries towards increasing private sector participation. The legal framework sets obstacles towards private sector participation in some countries in Northern Europe and the Netherlands. In Luxemburg although the legal framework is favourable towards PPPs there is no such trend recorded so far. Table 9 presents future trends regarding private sector participation. In Greece PPPs are being implemented in the following sectors: defence, port infrastructure, municipal projects, transportation, education, environment, culture, health and housing public services. Table 10 presents the approved PPP projects per region in Greece.

5. The environmental sector

The PPPs idea for the implementation of public projects is very old in Europe and in Greece. The first PPPs in Greece were the projects of ULEN and POWER that constructed and operated initially the water distribution system of Athens and the national distribution network

Table 8
Debate about PPP [20]

No debate – no relevant	Reservation	PPP oriented	Not a big debate as private participation is involved
Luxembourg	Austria (significant reservations about profit-oriented suppliers)	Italy (preference to PPP)	England and Wales (debate on competition)
Finland (not much public debate only among the sector professionals)	Netherlands	Greece (if the implementation of projects are inclined)	Scotland and Northern Ireland (debate on quality)
Sweden (debate almost water professionals an local politicians directly involved)		Belgium (PPP-oriented debate, with some reservations)	Spain (debate on privatisation of the resource)
Portugal (debate mainly among professionals)		Ireland	France (concentrated on "technical" elements
		Denmark	
		Germany	

Table 9
Future trends – possibilities towards PPPs [20]

None	Low	High	Private
Luxembourg	Netherlands	Austria	England and Wales
	Finland	Belgium	
	Sweden	Spain	
	Scotland and Northern Ireland	Greece	
		Denmark	
		France	
		Ireland	
		Italy	
		Germany	

Table 10
Number/budget of approved PPP projects in Greek regions (preliminary data taken from www.sdit.mnec.gr, 2008)

Region	PPPs no.	Budget (millions €)
East Macedonia and Thrace	14	203.07
Central Macedonia	24	1,321.88
West Macedonia	5	115.13
Epirus	9	171.50
Thessaly	4	136.10
Ionian Islands	8	55.20
Crete	3	72.70
West Greece	8	163.43
Sterea Ellada	2	36.20
Attica	12	810.18
North Aegean	1	20.30
South Aegean	1	9.00
Pelopponese	11	240.20
Total	102	3,354.89

of electricity respectively. These projects started in the 20s before the vote of the national law 3389/2005 that determined the PPPs regulatory framework in Greece. Today the PPPs worldwide are extended in every kind of project [5]. One of their most recent fields of application is the drinking water services [22]. Many PPP projects in Greece are being implemented in the environmental sector the last few years. They have to do with integrated systems of waste management and the construction of sanitation networks and of sewage treatment plants.

The water utilities in the developing world are facing high values of NRW. The NRW consists of three components (Fig. 1), the *Real Losses* representing the leakage from the system and the overflows at the utility's storage tanks, the *Apparent Losses* due to customer meter under-registration and data handling errors, as well as thefts of water in various forms, and the *Unbilled authorised consumption* that is the water used by the utility for operational purposes, the fire fighting water and the water given for free to certain customer groups. The total annual NRW volume worldwide is 48.6 millions m^3 according to

<table>
<tr><td rowspan="5">Annual System Input Volume (SIV)</td><td rowspan="3">Authorised Consumption</td><td>Billed Authorised Consumption</td><td>Billed Metered Consumption</td><td>Revenue Water</td></tr>
<tr><td></td><td>Billed UnMetered Consumption</td><td></td></tr>
<tr><td>UnBilled Authorised Consumption</td><td>UnBilled Metered Consumption</td><td rowspan="4">Non-Revenue Water</td></tr>
<tr><td rowspan="2">Water Loses</td><td rowspan="2"></td><td>UnBilled UnMetered Consumption</td></tr>
<tr><td>Apparent Losses</td><td>Unauthorised Consumption</td></tr>
<tr><td></td><td></td><td>Customer Meter Inaccuracies & Data Handling Errors</td></tr>
<tr><td></td><td colspan="2">Real Losses</td></tr>
</table>

Fig. 1. IWA international standard water balance [23].

the Word Bank estimates [24]. The related total cost to the water utilities is 14.6 billion US$ (Table 11), and almost 40% of that occurs in the developing world, where about 16.1 billions m^3 are lost every year through water leakage in the distribution networks, enough to serve nearly two hundred million people (Table 12).

These challenges seriously affect the financial viability of water utilities through lost revenues, lost water resources, and increased operational cost, thus reducing their capacity to fund necessary expansions of service, especially to the poor. At the same time, close to 10.6 billions m^3 are being delivered to customers every year but they are not invoiced due to several causes like pilferage, employees' corruption, and poor metering (Table 12). The loss of revenues is too crucial especially in the developing world where the public water utilities literally suffer due to budget shortcuts, as they do not have enough sources to fund the absolutely necessary projects related to the expansion and improvement of their water networks, as they are struggling with frequent failures and poor water quality. In these countries the annual commercial losses are estimated to be 2.6 billions US$, equal to 25% of their annual investments to fresh water provision related infrastructures (Table 11). It is a tragic realization that cannot be ignored.

The necessity of reducing the NRW levels is more than

Table 11
Estimated value of NRW and its components [24]

Countries	Marginal cost of water (US$/$m^3$)	Average tariff (US$/$m^3$)	Cost of real losses	Lost revenue due to apparent losses	Total cost of NRW
			Estimated value (US$ billion/y)		
Developed	0.30	1.00	2.9	2.4	5.3
Eurasia (CIS)	0.30	0.50	2.0	1.5	3.5
Developing	0.20	0.25	3.2	2.6	5.8
		Total	8.1	6.5	14.6

Table 12
Estimates of NRW volumes (billion of m^3/y) [24]

Countries	Supplied population, millions (2002)	System input volume (SIV) l/cap/d	Estimates of NRW					
			NRW as % of SIV	Ratio, %		Volume, billion m^3/y		
				Real losses	Apparent losses	Real losses	Apparent losses	Total NRW
Developed	744,8	300	15	80	20	9.8	2.4	12.2
Eurasia (CIS)	178	500	30	70	30	6.8	2.9	9.7
Developing	837,2	250	35	60	40	16.1	10.6	26.7
				Total		32.7	15.9	48.6

Source: World Health Organisation, IB-Net.

obvious today. If NRW levels are reduced by 50% only in the developing world this would mean that every year:

- More than 8 billion m^3 of treated water will be available to people suffering from water shortages;
- Additional 90 million people will gain access to fresh water resources without additional pressures put to either the water supply/distribution systems or the water resources reserves.

Concluding, the water losses can be considered as a potentially available "water resource" with a supplying capacity of as much as 25.6% of the total fresh water volume entering the whole world's water delivery systems (SIV – system input volume), as nowadays only 74.4% of this water volume is actually being consumed by the customers. Considering that the acceptable level of the water losses in a well maintained water distribution system should not exceed 5–10% of the SIV, this means that 15.6–20.6% of the SIV is being lost when it should not be. If the NRW levels could be reduced to the accepted value of 5–10% of the SIV, then with the same water resources reserves we could be able to satisfy the fresh water needs of an additional 21% (= 15.6/74.4) to 27.7% (= 20.6/74.4) earth's population. This is 25% as an average value.

6. Performance-based service contracts (PBSC)

The PBSC is a new and flexible approach to the NRW reduction programs. Under PBSC, a private firm is contracted to implement an NRW reduction program and paid to deliver services and provide incentives in order to meet operational performance measures [24]. PBSC can provide an enabling environment and incentives in order to reduce NRW, with immediate operational and financial benefits, when there is proper balance of government oversight and private sector initiative. On the other hand it is not a substitute for carrying out the broader institutional reforms necessary to promote the sustainability of the sector. In practice, the applicability of PBSC to an NRW reduction program depends on the level of risk that the private sector is willing or able to take. Although PBSC is a relatively new concept for the water sector in the developing world, it is increasingly contemplated in other sectors as a way to improve efficiency and accountability of contracts with private providers. The key issues considered in performance-based service contracts are contract design, management practices, outsourcing options, technical assistance, risk management, and other lessons learnt [24].

6.1. The success stories

Eliminating all NRW in a water utility does not seem feasible. To reduce by half the current level of losses in developing countries is a realistic target. Well-designed NRW reduction programs will give good paybacks, but still each opportunity has to be assessed in terms of its particular cost-benefit ratio. Successful project implementation requires two essential and related elements: preparing good contracts and setting realistic baselines.

Liemberger et al. [24] presented four significant and diverse projects where PBSC took place. Six key factors were used to evaluate these contracts, namely: scoping (the role of the private contractor); incentives; flexibility (to what extent the contract allows the private sector to be creative in the design and implementation of the NRW reduction activities); performance indicators and measurement; procurement/selection (of the private contractor); and sustainability. The case studies showed various levels of quality in contract preparation, baseline setting, and — as a consequence — project effectiveness. Contract design must be clear about what the utility expects from the contractor and how it envisions success. All NRW reduction contracts should include basic guidelines concerning risk transfer, an indicator for leakage, and provisions for effective oversight by utility managers. Contracts should set viable targets and allow for flexibility in responding to challenges and opportunities. To be successful, however, the study shows that good preparatory work is required. The starting point is to develop a strategy based on a sound baseline assessment of the sources and magnitudes of the NRW. Such a strategy needs to consider both the short and long terms (for example, the achievement of short-term reductions vs. how to maintain lower levels of NRW over the long term). It is during strategy development that opportunities for teaming with the private sector can be identified. Once those opportunities are known, policy makers must create an incentive framework that will encourage the private sector to deliver in the most cost-effective manner, allocating risk appropriately between the parties [24].

McKenzie et al. [25,26] presented a small scale performance based PPP that took place in South Africa. The problem was excessive leakage in the distribution network having as a consequence huge amounts of water being lost. From the study of this project it is obvious that PPPs can be small scale projects and need not be the typical mega-projects normally associated with this type of venture. Funding for such projects remains a key constraint and one that has not been addressed. Very few consultants will be willing or able to take on the financial risk for such projects. Those who are able to do so, may only be able to find appropriate security for one such project and may have to wait until the first project has been completed before tackling another — which may result in delays to future projects simply because the consultant cannot source appropriate funding. The red tape associated with the funding of such projects is horrendous and is delaying new projects by many months, if not years. Even with a normal bank loan, the funding for the project took more than five months to secure. Risk-reward contracts need not be 50/50 — type projects — this

one was an 86/14 project in favour of the public entity. Without such a weighted distribution of the savings, the local municipality might not have considered the project to be in the interests of its customers. The selection of the split in savings is a critical element of any risk-reward contract, and requires very careful planning and preliminary investigations. Both parties must be satisfied with the outcome for the project to be successful. The inclusion of a cup on savings is an essential element of any risk-reward contract to provide the client with the security that the consultant will not be overpaid for its services. The use of an independent auditor is a key element in any risk-reward contract. To date there have been no disputes or concerns from either side and the independent auditor has been a critical component in the success of the project. By introducing a five-year operation and maintenance period, the client effectively ensures that the savings will be maintained. The consultant must ensure that the savings continue throughout the contract period or it will not be paid. In effect, the client is paying around 10% per year of the savings to ensure that they are sustained, and the other 90% (plus) continues to accrue to the municipality. After the five-year period has elapsed, it is likely that a new contract will be awarded for another few years — the savings are so large that it would be foolish to risk losing 90% in an attempt to save 10%.

The greatest risk to the consultant is not necessarily that the savings are not achieved, but rather that the client does not pay the agreed savings. In the case of this project, the support and honesty of the client has been the key to the success of the project. The project is the first phase of a long-term plan to reduce wastage to normal levels and improve the overall level of service to the community. One of the unexpected benefits from the project has been the identification and repair of many water network problems that had not previously been identified. As these problems have been identified and addressed, the water supply system is operating more efficiently and many residents now experience higher pressures and a more reliable supply. This is an additional and unexpected benefit.

6.2. The problems

Harris [13] in a World Bank research showed several cases where more people received basic services following private participation in water and sanitation provision in developing countries. Although PPPs try to provide better service delivery and better infrastructure [19], many problems have been identified during the implementation of PPPs worldwide. The controversial involvement of the private sector in providing water, sanitation and electricity has been mentioned by Farlam [19]. Jerome [12] outlined that PPPs can have both positive and negative results. There are examples of public water utilities that became inefficient and the consumers had to pay high prices for low quality services [27].

From the PBSC case studies the main problem faced have to do with funding small-scale projects [26]. Few private partners will be willing or able to take on the financial risk involved. Those who are able to do so, may only be willing to find proper security for the project and may have to wait until the first project is fully closed before tackling another. This may result in delays to future projects simply because necessary funds are not available. The problem associated with the funding of such projects is delaying new ones by many months, if not years. Even with a normal bank loan, the funding for the project may take enough time to secure. Also another risk to the consultant is not necessarily that the savings are not achieved, but rather that the client does not pay them.

6. Conclusions

PPPs have attracted a lot of interest today although each country has a different level of experience and legal framework. The growing use of PPPs the last few years solved many problems of poor services to the people. The success factors such as the public acceptance and the powerful partners appear to be crucial for the success of these projects. In the near future the management's ability to create its competence for the PPPs implementation in local and regional level will determine how big the success will be. It is evident that the PPPs will be the choice for the countries will heavy public sector inheritance. The governments should not consider PPPs as the "easy solution" or panacea to their problems. They have to develop their ability to judge a PPP idea, calculate the risks and the benefits and choose the best solution. Table 13 presents the crucial PPPs success factors [28].

The public sector's inability to finance and manage the public projects was the main reason for the wide use of PPPs although the private sector's involvement in the water supply and in other common utility goods is still in doubt [19]. Although a number of significant challenges has been arisen for the successful PPPs implementation, their complexity and the costs involved should make the governments treat PPPs carefully, recognizing that the PPPs set the same problems being innately in privatization and definitely PPPs are not panacea. Issues that have to be raised are the PPP contracts complexity and their costs involved. The basic principles of PPPs such as value for money, cost effectiveness, affordability, transparency, risk management must be implemented in every service delivery.

The form of the PBSC is appearing a lot as well in many areas of public services. The main problem of the water sector in the developing countries is the great level of the NRW and the cost involved. The utilization of the PBSC practice in several NRW reduction projects

Table 13
PPP success and suitability factors [28]

Full understanding of PPPs social character	Delimitation of competence fields (for both sectors)
Public / community acceptance	Quality & product standards definition
Political backing	Legislative framework and empowerment
Public interest observance	Maturity of technology / project concept
Management transfer from the public sector to the private sector	Guaranty of meritocracy and performance evaluation during the contracting procedures
Profit assurance for the private sector	An Independent authority for conflict resolution
Knowledge transfer	Assistance in the PPP drafting phase
Public guarantees for loans	

provided the main key issues for a successful implementation. Basic condition of the PBSC success during its preparation is the partners' role change crosschecking process so they can check the resistance margins of their future partner. The public partner can not handle the financial suffocation that his absurd requirements will cause to the private partner. On the other hand the private partner does not want to loose the project's public acceptance caused by the profit maximization because of the decreased compensatory benefits to the public sector.

The final outcome is that accepting that water is a social good, essential for life and welfare and that water resources are limited and in stress [29], water users should pay affordable prices for water services taking measures for water protection. This is then the WFD main aim. Following its basic principles, "the polluter pays" and the "full water cost recovery", any wasteful use of water resources must be penalized while water users should pay socially just prices for water services.

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