Abstract
Since the UK Government launched its Private Finance Initiative (PFI) in 1992, the concept of Public Private Partnership (PPP) has flourished. Although some experts from the industry tend to think of PFI and PPP as synonymous, PPPs in context can mean anything ranging from annually reviewed performance based asset management contracts to a 50-year water supply and distribution concession for a metropolis. In fact, various forms of PPP arrangements have been used in the procurement and operation of infrastructure even before the term came into existence. Risk sharing takes the centre stage in almost every PPP contract. This paper attempts to look at the intrinsic risk sharing mechanism provided by various types of PPP arrangements. Emphasis is placed on PPP arrangements for the provision of water and wastewater services. The various risks pertinent to water and sanitation projects are identified and discussed. The paper concludes with case studies of how the generic PPP models are being applied in the water business.

Keywords: PPP, water and sanitation, risks, economics & finance

1. Introduction
Many of the earliest water providers in Europe in the 19th Century were owned and operated by the private sector. (Guislain, 1997) However, being the most monopolistic in nature among infrastructure services – and perhaps more so because of the political agenda – the provision of potable water and sanitation services has mostly been a total government responsibility in the last century in many parts of the world until now.

The agenda facing the providers of water and wastewater services vary considerably between the developing and the developed world. Whereas developing countries are gravely in need of basic treatment and distribution facilities elsewhere, rising customer expectation, increasingly stringent quality standards and the ageing assets are placing unprecedented financial strains on the industrialised world (Banyard, 2004). Nevertheless, a common issue facing policy makers in the water and wastewater industry in general is the source of finance. From that background, Public Private Partnership (PPP) has evolved as a means for the provision of water and wastewater services.

It is not unusual to think along the lines that PPP is only about solving the problem of capital constraint and bureaucracy in the public sector, and as a result, the risk transfer element of PPP is given less attention than it deserves. This paper serves to remind policy makers, business managers, professionals and the general public about the pivotal role of risk sharing in PPP, but before we go into details of the risk-sharing mechanism offered by different types of PPP arrangements, perhaps we should first discuss typical risks involved in the provision of water and wastewater services.

2. Risks associated with water and wastewater projects
2.1 Design and Construction (D&C) Risks

D&C risks are normally associated with the procurement of treatment or distribution assets. The project concerned can be a brand new membrane biological nutrient removal (BNR) plant or the expansion of the existing supply network into a new housing estate. The major problems facing the industry could be obsolete or inappropriate technology, cost overrun, programme delay, inadequate quality control, etc. If not properly managed, the D&C risks are likely to have knock-on impacts on the long term O&M and compliance risks.

2.2 Operation and Maintenance (O&M) Risks

O&M risks arise when the assets are in service. In the context of the common business model adopted by the water and wastewater industry, it is intended to restrict the scope of ‘operation’ in the discussion here to the infrastructure assets only. Typical O&M risks involve defects, latent defects, rising energy and material prices, deterioration and depreciation of assets, structural failure, process failure or obsolescence, supply and demand balance, raw water quality and quantity, site security and cost efficiencies etc. If these risks are not properly managed, they could lower the service level and/or escalate the operating costs of the utility.

2.3 Compliance Risks

If O&M risks can be viewed as the inherent risks associated with the operation of infrastructure assets, then compliance risks are externalities imposed by the law, environmental agencies or the regulator. Analogy could be drawn with performance risks in other public services such as transportation and health service. For water suppliers, these could be in the form of drinking water quality compliance, water resource constraints such as abstraction licences and non-revenue water (NRW) / leakage targets, etc. For the wastewater sector, common compliance risks are discharge consents and limits, fines and prosecution on watercourse pollution and targets on incidents of combined sewer overflow, etc.

2.4 Market Risks

Market risk here refers to the security of the source of revenues of the service provider. The context of the risks could be very different depending on the business model employed. For instance, (water) demand risk (this is the uncertainty on the sales volume and is not to be confused with the supply and demand balance risk which is an O&M issue) could be a major concern for the water supplier of a city in China where customers are billed on the water usage but may be not so much for a water company in England where the majority of the customers are not metered. In general, market risks cover demand risks, microeconomic behaviour of customers (i.e. their response in water consumption when facing a tariff increase), present and projected demographics of the area, water consumption pattern, illegal connectors, billing and bad debts and in the case of wastewater, people’s perception on the social cost of pollution.

2.5 Tariff Risks

Water plays a strategically important part in the economic, social and environmental development of a jurisdiction. Moreover, due to the inflexibility of the distribution / sewerage network, established utilities usually enjoy economy of scales over potential entrants, making direct competition improbable. Therefore, the technically monopolistic service provider is unlikely to be allowed to set the tariffs based on the market condition. Instead, tariff level is either strictly regulated or determined politically. Hence, it is more appropriate to consider tariff risks separately from the market risks facing a water/wastewater business. Tariff risks normally associate with the
tariff adjustment mechanism and triggers and the method of economic regulation (for instance, rate of return, price cap, etc.).

2.6 Financial Risks

Financial risks arise when there is a change in the cost of capital to the utility. The interest rate, crediting rating of the utility and investors’ appetite on the capital market are a few typical governing factors. A characteristic of the water and wastewater industry is the big and recurrent capital programme. Since the average life of assets in the water industry is long and the replacement need of different assets is highly variable, it is imperative to match the financing strategy with the asset management cycle to maximise financial efficiency and minimise risk exposure.

2.7 Transaction Risks

Transaction risks are incurred whenever a transfer of assets or human resources take place. Before a transaction is completed, due diligence would usually have been carried out to cover operational, financial and legal aspects of the incumbent. This would help to reduce the uncertainties in the quantity, quality and cost of the assets and hence the risks. There is also the arguably more sensitive issue of the transfer of staff which is a common practice in the water and wastewater industry to ensure the continuity of the operation. Notice that traction risks need not be at the front of the project and might take the form of premature termination risk or residual value risk for instance.

2.8 Legal and Regulatory Risks

Legal or regulatory risks can be associated with specific country or with the specific project agreement. Typical risks to consider are existing legal or regulatory framework for the provision of water and wastewater services, inconsistency in national and regional law, resolution of legal disputes as well as enforceability of the legal provisions.

2.9 Political Risks

Political risks concern the stability and socio-economical behaviour of the society, the trustworthiness of the government and the general political environment etc. Water supply, and to a less extent, sanitation, is always a controversial issue in every society since water is usually perceived as an essential good. Hence the element of political risk is intermingled with almost every project in the water sector. In some countries, expropriation, repatriation of profits, nationalisation, force majeure, as well as changes in fiscal policy or government can impose additional risks.

3. Generic PPP Models for water and wastewater projects

The term ‘PPP’ has been used by the UK Labour Government since 1997 as the vehicle to carry forward the Private Finance Initiative (PFI) which was originally announced by the Conservative chancellor Norman Lamont in 1992 (Montague, 2002).

To put PPP in a more general context, TheFreeDictionary.com has defined PPP as “...a variation of privatization in which elements of a service previously run solely by the public sector are provided through a partnership between the government and one or more private sector companies...”

Although the formal definition of PPP is relatively new, the idea of PPP had been widely studied and discussed by policy makers and economists long before the PFI was introduced (Tomkins,
1987). Tomkins’s proposed continuum of organisational forms (reproduced as Figure 1) has provided a sound footing on which our discussion of PPP models can be based.

In this paper, PPP will be defined as any form of collaboration that sits between B and F in Tomkins’s continuum. In the context of the provision of municipal water and wastewater services, a simplified schematic representation of a PPP is shown in Figure 2. It constitutes an alliance between the public and private sectors, supplying water and/or wastewater services to the customer who will in turn pay a tariff or tax to the partnership. The actual project structure and contractual arrangement are obviously more complex and vary from project to project. Nonetheless, it is precisely the project structure and contractual arrangement that help to define the risk sharing mechanism of a PPP. This is then reflected through the cash flows of the project.

In the following sub-sections, four generic types of PPPs classified by the asset ownership, source of finance and rights to the sales operation and customer interface are introduced and their risk sharing mechanism is discussed.

3.1 Type I PPP: Public Ownership, Finance & Sales operations
A Type I Public Private Partnership is characterised by the retaining of asset ownership, source of finance and downstream operations (i.e. billing and revenue collection) within the public sector (Figure 3). With reference to Tomkins’s continuum, it will be represented by project structures E and F. In a typical arrangement, the private sector will provide O&M and/or capital programme management services and receive an annual fee from the public partner. The revenue collection function is retained in the public sector.

To some people, a Type I PPP resembles more of a public sector outsourcing or contracting out initiative rather than a Public Private Partnership. For instance, the scope of risks transfer is limited. Apart from the D&C and O&M and compliance risks, almost all other major risks are owned by the public sector.

Nevertheless, Type I PPP is a handy model to deploy if the government prefers owning the assets herself and/or the public is not comfortable with the notion of privatisation of ‘public’ services. If additional risk transfer is desired, the partnership can be arranged such that specific requirement of the transaction is incorporated into the agreement. For example, the private sector might be required to continually employ a number of existing employees for a certain period of specified time.

3.2 Type II PPP: Private Ownership, Finance; Public Sales Operations

Type II PPPs have the feature of having the private partner as the owner and financier of the project whereas downstream operations are retained in the public sector (Figure 4). This should not be mixed up with full privatisation where all functions of the water and wastewater undertaking are transferred to the private sector. There is no exact match in Tomkins’s continuum but a Type II PPP should lie somewhere between project structure D and E in terms of degree of control the public sector can exercise.

A BOO (Build – Own – Operate) / BOOT (Build – Own – Operate – Transfer) / ROOT (Renovate – Own – Operate – Transfer) / TOT (Transfer – Operate – Transfer) / PFI type project is a typical Type II PPP. The private sector has to come up with its own finances, usually on a non-recourse or limited recourse basis, to procure a new asset or to renovate or upgrade an existing asset. The scope of this form of partnership is normally limited to treatment assets and does not include any downstream operations. The public sector will receive a retail tariff or tax from the customers and pay a bulk tariff to the private partner based on a bulk water purchase agreement. The operation period of the PPP is normally 15 to 20 years.
Apart from D&C, O&M and part of the compliance risks (water quality risk in the network is still retained in the public sector), the public sector can also be rid of the hurdle of the fluctuations in the financial market as a typical Type II PPP effectively transfers any financial risk to the private partner. Transaction risks also rest with the private partner since staff transfer in the beginning is not an uncommon feature and the private partner is required to transfer the ownership and management of the assets back to the public partner towards the end of the project.

Type II PPPs are frequently used by governments that have capital constraint but are badly in need of extra treatment capacity for water balance issues and/or advanced treatment technology to comply with new water quality / environmental standards.

### 3.3 Type III PPP: Public Ownership; Private Finance, Sales Operations

In a Type III PPP, the public sector retains the ownership of the assets but almost everything else is transferred to the private partner including the downstream operation, financing and the discretion to make investment decisions. Effectively, it is very much the same as a private regulated utility as in project structure D in Tomkins’s continuum except that the public sector is still the legal owner of the assets (Figure 5).

A concession or an *affirmage* is the typical setup that the water sector used to deliver a Type III PPP. Although the public sector still owns the assets, the degree of risk transfer is much more substantial than a Type II PPP. Apart from the D&C, O&M, compliance and financial risks, the transfer of the distribution, billing and customer service functions to the private sector implies that the private partner will be taking the market risk and perhaps also the tariff risk. It is customary for the private sector to demand some sort of guarantee on tariff in the form of tariff adjustment mechanism or pre-agreed tariff increase. However it might not be in the public sector’s interest to offer a guarantee and hence where the tariff risks sit will be dependent on the local situation.

From the private sector’s point of view, a Type III PPP offers more flexibility in running the business than a Type I PPP. The typical duration of a Type III PPP is usually 25 years or more and therefore, the private partner can make better weighted investment decision for the long-term
benefits of the undertaking. On the other hand, the transaction risks can be much higher than either the Type I or Type II arrangement.

The Type III PPP model is favoured by governments which would like to see a radical change to the way the water and wastewater services are run but would not like to or are not permitted to relinquish the ownership of the assets.

3.4 Type IV PPP: Joint Ownership, Finance and Sales Operations

Type IV PPP stands out from the other prototypes as the partnership is more intimate and integrated. It is represented by category C in Tomkins’s continuum under which the public and private sector form a joint venture to provide water and wastewater services to the customer. It is a common practice for the public sector to inject the treatment and distribution assets and the private sector to contribute capital to form a joint venture company. The joint venture company will assume ownership of the assets and take over the downstream operations (Figure 6). This is potentially the most complicated of the four types of PPP mentioned here but is also an increasingly popular model favoured by the different stakeholders. This is typified by a number of high-profile deals signed in China recently.

Although the underlying principle of risk sharing is still the key feature of a Type IV PPP, the dynamics of the risk sharing mechanism has a fundamental change. Instead of the I-pay-you-the-money-you-take-all-the-risks arrangements, the joint venture model permits the sharing of risks in the form of profit-and-loss sharing. This allows the redistribution of savings and potential benefits in a project between the public and private partner, a provision which is usually conspicuously missing in PPP projects (Northam, 2004).

On the other hand, the public sector will have to retain a certain degree of risks in areas like O&M, revenue collection and financing, etc. The rationale to justify this is that the private sector can bring along innovation and incentive in the form of knowledge and technology transfer which in itself reduces the risks on a lot of issues compared to sole public ownership and operation. It is also customary to have specific risks assumed by the party that is most capable of managing them. For instance, the public partner can give assurance on the initial tariff increase before the joint venture takes over the existing operation.

Under the joint venture arrangement, the only function which needs to be retained in the public sector is regulation. It is of paramount importance that the regulatory arm and the asset ownership arm of the government are separated to avoid potential conflict of interests. Public opinion also needs to be carefully managed because a transfer of state owned assets is involved in a Type IV arrangement. The joint venture model is particularly suitable for governments which are not overly risk-adverse and would like to share the financial gains of a successful PPP. Such a joint venture arrangement also offers the opportunity of expansion through acquiring water and wastewater undertakings elsewhere which is not possible with other PPP structures.
3.5 Choosing the ‘Right’ Model

The four types of PPP model discussed in the previous sections are intended to be generic classification of common PPP models used in the water industry. The four types are by no means exhaustive and there will be a certain degree of variability in the actual arrangement of individual projects.

Table 1 shows the risk matrix which summaries the risk sharing mechanism for each of the four types of PPP arrangement mentioned above. Political risk has not been included as it is a function of the political stability of the country, the local culture and the socio-economical characteristics of the society and is likely to impact the choice of PPP model rather than constituting a project risk element.

Table 1: Risk matrix for Type I to IV PPP arrangements

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<tr>
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<th>Type I</th>
<th>Type II</th>
<th>Type III</th>
<th>Type IV</th>
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<td>D&amp;C Risks</td>
<td>Private</td>
<td>Private</td>
<td>Private</td>
<td>Public &amp; Private</td>
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<tr>
<td>O&amp;M Risks</td>
<td>Private</td>
<td>Private</td>
<td>Private</td>
<td>Public &amp; Private</td>
</tr>
<tr>
<td>Compliance Risks</td>
<td>Public / Private</td>
<td>Public / Private</td>
<td>Private</td>
<td>Public &amp; Private</td>
</tr>
<tr>
<td>Market Risks</td>
<td>Public</td>
<td>Public</td>
<td>Private</td>
<td>Public &amp; Private</td>
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<tr>
<td>Tariff Risks</td>
<td>Public</td>
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<td>Public / Private</td>
<td>Public &amp; Private</td>
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<tr>
<td>Financial Risks</td>
<td>Public</td>
<td>Private</td>
<td>Private</td>
<td>Public &amp; Private</td>
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<td>Transaction Risks</td>
<td>Public / Private</td>
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<td>Legal Risks</td>
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If the perceived political risks of a country or a municipality are low, the private sector is more inclined to go for Type III or Type IV PPPs which are riskier but offer potentially the biggest benefits in the long run. On the other hand, if the perceived political risks are high, the private sector will tend to minimise its overall risk exposure and choose the more established Type I or Type II PPPs.

For the public sector, it is tempting to draw a flowchart that maps out the decision path for choosing a ‘right’ model for the PPP. However, we should be cautious that no two places in the world are identical and the generic PPP model should at best be used as a guideline on which to develop the details and specific needs of each project.

4. Examples of PPP Projects undertaken by RWE Thames Water

This section shows a number of PPP project undertaken by RWE Thames Water with particular reference to the risk sharing component of the project.

4.1 United Water, Adelaide, South Australia

United Water is a joint venture between RWE Thames Water, Veolia Water and Halliburton KPR formed specifically for the management of the water supply and wastewater service provision contract in Adelaide, South Australia.

United Water is responsible for the O&M and management of the capital programme for the city of Adelaide and its suburbs. The 15.5 years contract commenced operation in 1996 and has since delivered savings in operating cost of 20% p.a. to the South Australia Government.

The project is a typical Type I PPP but also features a saving sharing mechanism by implementing a lump sum plus target reimbursable payment mechanism. The transaction risks are retained in the
public sector as United Water was allowed to choose its own staff according to requirement from the personnel originally working for the South Australia Government.

4.2 West of Bangkok, Thailand

West of Bangkok water supply project is a 30 year BOOT contract to supply water to suburban and industrial area to the west of Bangkok. The project scope includes the design, construction, operation and maintenance of a 320 MLD conventional water treatment plant and 20 km of a 1000 mm trunk main with two associated service reservoirs.

The project is a Type II PPP with the variation that part of the distribution network (the trunk main and associated reservoirs) is also owned and operated by the private partner. As the bulk tariff paid to the private partner is based on the meters downstream of the service reservoirs, any water loss in the trunk main and the service reservoirs is a risk to the private partner.

4.3 Aguas Nuevo Sur Maule (ANSM), Chile

In 2001, Thames Water won a 30 year concession in Chile to supply water and provide wastewater treatment services to the whole Region VII of Chile. ANSM has around 158,000 customers and serves 582,000 people.

In this Type III PPP, the private partner assumes the full management rights of the undertaking and is contracted to the delivery of a US$ 90 million capital programme over 5 years during the concession period. While the concessionaire derives revenues from water tariff (and therefore taking the market risks), it will be penalised when regulatory obligations, such as the continuity and quality of the water supply, are not complied with.

4.4 Berlinwasser, Berlin, Germany

Berlinwasser supplies water and provide wastewater treatment services to a population of 3.7 million in Metropolitan Berlin and surrounding areas. It operates 11 waterworks with a total capacity of 1140 ML/day and 7 wastewater treatment works with associated sewerage system (Figure 8).

A Type IV PPP was formed between the Berlin Government (50.1%) and a private consortium (49.9%) that consists of Allianz, RWE and Veolia (then Vivendi) (10%: 45%: 45%) in 1999. The public sector retains the majority stake of Berlinwasser (50.1%), allowing the public sector to tap into the entrepreneurship of two experienced private utilities while retaining the board control of the undertaking.
5. Conclusion

There is an indisputable need for investment in water and sanitation assets in every part of the world. PPP is one solution but it has to be emphasised that there is something more than just a source of funds that the public sector can expect from a PPP in risk sharing.

A few commonly seen generic PPPs have been introduced and the risk sharing mechanism explored. Political risks have been highlighted as an important consideration for the private sector. A few PPP projects that RWE Thames Water undertook have also been discussed.

The transfer of risk is a feature in every PPP. It is vital to recognise that appropriate risk sharing or risk transfer is a critical factor for a PPP to be fruitful. During a time when the world economy is as volatile as ever before, it is alluring for an organisation - especially the public sector - to be prudent and risk averse. However, decision makers in both public and private sectors should bear in mind that risk and opportunity are two sides of the same coin. Transferring all the risks to the other partner could reduce the total benefits from a PPP if the situation is not sustainable. The best approach is to develop a true partnership relationship so that each risk element is allocated to the party best able to manage it.

References


