RISK AND ASSET MANAGEMENT IN PRIVATIZATION/PRIVATE FINANCE OF PUBLIC UTILIITIES: A RISK INVESTIGATION OF WATER INFRASTRUCTURE PROJECTS IN CHINA

Ching Kwok[1], Robert J Young and Richard J Kirkham

School of Mechanical, Aerospace and Civil Engineering, The University of Manchester, M60 1QD, U.K.

The provision of public utilities, such as water, electricity or gas is usually characterized b\y an asset-intensive environment. The costs associated with operating and maintaining this are significant, and more so where infrastructures are ageing or unsupported by a pro-active maintenance and life cycle renewal strategy. A growing number of governments have sought to take these costs "off balance sheet" through privatization, on the premise that this reduces the taxpayer burden, transfers risk and creates added value for money. There continues to be a complex debate surrounding privatization, the use of private finance and commercial management of public utilities, and this falls beyond the scope of this paper. What this paper will reflect upon are the notions of risk, risk management and how it may suitably be applied within the context of public utilities procurement and management. Literature reviews are used to examine relevant risks to infrastructural projects. This paper also considers the impact of"whole-life" evaluations of asset costs and provides examples of implementation of asset management methodology PAS-55 in utility services. Taking the Chinese context, the work then moves on to describe the potential risks found in the Chinese potable water market. The paper concludes by recognizing the importance of the political landscape in China and the aggressive market growth that has characterized its economy of late. It is clear that whilst political risk is an important variable in the risk management process, the "management" of it can be exceptionally complex and fluid.

Keywords: asset management, China, privatization, risk management, wastewater treatment, whole life cycle costing.

INTRODUCTION

During the last century, the global population tripled whilst water consumption increased six-fold. The rapid development of international economies and subsequent increased demand for potable water resources places a significant strain on existing utilities infrastructures, particularly in developing states. In order to maintain sustainable provisions of potable water, governments have had to seek to explore economic and environmentally sustainable methods of wastewater recycling provision. In transitional economies such as China, wastewater-recycling provision has become increasingly important (Fight 2004), although the funding of such

[1] ching.kwok@postgrad.manchester.ac.uk

Kwok, C, Young, R J and Kirkham, R J (2010) Risk and asset management in privatization/private finance of public utiliities: a risk investigation of water infrastructure projects in China. *In:* Egbu, C. (Ed) *Procs 26th Annual ARCOM Conference,* 6-8 September 2010, Leeds, UK, Association of Researchers in Construction Management, 1279-1288.

schemes is complicated by a difficult political and financial landscape, which requires careful navigation.

Clearly, such schemes must be managed and operated in a way that embraces a rigorous approach to risk and value management. This is particularly important in the case of potable water provision, which is of course a necessity in the normal operation of a society, and where the consequences of failure to do so can be harmful to health and economy.

There are numerous approaches to asset management are discussed in the literature, and are well established in the European and American contexts. In the case of China however, progress continues to be slow. The vast majority of risk management techniques that are used manifest during the investment decision or financing stage (i.e. risk management carried out as part of due diligence in an actuarial context) and not during operation and asset management. There is also evidence of a lack of appreciation of how risk management principles should pervade the various levels of the corporate structure. However, the increasing involvement of international utility companies and commercial organizations with experience in public service provision within the Chinese market has brought with it an increased level of organizational maturity in dealing with risk.

The aim of this paper is to conduct literature reviews on privatization/private finance initiative, risk and asset management so as to form a foundation for the study of Chinese water market and hence investigating the potential risks, which appear in the procurement of water infrastructural projects. The definitions of privatization, risk and asset management will be considered in an asset management context, and the impact of the idiosyncratic nature of the Chinese market will also be considered to explore the potential risks that may arise in the potable water infrastructure sector.

LITERATURE REVIEW

Privatization and Private Finance Initiative (PFI)

Hall *et al.* (2003) claimed the term 'privatization' was used to cover all forms of private participation during the Thatcher period in UK while Broadbent and Laughlin (2003) raised a question of 'is PFI (PPP) a form of privatization?'

It is deemed that the concept of privatization is generally broad and rather complicated, politically controversial (Hall *et al.*l, 2003) and muddled (Savas, 2005). Savas even repeatedly used 'confusing' when he tried to define the term 'privatization'. He gathered nine different ideas of privatization and concluded with: "Privatization is the act of reducing the role of government or increasing the role of the private institution of society in satisfying people's needs".

In fact the UK government issued two publications to state the official approach to public-private partnerships (PPP) and PFI. The report in 2000 (Public Private Partnerships: 2000) divided PPP into three different types of partnerships, where PFI and privatization clearly appeared forms of partnerships. In a House of Commons Library Research Paper, PFI was described as "a form of PPP that marries a public procurement programme… PFI differs from privatization in that the public sector retains a substantial role in PFI project… PFI differs from other PPPs in that the private sector contractor also arranges finance for the project."

In the context of asset management, privatization is referred to a form of PPP that represents the transformation of ownership of physical assets from government to private sector(s). In contrast, PFI involves a new development of assets, in which the

private sector's participation starts from the beginning of the process, including financing the capital funding(s).

Risk management (RM)

One of the major challenges to developing a robust risk management strategy lies in unravelling the complexity of the term 'risk' itself. Traditionally, risk is conceptualized as a negative aspect; an outcome or event that is to be avoided where ever possible. However, classical economic theory and the definitions of risk proposed in the project management literatures recognize the threat and opportunity aspects of risk. Some researchers have postulated that risk is a situation that is probabilistic in nature and thus quantifiable but not certain (Kirkham 2002) but practical applications of risk often reveal a more subjective discourse. It is probably this contradictory landscape of knowledge that has contributed, in part, to the diffused application of risk management. Indeed, one is advised to refer to the work of Stuart Green (2001) who offers an interesting postmodernist interpretation of the debate as well as that of Hansson (in Neill *et al.* 2008) who argues that "the drive for a single definition of 'Risk'" is "a futile form of linguistic imperialism".

Consequently, the definition of the term 'risk' has undergone a paradigm shift from one that is focused on negative outcomes to one that reflects a balance. Given the complexity of the debate, the reader is advised to refer to Dowie (1999), Chapman and Ward (2002) and Perminova (2008) for further analysis. In this work, the definition proposed in Merna and Al-Thani (2005) is adopted for the purpose of simplicity (whilst accepting the postulates in Neill *et al.* (2008)): 'Risk' can be possible losses or possible gains… With proper management, risks can be overcome and have a positive impact.

Generally, RM is the set of techniques which, when combined, facilitate the analysis and response to risk events during the project or corporate life cycle. RM is usually bifurcated into qualitative and quantitative techniques although this differentiation is largely superficial (Kirkham 2002). The former are usually applied at the early stages of the project where stakeholder engagement is required and data availability is usually low. Qualitative approaches tend to support the identification of risk and assist the analyst in prioritization. Subsequently, quantitative techniques tend to lend themselves to more detailed analysis and drill down on specific areas of focus that have been previously identified. The implication clearly is that qualitative and quantitative techniques work in a complementary way.

In the context of asset management, quantification of risk usually enables stakeholders to appreciate the assumptions that underpin a capital investment proposal and assess the long-term implications of that decision (Boussabaine and Kirkham 2004).

Asset Management (AM)

'Asset management', as a concept, should be understood contextually given the various definitions available. The Institution of Asset Management (IAM) describes the concept of asset management in a relatively physical and technological dimension, 'The management of physical assets (their selection, maintenance, inspection and renewal) plays a key role in determining the operational performance and profitability of industries that operate assets as part of their core business.'

Woodhouse (2006) advances the traditional perception of AM from a "housekeeping" and maintenance centred approach to one that is more strategically aligned with the corporate objectives of an organization. He argued, that due to a lack of understanding of the relationship between risk and value management, senior management in

organizations present with a 'distorted, risk averse, cost-conscious and performance/customer-focussed' viewpoint, which actually lies at variance with the true meaning of optimization in the context of AM.

In fact, AM should provide opportunities for organizations to make the right decisions by integrating the concepts of risk taking with decisions which impact upon other critical project management success factors to achieve the strategic goals: minimization of overall life cycle cost and maximization of value. By way of example, the physical value of the asset and the profits that may arise through the life-cycle (from cradle to grave). Therefore, RM should be recognized as foundation concept in AM.

The literature suggests that AM strategies have evolved from the specific conditions in which the organization operates within. Safety critical industries will design approaches, which reflect this; the asset management strategy will often reveal a great deal about the risk averse nature of the organization (or not as the case may be). In fact, various approaches are available for different industries to implement, in order to meet the special needs of the facilities and hence, optimizing the outcome.

For instance, a wastewater recycling facility can be constructed as an extension of an existing wastewater treatment facility. As a result, common AM approaches used for public utilities can be applied to explore the potential options available for implementing operational and maintenance regimes in wastewater treatment facilities. This paper will focus on two approaches, namely whole life-cycle costing (WLCC) and PAS 55.

AM in Public Utilities – Two approaches

Whole Life-cycle Costing

Traditional life-cycle costing (LCC) approach for use in asset acquisition and management has been well recognized over the last decade. During the 90s, LCC was mostly applied to projects with very high capital costs, such as national defence projects and civil infrastructures (Boussabaine and Kirkham, 2004). More recently many government departments actively require LCC based assessments during the procurement life-cycle in order to develop a greater appreciation of potential value for money.

WLCC emerged as an improved approach to existing LCC techniques, with a focus on continued analysis of building performance though the "whole-life" rather than simply at capital investment stage (Boussabaine and Kirkham 2004). WLCC should provide a dynamic and holistic approach to asset performance management over its entire life span; this is contrary to the concept of LCC, which analyses costs over a specified time period. Boussabaine and Kirkham (2004) describe WLCC and risk assessment as "part of the overall management of the whole life-cycle of project processes that comprise the art and science of decision analysis". This approach has been widely applied on infrastructure projects, such as transportation services and projects funded using private finance. Boussabaine and Kirkham (2004) define the function of risk in WLCC as; 'Risks refer to probabilities of errors in the decisions and WLCC forecasts throughout the life-cycle of a project, or the probabilities of occurrence of events. Risk assessment deals with the likelihood and expectation of possible WLCC outcome using probability concepts."

Well established in the UK and other developed countries for AM technique for infrastructure projects, LCC or whole life-cycle costing (WLCC) has also been introduced to the water business in post-socialist countries such as China by

international companies for a significant period. The advantage of using LCC or WLCC is the sophisticated development of the models and being recognized by the senior management level and has become a directive among the decision makers in an organization.

PAS (Publicly Available Specification) 55

PAS 55 is an AM framework. It was developed to satisfy the industry demand for a standard methodology for AM. In PAS 55, the definition of AM is defined for this specification as: "Systematic and coordinated activities and practices through which an organization optimally and sustainably manages its asset systems, their associated performance, risks and expenditures over their life cycles for the purpose of achieving its organizational strategic plan."

PAS 55 is being regarded as a dynamic, risk-based and three-dimensional framework (Woodhouse, 2006) which involves various inputs, constraints and competing objectives. Hence, as an overall long-term plan for an organization, organizational strategic plan should incorporate vision, mission, values, business policies, stakeholder requirements, objectives and management of the organization's risks. It is applicable to various AM scenarios, from small-medium sized enterprises (SME) to large international organizations. This specification is designed to cover the life cycle management of assets, particularly the core asset of an organization, therefore, it is vital to adopt an AM system in this type of organizations, where the business is entirely dependent on the efficient functioning and performance of the physical assets used to deliver their services or products.

Water companies such as Wessex Water for instance, implemented PAS-55 as their corporate AM model. The company operates a significant number of assets in the service chain, including wastewater disposal. Naturally, any downtime in the organizational capacity to deliver a consistent supply of potable water can have severe consequences. The key challenge, similar to the other utility service providers that drove the company to obtain the accreditation, was 'the lack of a common view on strategic risks relating to the management of assets'. The company claimed that the accreditation displays a good demonstration of AM capabilities to external stakeholders.. It also assisted with the improvement of the profile of AM throughout their business in order to reduce risks by working in an integrated and structured manner, as well as helping the company to develop the planning and facilitating maturity of their assets with an additional operational and strategic approach.

PAS-55 has been developed and widely implemented by British practitioners, however, the protocol of this specification may not align with the current specifications advocated in other countries. Hence, international investors avoid the implementation of novel approach to avoid creating further unnecessary risks. Yet, Hong Kong with pre-adopted British system in various aspects, utility service providers such as Town Gas, the China Light and Power, the Mass Transit Railway Corporation (MTRC) and the Electrical and Mechanical Service Department (EMSD) have obtained PAS-55 accreditation. Among these companies, Town Gas and China Light and Power are solely owned by private investors. However, the MTRC is a privatized transportation network and the EMSD is a government department which provides outsourcing services for cross-discipline projects within the government structure.

CHINA AS A CASE STUDY

The limitation of public funds (Grimsey and Lewis, 2002) and the insufficient operation and service quality (Zhong, Mol and Fu, 2008) are the core drivers that have accelerated the privatization of the water market in China. However, the change of the perception of 'government pays' to 'user pays' has already created a significant tension in Chinese society.

Despite the fact that 'privatization' per se in a communist country appears to be an oxymoron, the breakthrough was actually implemented by the State Council in 1988. The council defined the term 'private sector' in 'Provisional Regulations of Private Enterprises in PRC' (Zhong, Mol and Fu, 2008) as 'economic organizations whose aim is to generate profit, in which assets are privately owned and which have eight or more employees'.

The Chinese government has welcomed foreign investment (FI) for more than 30 years, and while an exceptional growth of local private enterprises has been observed, the development of privatization is still being handled with caution.

The Road to Privatization in China

Since 1978, China has invited foreign investment as it strives to build the foundations on which effective public utility services can be developed. The flow of foreign investment has, without doubt, expedited progress towards privatization in the water sector. This development process is illustrated in Figure 1.

With the support of the Chinese government, foreign investors initiated their involvement in the water sector and benefited from financial assistance offered by the government. However, by the diminishing role of the central government in the water market, an accountability gap was formed (Wei 2009) and end users suffered from poor decisions made by local governments. Therefore in 2008, the rejection of a generous tender offer by Veolia has been claimed as an important action by the State government to rationalize the water market (Ma 2009). It was because the state government has foreseen that the unusual premium of the bid would finally lead to significant rise of water tariff.

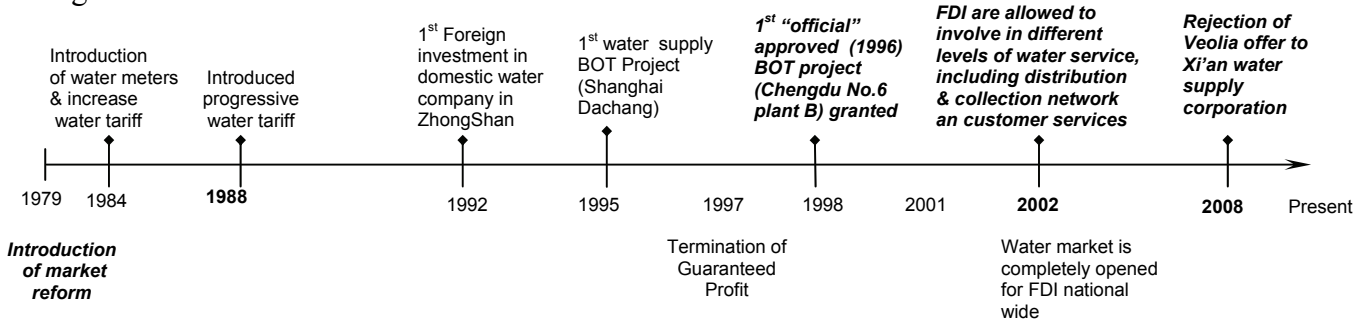

Figure 1. Development of privatization in the Chinese economy (source; Chinese Ministry of Commerce)

The Ministry of Commerce (MOC) has classified four main investment modes (Table 1) for foreign companies to enter the Chinese market. The total investment in China can be regarded as substantial, although only 320 out of 27,537 projects (1.16%) were directly related to the public utility services with a value was 1.57% relative to the total FDI, which was equivalent to USD 108.312 billion. In the context of the China water market, the investment scheme can be further categorized into 'official' and 'non-official' (Chen and Messner, 2003), however, this aspect is beyond the scope of this paper.

Table 1: Main investment modes for foreign companies (MOC, PRC, 2010)

	Investment modes	Features	Examples
I	Sino-Foreign Equity Joint Venture (SFJV)	Jointly offer investment, operation, sharing the risks in accordance with the proportions of investment. Joint responsibility for profits and losses. Investment can be in tangibly or intangibly form. FDI shall not be less than 25%. A liability limited company.	Sino French Water JV with Zhongshan Tanzhou Municipal Economic Development Company (1994) – concession contract 35 years
II	Sino-Foreign Contractual Joint Venture a.k.a. Sino-Foreign Cooperative Joint Venture (SFCJV)	Investment of both sides will not generally be converted into ratios of investment. Profits will not be shared accordance with their ratios of investment. Cooperation period, rights and obligations of all parties: defined, agreed and signed by all parties. Foreign company shall provide all or most of the capital; Chinese partner(s) provide physical and tangible assets and sometimes the match funding for the total investment. Foreign partner: redeem the profit during the period;	Sino French Water and Nanchang Water Supply Company Ltd (1996) – cooperation period 28 years
III	Wholly Foreign-owned Enterprise (WFOE)	100% foreign ownership, management control. Limited liability on the registered capital (equity) only.	Thames Water Overseas Ltd (1995)
IV	FDI Shareholding Incorporation	No definition or information available on Chinese government information gateway.	Not available

Potential Risks of Investing in Wastewater Recycling Projects in China

International financial institutions such as the Asian Development Bank (ADB) and the World Bank (WB) conduct occasional reviews to monitor the development of their business partners. For instance, WB conducted a review on the bank assistance of the urban water and wastewater sector in 2002. Likewise, the U.S. Department of Commerce (USDoC) issued a study of the water supply and the wastewater treatment market in China in 2005. The US's report, analysed the Chinese market and suggested the possible opportunities that US companies could benefit from. In fact, it also mentioned that potential risks exist in China's market but the report lacked a detailed investigation of the types of risks that the US companies might encounter. In contrast to the foreign perspective, Chinese labour activists (Au and Liu 2006) and other international movements argue that the government overlooked the social conflicts generated by such schemes. They advocated the domestic management of water companies, assuming paradoxically, that with the intervention of the Chinese government, investment in the water markets would become a risk-free business.

Grimsey and Lewis (2002) suggested that most of the risks during privatization arise from the complexity of the arrangement itself while the nature of risks transfer to the duration of project. For instance, the risks found during the operation could be a consequence of the activities carried out in the construction phase of the project.

In addition to the adopted nine risks mentioned in their study of PPP for infrastructural projects, it has been generally extended to China water and wastewater sectors in various aspects as the following.

Legal risk: the legal system in China always draws the attention of the investors which has an entirely different legal environment. Chinese water market observers such as Zhong and Fu (2008) have already explored the development of the legal basis underpinning the exponential growth of privatization projects in the water sector. Li (2007) claims that the failure of foreign investment in China's market is due, in part, to a flawed BOT legal environment.

Country risk: country risk is the exposure to a loss in cross-border lending, which originates from various events within a particular country (Fight, 2004). These types of events are usually government-controlled rather than private enterprises or individual involvement. This situation is less likely to happen in a country like China because of its emerging economy. However, Fight (2004) believes that there are three factors that could elevate the country risk: political events; economic factors and social factors and all these three can be found in Chinese society at various levels.

Political risk: due to legal changes and unsupportive government policies. This can be observed in China due to the rapid growth of the economy superimposed on an insufficiently developed policy landscape. Private investors are encouraged, however, with the enactment on the environmental policies and the complexity throughout the execution of the regulations, it further complicates the privatization of the wastewater treatment facilities.

Environment risk: which is generated due to the adverse environmental impacts and hazards.

Force majeure risk: war and other external factors such as climatic changes or natural disasters. Recent examples include the drought in Yunan province and several earthquakes happened recently in western China.

Financial risk: arising from inadequate hedging of revenue streams and financial costs.

Revenue risk: typically due to the volatility of prices, shortfall in demand or failure to extract resources. For instance, a poor sewer network may cause unexpected demand shortfalls in wastewater treatment.

Technical risk: due to engineering and design failures; but also risks arising from inadequate maintenance regimes and also obsolescence.

Construction risk: arising from inadequate materials and construction methods as well as cost escalation and delays arising from an uncertain project environment.

Operating risk: due to increased operating and maintenance costs.

Resources risk: The demand for energy and natural resources in industrial areas has led to a situation where commercial enterprises have had to seek alternatives. A recent scenario illustrates this well; the manufacturing industry, which was centred on regions to the south of China relocated to inland cities in the southwest region where resources were more readily available. However, this kind of 'migration' does not improve the situation, indeed it may potentially exacerbate the problem if strategic approaches to managing resource risk are not implemented.

Intellectual property (IP) risk: in the year of 1995, 90% of the equipment in large or medium-sized WWTPs was imported to China (US DoC report). However, with the localization of equipment manufacturing and the advancement on research and development in local enterprises, the demand of imported equipment has gradually decreased. 'Localization' usually deters foreign companies when attempting to enter

the Chinese market due to the fear that the copyright of the product would be exploited once it entered the market. This has become an obstruction to the SME technology and equipment providers entering China's market (Yeo and Lai, 2004).

Socio-economic risk: unemployment due to privatization (Au and Li, 2006) and exploitation of rural areas for new treatment facilities could result in demographic abnormalities.

CONCLUSIONS

The Chinese economy continues to grow within a market-oriented business model, but conceals various risks through this transition; those risks are complicated and rather unpredictable. Due to the interpretation of risks from the Chinese government's point of view, it is significantly different from the investors or other foreign perspectives. Besides, the information from the Chinese market observers is abundant, yet official data and references are rather superficial.

In the context of political landscape in China, the government, on one hand opened furthermore the market and encourages new investment coming into the country in order to progressively nudge the privatization of the water market; on the other hand, the state does not want to give up on the authority it possesses on the ultimate decision making. The investment environment is then become complicated and the management of risks is volatile. Hence, the China's water market is being characterized by the fact that that no single financial body can be used as a reference to describe the entire situation during the financing or the procurement of the water infrastructure projects. This is a different topic that requires further research.

In this paper, potential risks of China's water market have been identified and listed and a further development on the quantification of these risks and the management programme which works alongside with the asset management system should be further explored so as to solidify the work of risk investigation in this research.

Finally, it can be observed that the involvement of foreign investors with the active participation of the domestic market offers prospects in developing a customized risk and asset management framework to accommodate the idiosyncratic nature of China's emerging water market.

REFERENCES

Au, L Y, Liu, D Q (2006) The privatization of water supply in China, In: Quinlan V, Balanya B *et al.* (eds.) *Reclaiming Public Water: Achievements, Struggles and visions from around the world*. Chinese ed. Hong Kong: Transnational Institute and Corporate Europe Observatory publisher.

Boussabaine H A, Kirkham R J (2004) *Whole Life-cycle costing: Risk and Risk Response*. Oxford: Blackwell Publishing Ltd.

Broadbent, J, Laughlin R (2003) Public private partnerships: an introduction, *Accounting, Auditing and Accountability Journal*, **13**(3), 332-341.

Chapman C, Ward S (2002) *Managing Project Risk and Uncertainty: Constructively Simple Approach to Decision Making*. West Sussex: John Wiley and Sons, Ltd.

Chen C, Messner, J I (2003) Comparative analysis of Chinese BOT projects in water supply. *Joint International Symposium of CIB W55/65/107 Working Commissions*, 22-24th October 2003, Singapore.

Dowie J (1999) Again Risk. Risk Decision and Policy 4:1, 5773.

Fight, A (2004) *Understanding international bank risk*. West Sussex: John WileyandSons Ltd.

Green, S D (2001) Towards and integrated script for risk and value management, *International Project Management Journal*, **7**(1), 52-58.

Grimsey, D, Mervyn K Lewis (2002) Evaluating the risks of public private partnerships for infrastructure projects. *International Journal of Project Management*, **20**, 107-118.

Hall, D, de la Motte, R, Davis S (2003) *Terminology of Public-Private Partnerships (PPPs)*. University of Greenwich, London.

HM Treasury (2003) *PFI: meeting the investment challenge*. HMSO.

Kirkham, R J (2002) *A stochastic whole life cycle cost model for a national health service acute care hospital building*, PhD Thesis, Department of Architecture and Building Engineering, The University of Liverpool.

Li, S S (2007) *The legal environment and risks for foreign investment in China*. Springer.

Ma, J (2009) Marketing Urban Water Supply in China. *Universitas 21 International Graduate Research Conference*, 29th Nov – 5th Dec 2009, Universities of Melbourne and Queensland (Brisbane), Australia, 107-110.

Merna, T. and F. F. Al-Thani (2005), *Corporate Risk Management: An Organizational Perspective*. West Sussex: John Wiley and Sons Ltd.

Neill, M., Allen, J., Woodhead, N., Reid, S., Irwin, L., and Sanderson, H. (2008) A Positive Approach To Risk Requires Person Centred Thinking, London, CSIP Personalization Network, Department of Health.

Perminova, O, Magnus G, Kim WikstroÅNm (2008). Defining uncertainty in projects – a new perspective. *International Journal of Project Management* **26**, pp.73-79.

Report No. 24979 (2002) China: Review of the banks' assistance to the urban water supply and wastewater sector. World Bank.

Savas, E S (2005) *Privatization in the city: successes, failures, lessons*. Washington DC.

U.S. Department of Commerce (2005) *Water supply and wastewater treatment market in China*. Washing D.C.: International Trade Administration.

Wei, Y (2009) The accountability gap in China's urban water supply marketization reform. *Universitas 21 International Graduate Research Conference*, 29th Nov – 5th Dec 2009, Universities of Melbourne and Queensland (Brisbane), Australia, 195-196.

Woodhouse, J (2006) Putting the total jigsaw puzzle together: PAS 55 standard for the integrated, optimized management of assets. *21st International Maintenance Conference*, 5-8 December 2006, Daytona Beach Florida. IMC.

Yeo, K T and Lai, W C (2004) Risk Management Strategies for SME Investing in China – A Singaporean Perspective. *IEEE: International Engineering Management Conference*, 18-21st October, 2004, Singapore, 794-798.

Zhong, L, Mol, Arthur P J and Fu, T (2008) Public-private partnerships in China's urban water section. *Environmental Management*, **41**, 863-877.

Zhong, L and Fu, T (2005) BOT applied in Chinese wastewater sector. *Asian Development Bank: Hands-on workshop on sanitation and wastewater management*, 19-20th September 2005, Manila. ADB Headquarters, 1-8.