



# Public-Private Partnerships and Smart Technologies for Water Sector Development

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The report provides a summary of the proceedings and discussion points resulting from a two-day workshop in Tashkent, Republic of Uzbekistan. The workshop provided an interactive introduction to issues and challenges in implementing PPP projects and ICT (smart) systems in the water sector. Around 80 participants from 8 ministries and 14 *suvakovas* (provincial water utilities) attended the workshop.

On Day One of the workshop, international expert speakers were invited to share knowledge and lessons learned in successfully delivering PPP projects in the People's Republic of China, the Republic of Korea, and Armenia.

Day Two provided an introduction to smart systems in the water sector. There was a particular focus on remote monitoring of water networks through smart meters and other instruments; subsequently using this information to make smart decisions for improving efficiency and reducing water losses; and ultimately integrating this information into smart city network.

To wrap up the workshop, the participants had a chance to develop and share initial project ideas in a group discussion exercise which was guided by expert resource persons.

The newly established Ministry of Housing and Communal Services is implementing a process of reform in the governance and management of water supply and sanitation in Uzbekistan. The ongoing reforms will introduce improved sector governance and aim to stimulate uptake of modern best practice approaches for management of water supply and sanitation services. This modernization is expected to drive the application of high-tech smart solutions for the sector, in both hardware and software. The Ministry accepts such modernization will need government budgetary support, and this year the Ministry increased its budget allocation for the sector by threefold (from UZS 500 billion to UZS 1.5 trillion). However, to deliver the necessary investments and upgrades without creating an intolerable fiscal

burden, the Ministry is clear that other sources of finance, including public-private partnerships (PPPs), will have to be leveraged.

Attracting private finance to water sector projects is a difficult task – the majority of PPP projects in Asia are in the transport and energy sectors – but the benefits go beyond funding alone. The private sector brings with it access to modern technologies and know how, potential for improved efficiency, and turn-key smart solutions.

Widespread uptake of PPP approaches, however, will require significant effort on behalf of the government: involvement of the private sector does not relinquish government of responsibility. Preparing, negotiating, contracting, monitoring and managing PPP contracts requires a deep understanding of technical and legal issues. The participants of the workshop heard that a gradual approach to PPPs is important, commencing with smaller-scale pilot projects to learn lessons, build expertise, and build confidence in both the legal framework and the abilities of the private sector.

Through open discussion, participants also learned that there is an existing law in Uzbekistan covering government concessions, and that a PPP taskforce is being established, and the legal framework to cover PPPs is to be updated.

It is clear that leveraging private sector expertise and finance is a strategic objective of the Ministry of Housing and Communal services. There will be many challenges in implementing this strategy, but, based on workshop feedback, there is currently support and optimism from all levels within the water sector.

To incentivize mobilisation of private finance, this initial support must be developed into a long-term and stable strategy underpinned by a strong legal framework, sound policy, and the political will to bear costs, guarantee risks, and develop trusting partnerships with the private sector.



Workshop participants and speakers



**Minister Muzaffar Soliev of the Ministry of Housing and Communal Services, Republic of Uzbekistan**

*"Efficient operation of utility services has a direct impact on all citizens of Uzbekistan and the social climate of our country. Access to safe drinking water and sanitation is one of the first considerations of any government. Providing reliable and high-quality water and sanitation services is a huge fiscal burden on the state. And delivering these services from government budgets alone is not currently possible. PPPs provide access to private capital and will also improve management of project implementation and water operations in accordance with international best practices. This workshop is, therefore, extremely timely from our perspective. We thank ADB for their support to our government, particularly in this sector. To date, we have implemented seven large water and sanitation projects with the support of ADB and we are continuing this partnership through ongoing projects."*

*"As well as accessing finance, PPPs can also improve efficiency and introduce best practices in management and operations of water service delivery and project implementation. However, experience from ADB member countries illustrate that there are many issues with PPPs.*

- Available competent of private companies.
- Legal frameworks
- Accountability
- Stakeholder acceptance of private sector in water provision
- Capacity to develop projects and manage PPP contracts.

*PPPs can and do improve utility performance, but politics and public perception can make water PPPs a challenge to implement. To attract the private sector we need incentives, transparency, competency, appropriate legal frameworks. Without this, the private sector will not be interested.*

*We at ADB can share some lessons learned in implementing PPPs, we do not want to Uzbekistan to make the same mistakes we have seen before. This workshop is a platform for sharing knowledge, best practices, and facilitating learning, and it will support our collaboration with the Government of Uzbekistan in the water sector. Thank you for participating."*



**Yong Ye, Director at Central West Asia Urban Development and Water, ADB**

In 2015, the Cabinet of Ministers of Uzbekistan adopted a Decree (DCM 306) to consolidate the 131 original water supply and sanitation providers into 18 enterprises with standardized organizational structure. The decree further introduced a broad set of reforms in the sector, including:

- Development of the concept on Comprehensive Development and Modernization of WSS systems of Uzbekistan till 2035;
- Development of the program on improvement of the regulatory framework of water supply and sanitation;
- Adoption of modern methods of utilities' management by introducing Public Service Contracts for clear delineation of responsibilities between local state authorities and the consolidated utilities;
- Adoption of the regular reporting on Key Performance Indicators, financial and operating parameters;
- Overhaul of practices on annual budgeting, external budget reviews, and business planning;
- Adoption of Key Performance Indicators for monitoring performance of the utilities;
- Universal adoption of customer databases and billing system software to be implemented through the National Bureau of Enforcements, which is to be established under the General Prosecutor's Office;
- Installation of modern meters at production sites, distribution hubs, and customer connections;
- Adoption of ICT solutions for Water Balance reporting;
- Adoption by the utilities of Geographic Information Systems (GIS) "Asset Management";
- Introduction of annual training for key management personnel of the utilities;
- Creation of appropriate information sources (websites) for public accountability and customer grievances;
- Broad information campaign with regular reporting in mass media and Internet on content and purpose of reforms in the WSS sector.

In 2017, the Ministry of Housing and Communal Services was established. This has instigated a process of centralization in the sector with the primary governance responsibility shifting to the ministry and its provincial departments.



Prior to the reforms, the utilities information circuits were closed, only insiders had access to reliable information on quality and scale of the utility's operations. To date, the reforms have opened up information circuits on utility operations, with authoritative external audiences continually present and active in overseeing performance of the utilities. Transparency and accountability of operations, as well as the general control environment have improved, but there is still progress to be made on accurate monitoring, reporting and accounting.

The reforms are still at a relatively early stage of development, greater effort and investment is required to deliver a sustainable and well-performing water and sanitation sector. Prior to the workshop, the author consulted with Tashkent City Suvakova to understand the prevailing situation, this is summarized in **Box 1** to provide further context to this workshop report.

## Box 1: Tashkent City Suvakova

Tashkent City Suvakova provides water supply and sanitation services to Tashkent City and some areas in the Tashkent region.

The serviced population includes 594,000 households, 18,000 commercial connections, and 3,000 public institutions. Revenue collection is reasonable across customer groups, and total annual revenue is UZS 164 billion. This generally covers their annual operational budgets. However, the Suvakova has plans to improve collections (revenues) and reduce costs as they still rely on international funding and local government transfers for capital projects.

Currently only 50% of households are metered; the remainder are estimated according to a standard. This results in collections which are not reflective of consumption, and does not provide any incentive to control water consumption. In addition, the lack of bulk flow meters limits the ability to undertake detailed analysis of losses to provide focus areas for pipe rehabilitation works. Water losses are currently estimated at 34% but this may be optimistic as accurate water use data is not available.

Due to the flat topography the Suvakova incurs high pumping costs compared to more favorable regions in Uzbekistan. Furthermore, there are currently 5,000 employees, and therefore the potential for human resource efficiency improvements.

Current program examples:

- Since January 2018, billing and collection responsibilities have been shifted to the National Bureau of Enforcements under the General Prosecutor's Office, along with electricity and gas. The transition has incurred some teething problems but these are being resolved month by month by working closely with the Prosecutor's Office.
- The Suvakova is working with the Ministry of Housing and Communal Services to develop the best approach to roll out Smart Metering, to ensure accurate water use monitoring and billing.
- A water accounting and losses task force is being established underneath the Head of the Suvakova with an objective to reduce NRW to 20% across the whole utility, a pilot has been completed.



- Energy efficient pumps have been procured through a (low interest) credit loan from the pump supplier to replace existing inefficient systems. Repayment is being made over 5 years, the savings made through reduced energy consumption cover the repayments.
- The Suvakova has recently moved to outsourced service contract for pipe rehabilitation with a private company who will guarantee the work for 2 years. This work was previously undertaken by their works department.
- Tender documents are under preparation for contracting a private company to operate a small system in Tashkent province under a concession. This is a pilot study supported by the Ministry of Housing and Communal Services. Key findings will include a tariff review exercise.
- \$10 million borrowed directly from EBRD for pumping station upgrades. Repayment has recently been completed from their own operational revenue.
- \$30 million borrowed directly from the Islamic Development Bank for Wastewater treatment plant construction. Repayment is ongoing.

*(Consultation: 4th July, 2018)*

# Public-Private Partnership

There is no standard, internationally accepted definition of a PPP. The term is used to describe a wide range of types of agreements between public and private sector entities, and different countries have adopted different definitions as their PPP programs evolved. For the purposes of the workshop, a PPP has been defined as **a contract between a private party and a government entity, for providing a public asset or service, in which the private party bears significant risk and management responsibility, and remuneration is linked to performance.**

## Why PPPs?

### PPPs provide an alternative source of funding.

Limitations in infrastructure budget is a problem shared by every country in the world, this is not an issue in Uzbekistan alone. By allowing private sector involvement in projects, private sector investment can be accessed, thus expanding the fiscal space to fill the government's infrastructure funding gap. It is important to remember that to interest the private sector in infrastructure projects, the opportunities must be financially viable: to mobilize private finance and (equity) investment, downstream profits are essential.

### PPP provides efficiency gains.

As noted above, private sector involvement is driven by the ability to make a profit. The private sector has an incentive to maximize their profits. In PPP arrangements with relatively fixed revenues this means focusing on cost reductions (efficiency gains). Furthermore, by integrating design and build as well as operation into a single contract, life cycle costs can be minimized. Under the business-as-usual system, the designers and construction contractors have no incentive to deliver the most efficient systems (plant, pumps etc.) as they have no responsibility for maintenance and operations.

By combining these contracts, for example, under a Design-Build-Operate contract, there is a strong incentive for contractors to deliver reliable and efficient systems, to reduce their future operating costs, and therefore maximize future profits.

Efficiency gains can also be generated with respect to time. Clauses for construction completion deadlines and penalties for non-compliance can be included into PPP contracts.

*"Suvakovas have concerns about reporting and accounting. But currently commercial losses are at 60% (although they are reported at 30%). Private companies will fully control this and monitor this. In addition receivables and payables. Power consumption - suvakovas do not have systems to account and report their power costs. They say it is up to the power company to meter and bill them so they don't know how much power they consume. This issue has never been addressed. We would fully support PPP arrangements as the private party will be profit oriented and will thus have to account for everything."*

**Ministry of Finance**

## Quality of Service

As well as efficiency gains, PPP contracts can be set up to ensure quality delivery. Pre-specified performance indicators can be monitored, with penalties (i.e. reduced payments), if quality standards are not met. The monitoring approach needs to be defined in the contract as well as a mechanism for the public sector to audit any indicators/reports provided by the private operator. Such contractual incentives can help to maintain service delivery quality.

Furthermore, private operators tend to be more responsive to the preference of consumers. Seemingly commercial reputation is often more powerful than political reputation. Particularly with large multinational concession providers.

## PPP Approaches

During the workshop, three main groups of PPP approaches were discussed: management contracts, lease contracts, and concessions. There are many variants within and across these groups. In reality, the specifics of a PPP agreement are flexible, and all can be appropriate provided that the responsibilities are clearly defined in a contract governed by a suitable legal framework.

Jung Ho Kim, Urban Development Specialist, ADB, presented the diagram below which illustrates the applicability of these three groups of PPP agreement based on private sector risk appetite, which inherently depends on potential for tariffs to cover operational and investment costs.

# Public-Private Partnership



*"Many successful water PPPs were largely based on public financing (leases or hybrid schemes), combined with efficient private operation. In many cases the biggest financial contribution from a private operator is not in the investment but lies in improving the financial viability and efficiency of the WSS services."*

**Jung Ho Kim**  
Urban Development Specialist, ADB

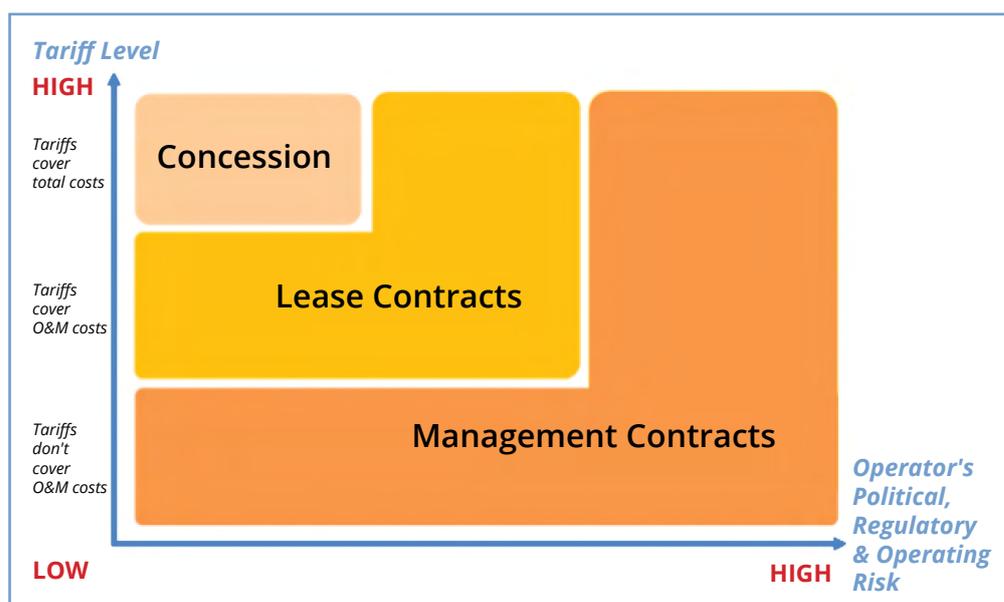
**Management contracts** are outsourcing contracts for private sector to manage and/or operate defined assets or functions of the awarding authority for a relatively short time period. The simplest management contracts involve the private operator being paid an agreed (generally fixed) fee for performing specified tasks – the remuneration does not depend on collection of tariffs and the private operator does not typically take on the risk of asset condition. This does not conform with the definition of PPPs provided previously for the purposes of this workshop. Management contracts were included in the discussion because they provide a useful and simple

initial approach for engaging the private sector initially (the reduced risk will be attractive) to exploit their operational experience, and gauge private capabilities, see **Box 2**.

**Lease contracts** are arrangements under which the private operator is responsible for operating and maintaining assets and managing the utility but not for financing investments. Generally, a fixed rental payment is paid to the awarding authority irrespective of the level of tariff collection achieved, thus the operator takes a risk on bill collection covering its operating costs and anticipated profit. The awarding

authority remains responsible for financing and managing investment in the assets, to which the lease payments can contribute. Lease contracts should be used when private equity and commercial debt are not available for financing investment, and therefore the awarding authority wants to combine public funding with private sector expertise and efficiency.

Greater commercial risks are passed on to the operator than with a management contract, with the inherent incentive to perform – increasing receipts and reducing costs.



Under a **concession**, the concessionaire will pay a concession fee to the authority for the right to use utility assets under a long-term contract, including responsibilities for operation and maintenance. The concessionaire typically obtains most of its revenues directly from the consumers. Asset ownership typically remains with the contracting authority, including assets purchased and constructed by the concessionaire. A concession covers an entire infrastructure system so usually includes the concessionaire taking over operation of existing assets as well as building and operating new assets. Although new asset development can also remain the responsibility of the asset owner. A Build-Operate-Transfer (BOT) contract is similar to a concession in that private debt and equity are used to develop

infrastructure assets. However, BOT contracts are typically used to develop and operate a discrete asset rather than a whole network, and the project is generally greenfield in nature.

**Box 2** below illustrates progress in the water sector in Armenia by working with the private sector under management contracts.

### PPP Implementation and Enablers

Professor Park Hyeon, University of Seoul, presented the process outlined opposite, for developing a PPP investment project, such as a BOT. He stressed that a PPP is like any other project which must be prioritised according to existing planning processes.

## Box 2: Implementing Water Supply Improvements through PPPs in Armenia

Twenty years ago, on the breakup of Soviet Union, water infrastructure in Armenia was ageing and in need of replacement, there was a centralized water planning system, no tariffs, and water supply was scheduled for a few hours each day. Armenia signed a water code in 2000, under which water metering started and water tariffs were established. Some investment was made in partnership with IFIs but they had little confidence in the management capabilities of the utilities to generate suitable revenues and deliver sustainability.

Improvements made through management contracts	2004	2016
Billing payments increased by nearly three times (tariff increased by 40%)	USD 5.3 m	→ USD 14 m
Subscribers with water meters nearly doubled (%)	40%	→ 87%
Daily water service hours increased	6 hours	→ 18 hours
Electricity consumption halved	61 million kWh	→ 31 million kWh
Treated water quality improved (% of water disinfected)	61%	→ 91%

To improve confidence in the utilities and therefore stimulate further investment, the government outsourced utility management to the private sector in 2004, under a number of separate contracts. This commenced with a two-year pilot and ultimately resulting in concrete successes, as outlined in the table below. After some teething problems utility management improved, mobilizing further financial resources from donors.

Even though management contracts improved utility performance, rural utilities still operated at a loss relying on fund transfers to maintain operations. To reduce these subsidies the government decided to lump all utilities together under a single nationwide lease agreement for 15 years in 2017. In this way, the profits possible in urban areas cross-subsidize losses in rural areas.

Primary objectives of the lease:

- Further improve efficiency
- Improve service delivery, thus willingness to pay
- Improve financial performance
- Develop a long-term investment plan
- Training and capacity development



**Eduard Chil-Akopyan, International PPP expert**

# Public-Private Partnership

If the aim of the PPP is for accessing private sector finance for specific infrastructure investments, a Special Purpose Company is set up to fulfil the terms of the project (BOT/DBO, etc). PPP law usually specifies that a new company is established for the project. This is to ensure clear accounting and reporting from a single entity. The typical PPP project structure is illustrated in the figure below, as presented by Jung Ho Kim. Capital costs are generally finance through 20% equity investment and 80% debt.

Professor Park went on to describe how the Government of Korea attracted private sector investment in public infrastructure, starting in the late nineties, see **Box 3**.

## Legal and Institutional Frameworks

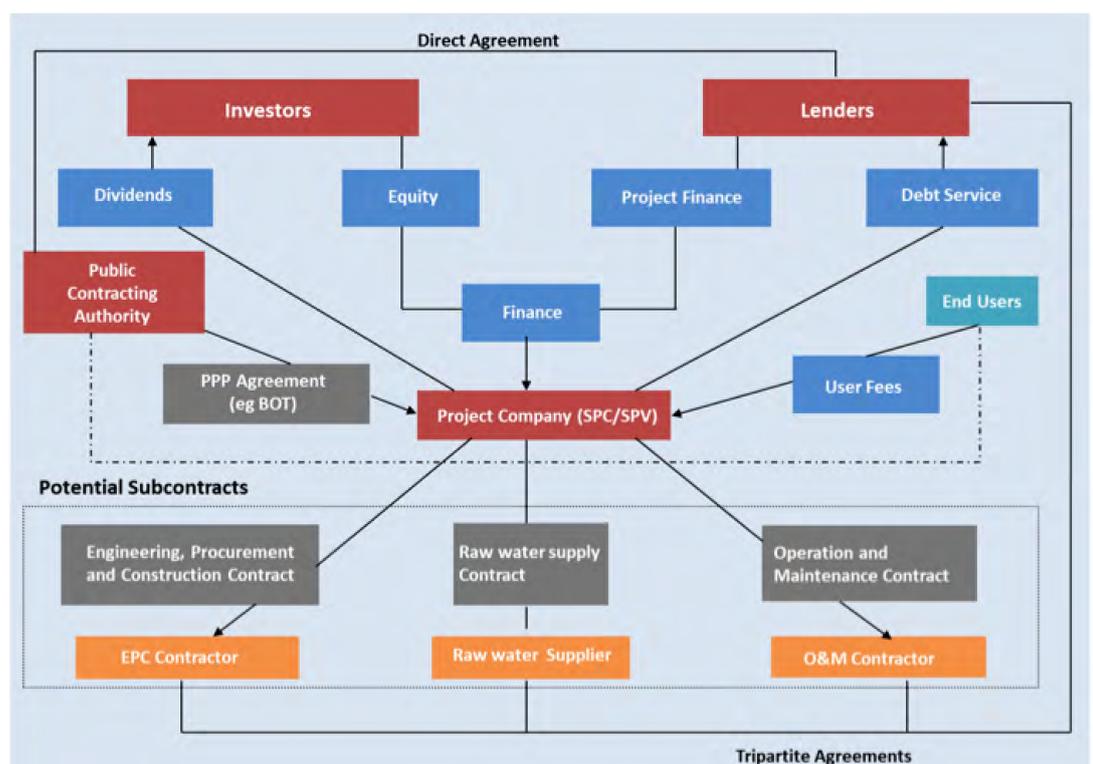
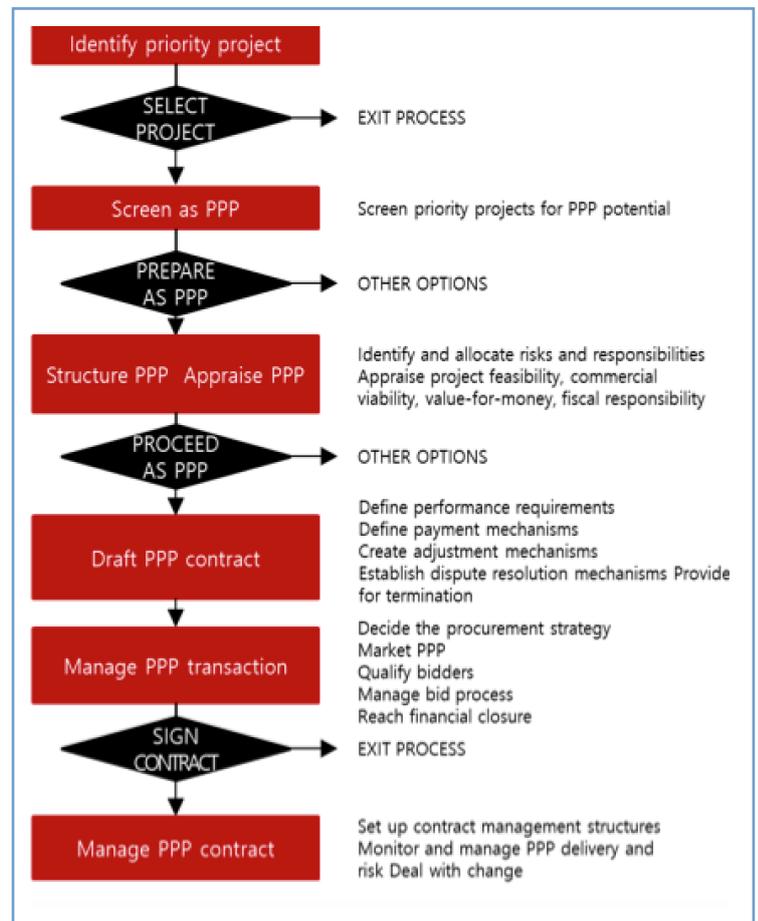
To attract foreign direct investment through PPPs a sound legal framework is essential. A PPP law is often required to establish a clear institutional framework for developing, procuring, implementing and regulating PPPs.

PPP laws can also be used to close gaps in existing sector specific laws, procurement or competition laws. **Box 4** outlines a breakdown of potential legislative provisions. Further specific considerations related to the water sector were presented by Mats Anderson, International PPP expert:

- Tariff setting and revision
- Abstraction licensing / Raw water supply
- Bearing of raw water quality risks
- Offtake / Water purchase agreements

Most countries who have had success in attracting private sector projects have established such a legal system, as well as a PPP Unit at a national level to:

- support the continual development of suitable frameworks and policy for implementing PPPs
- provide and coordinate technical assistance for



- preparing PPP projects
- prepare and revise standard PPP documentation
- market promotion
- preparing and updating project proposal pipeline

### PPP Success Factors

Successfully preparing and signing PPP contracts requires that the private sector operator is comfortable operating in the market, and that their investors and lenders are willing to provide capital for projects. Key considerations for operators and investors as presented by Jung Ho Kim, include:

### Investor considerations

- Is there a financial reward?
- Do the borrowers / Project owners have the capacity to implement the contract?
- Has the borrower invested sufficient equity?
- Availability of step in rights?
- Have they successfully worked together before?
- Are they committed to the long term?

### Private partner considerations

- A viable project with potential for profit.
- Political and legal stability and political support.
- Clear legal framework and rule of law.

## BOX 3: Incentivizing PPPs in South Korea

The Korean government wanted to promote the PPP market in the wake of Asian Financial Crisis in 1997-98. They revised the PPP Act in 1999 to incentivize PPPs:

### Risk Mitigation

- Consistent and explicit rule of risk allocation
- MRG (Minimum Revenue Guarantee) clause introduced to mitigate risks and increase PPP projects
- Early termination payment clause
- Foreign exchange volatility risk mitigated (80-120% fluctuation)
- SOC Credit Guarantee Fund

### Promoting Unsolicited Proposals

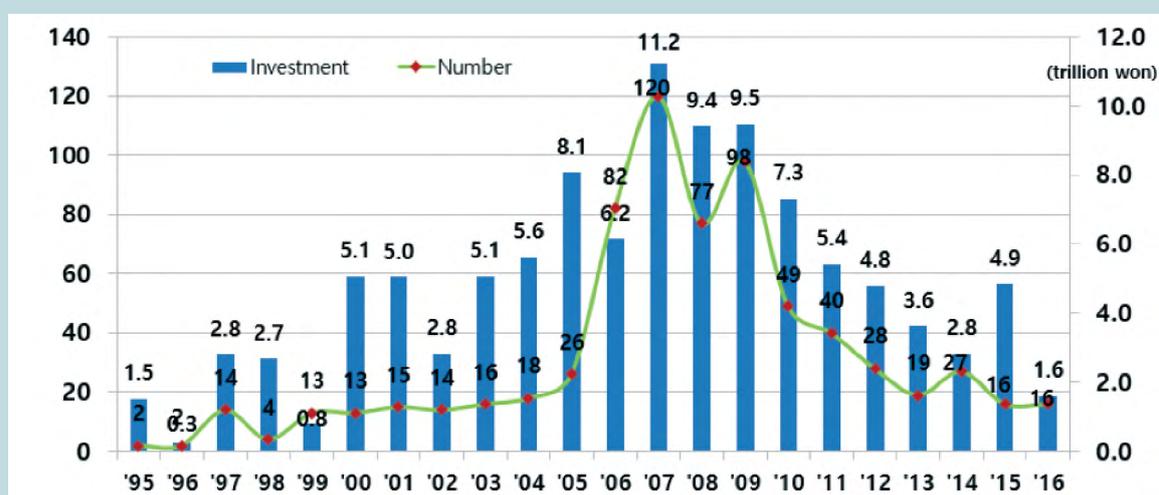
- Streamlining implementation procedure of unsolicited proposal
- Bonus point (max 10%) awarded at the bidding stage

### PPP Unit Established

- Technical assistance to PPP project implementation organizations
- Develop and maintain standard documentation for RFP, bidding, and negotiation
- Policy advisory in formulation of PPP policies
- Theoretical and practical research on PPP
- PPP market promotion by inducing FDI

The government also provides subsidies, if and when they are necessary to keep the tariff at an appropriate, affordable level. The subsidy is determined in the individual concession agreement. On average, under Korean PPPs, 28% of the finance is provided by the subsidy.

The chart below illustrates the success of the incentives, with private sector investment in public infrastructure increasing significantly to 2007. After this, PPP investment has declined as the infrastructure funding deficit has declined – a considerable level of the required infrastructure stock had been supplied. At this point, the government took action to re-balance the public/private risk allocation and abolished their minimum revenue guarantee policy which was originally enacted under the 1999 Act.



# Public-Private Partnership

- Dispute resolution mechanisms.
- Creditworthiness of off-taker/client
- Clear and well-balanced risk sharing

## Specific Local Considerations

Mats Anderson presented two specific prerequisites that the Uzbekistan Government and water utilities should focus on before widespread adoption of PPPs.

Firstly, it will be essential to develop accurate baseline data. It is important to understand how systems function to know how your system works. Developing understanding of your assets and their condition will be crucial. GIS-based systems are ideal for this. This baseline and monitoring systems will be crucial for determining realistic and achievable performance indicators, whether they are related to efficiency, flow, quality, etc. It will also be necessary to understand the hydrological baseline to prove water availability and understand future water availability and possibly quality.

Secondly, consideration should be given to developing a simple, predictable and reliable arrangement for tariff setting (and transfers/subsidies if relevant). Potential partners will consider in detail how realistic, stable and reliable the tariff system is, as this will determine their potential revenues, thus profitability.

## BOX 4: Legal Considerations

### General Provisions

- Definitions
- Eligible Sectors
- Scope and minimum size of PPP projects
- Authority to enter into concession contracts

### Selection of the Concessionaire

- Pre-selection of bidders
- Procedures for requesting proposals
- Comparison and evaluation of proposals
- Negotiation of concession contracts
- Unsolicited proposals

### Implementation of the Concession Contract

- Governing law
- Organization of the concessionaire
- Ownership of assets
- Financial arrangements
- Accounting and reporting requirements
- Auditing the concessionaire
- Operation of infrastructure
- Compensation for changes in legislation
- Revision of the concession contract
- Takeover by the contracting authority
- Substitution of the concessionaire

### Termination

- Termination by the contracting authority
- Termination by the concessionaire
- Compensation upon termination
- Wind-up and transfer measures

### Settlement of Disputes

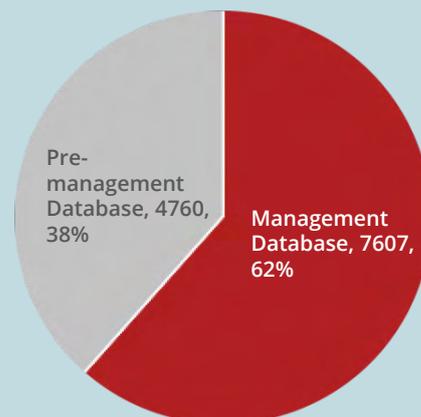
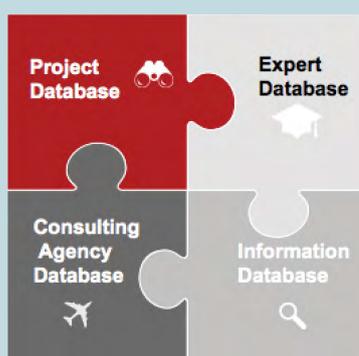
- Disputes with the concessionaire
- Disputes involving customers
- Disputes with other parties

## BOX 5: How China promotes PPPs



Wu Yun, China Investment Consulting Co. Ltd.

1. National Demonstration Projects act as Guidance.
2. The China Public-Private Partnerships Financing Forum is held annually, this brings together Government, Investors, Financial Institutions, and operators. This establishes a bridge between projects and capital.
3. Created an information platform, as illustrated:



# PPPs: Discussion and Q&A

*If our systems are given as a concession. If we involve a foreign partner, they may have good experience, but if they invest their capital in a boiler house (for example), will this asset be transferred to their balance sheet. What happens if their assets are frozen, if the company fails, how do we resolve this?*

When developing assets with the private sector, the timing of the transfer can be done in 2 ways. For example, in Korea, we transfer the asset (from private to public) on completion of the construction (BTO). In many other countries, they transfer these assets at the end of the contract (BOT). The Korean approach would mitigate this risk. Under a concession, such risks have to be mitigated in the concession agreement. For example, assets do not have to be transferred to the operator. If the contract includes transfer of asset ownership to the private sector, measures can be incorporated to deal with asset ownership in such circumstances. It will be clear how assets will be disposed of and for what price, usually through a formula based on depreciation.

*Given the social importance of water supply and sewage, what impact will PPPs have on tariffs. Will there be rapid growth of tariffs? How can you address this?*

Services have to be paid for, whether they are provided through PPP or not. These services are ultimately paid for through taxes (subsidy) or tariffs. There is no exception to this. If affordability or willingness to pay present issues, subsidies may be required to keep tariff low (tariff structuring can also be reviewed, with low tariffs for consumption up to a certain threshold). While private sector involvement essentially creates an additional cost (in private sector profit) to service delivery. Often efficiency gains in staffing, water losses, and energy consumption can offset this cost.



Either way, tariffs need to be decided through set mechanisms and regulated and where possible, removed from short term politics. Tariff reductions or freezes are often leveraged by government for votes which can make utilities unsustainable. As you note, tariffs need to increase over time, to reflect cost increases. In agreements with the private sector this can be linked to Consumer Price Index - a nominal rate to reflect inflation but not reflecting actual cost. The basis for requesting and agreeing tariff increases needs to be clearly set out in the agreement with the private sector.

Having said that, implementation of these required tariff increases is difficult. Increasing tariffs is often criticized by media and public. This is a typical response. Awareness campaigns on the real cost of service provision can support this.

In Armenia, we have implemented both management contracts and lease contracts. In a management contract the company do not care to increase tariffs, they just want to improve efficiency to generate profit from their fees. Under these contracts, the World Bank would pay for the services through a loan and MOF repay the loan. When we started a lease contract, we found that tariffs did not have to increase beyond inflation. The tariff does not necessarily grow. It depends on how you negotiate with the operator.

*We have a limited amount of water we can supply. The private sector will have to operate within this constraint. This also constrains their profits. And could cause disputes. How do we set tariffs, how do we transfer to a market driven pricing policy?*

The first step to developing a project is to define the scope of the project. In this way, a PPP is the same as any project. But with a PPP, it is important that you allocate the risk effectively. In this situation of importing raw water, it would probably be better for the public sector to negotiate on price of raw water. Government agencies control water abstraction and government will likely be responsible for regulating any raw water tariffs, as well as preparing and implementing future water resources projects if necessary. A PPP does not resolve the problem of limited raw water availability, or the cost of water abstraction and transmission. It is a problem that exists, and it will always exist.

# PPPs: Discussion and Q&A

*What are the profit margins that private sector is looking for in water sector projects?*

The investors will have to wait for maybe 20 years for investment to be returned through a dividend. Theoretically, private investors are looking for returns to cover the market interest rate PLUS profit PLUS a risk premium. In Korea, for economic infrastructure, roads and sewage, expected return is around 6%. In Uzbekistan, we don't know, the market will decide the return. At least initially, the risk will be higher, therefore the returns required to interest the private sector will reflect this. Liquidity will also be a factor in determining rates.

In Central Asia, there are not many water sector PPPs and there may be companies who want to capture the market. With IFI investment or guarantees they may actually overlook some risks and decide to take on a project at a lower margin, at least initially.

*In Namangan Province we are interested in PPPs to improve our efficiency. We have meters at the water source, at the distribution center, and some consumers, and our losses themselves are estimated at 16 million m<sup>3</sup> / year. We visited Shymkent water utility in Kazakhstan. The staff get higher salaries because they are more efficient. They monitor water use and water pressure on a 24x7 basis, they have installed more efficient pumps, they have solar panels and biogas projects at sewage treatment plants. These improved efficiencies and SMART technologies can be implemented through PPPs.*

This may be the case, that the private sector will implement smart technologies to deliver efficiency gains. But remember that PPPs are output governed contracts. From the point of the public sector they only oversee the output specifications, usually water quantity and quality. The operator needs to be given flexibility to deliver. If they have confidence in implementing innovative technologies, they can apply them at their own risk. Certainly there is capacity internationally to combine innovative technology and ICT to deliver efficiency and greater profits.

*In Armenia, when PPPs were first implemented, were there many disputes with the private sector?*

Our PPP projects started in Yerevan and we did have some initial problems. These disputes never reached the courts and were primarily related to tariff setting.

*In your experience in Korea, what are the first things that need to be addressed in Uzbekistan before engaging the private sector?*

First, listen to the private sector, see what they want. In Korea we have a task force who regularly meet with chamber of commerce and international chambers of commerce.

Also, managing a long-term contract over 20 or 30 years is difficult. There may also be extensions, renegotiation, and refinancing. To remain on top of this we need to have good project management and recording because we cannot rely on staff continuity to cover these periods, and institutional memory is often lost. Utility staff will have day to day jobs and it will be difficult to keep an eye on PPP issues so a specific unit to deal with project management is important, ensuring that all records, negotiations, reports and audits are held on record throughout the length of the project.

*What areas could ADB provide some assistance?*

It will be important to have a coordinated approach, with a long-term plan. It is important to have clear policy and a strategy: a systematic approach rather than an ad hoc approach.

It is not easy to attract private sector to water sector projects. The approach to PPPs needs to be gradual to ensure lessons are learned. We, ADB, could initially assist with TA resources on drafting a policy and action plan. A solid strategy will allow us to coordinate on future ADB support.

# Smart Water Management

## Why smart?

Smart systems allow us to change our conventional water and wastewater systems to instrumented, interconnected and intelligent systems.

- Instrumented – the ability to detect, sense, measure, and record data
- Interconnected – the ability to communicate and interact with operators and people who manage the systems
- Intelligent – the ability to analyze the situation, enable quick responses, and optimize trouble shooting solutions

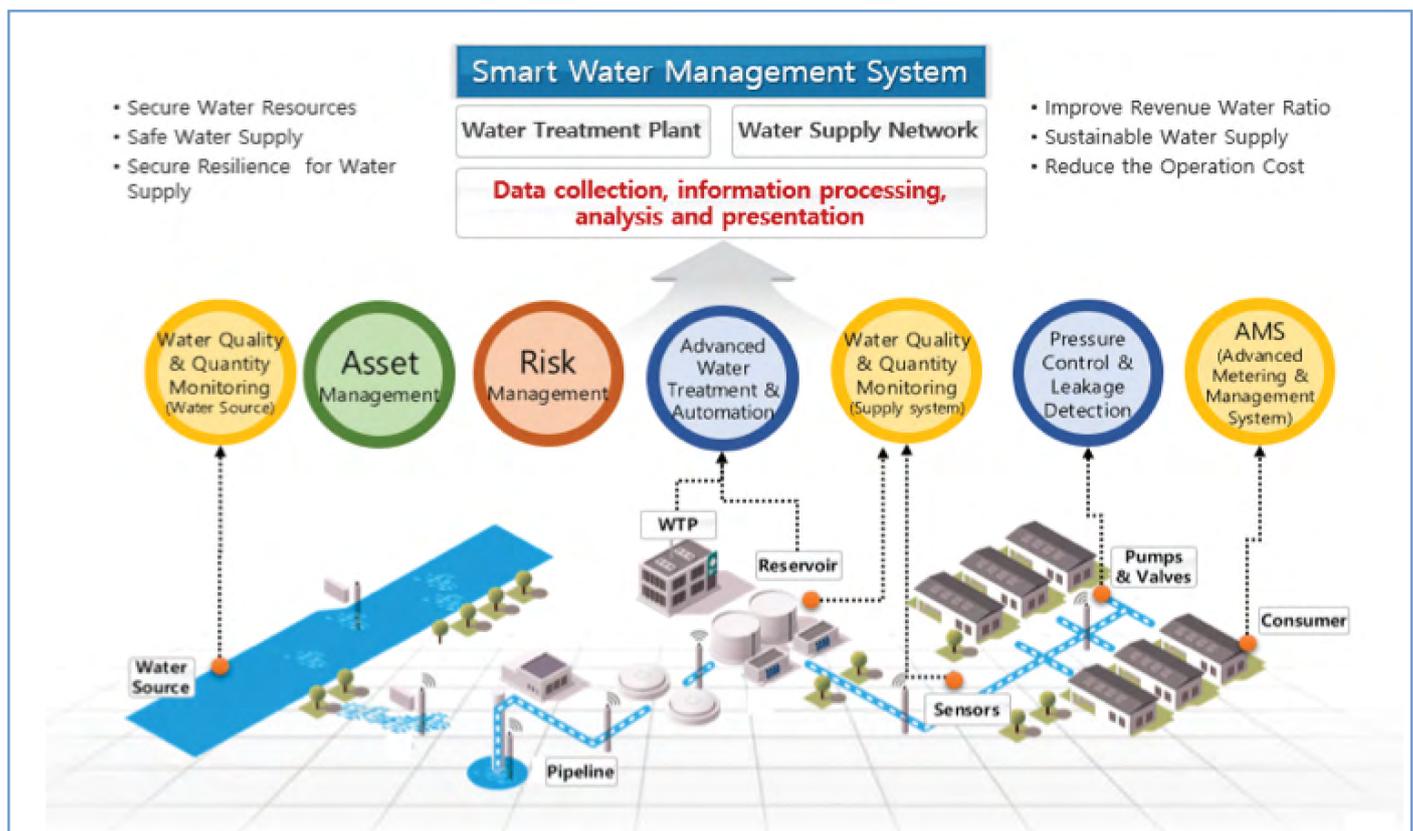
In terms of outcomes, as per the figure presented below by Mr You Kwangtae (CEO, UnU Civil & Environmental Engineering, Korea), smart water management systems can provide a more resilient water supply system, and improve water supply system efficiency, reducing costs and improving sustainability.

## Smart Applications

Heuy Douglas Pham, an international water and wastewater expert, presented a range of applications of smart technology in the water sector. Generally, the smart components can be divided into digital output instruments (meters and sensors), SCADA systems, GIS, and software. The purpose and application of these component varieties are summarized in Box 6.

Smart systems ultimately allow informed and systematic, rather than ad hoc, decision making for water managers, based on accurate and up to date information. Smart systems allow automation, taking human influence out of decision making, and can reduce staffing requirements. It was noted at the workshop that Seoul Metropolitan government have just 80 staff managing their water supply systems. This is enabled by employing smart technology.

When implementing smart systems, there is a tendency to think that new will always be challenging. However, these technologies are well established,



# Smart Water Management

and companies can deliver turn-key solutions in provision and installation of equipment and training in technology/software use and maintenance. The research has been done in countries such as Korea, the technology has been tested, and it is now becoming cheaper every year.

The smart technologies in the marketplace are not limited to water supply, the link below provides a report summary of a recent workshop event held in Korea which focused on smart technologies for waste and wastewater management. During the workshop Korean expertise in smart technology as well as innovative policies for waste management were shared with a number of ADB member country government staff.

<https://k-learn.adb.org/materials/20180321/knowledge-brochure-series-issue-5-smart-waste-management>

## Implementing Smart Systems in a Smart City

When implementing smart systems, utilities, and cities should consider integrating data collection and data use across sectors. Smart solutions can be applied across a number of sectors and be used for integrated urban planning efforts:

- Water and wastewater management
- Transport
- Buildings
- Energy
- District heating and cooling
- Public space and security
- Communications
- Air quality
- Water quality and drainage

Fortunately, technology is already available for collecting and storing this information for analysis and use. Where possible, existing systems should be used, as these will be more reliable and cheaper than implementing new bespoke communication

## BOX 6: Technology for Smart Water Management

Components	Purpose	Example Applications
Digital output instruments (meters and sensors)	To collect and transmit information in real time	<ul style="list-style-type: none"> <li>• Rain gauges, flow meters, water quality monitoring and other environmental data</li> <li>• Acoustic devices for real time leakage detection</li> <li>• Video, camera, for asset management</li> <li>• Smart water meters for metering consumption</li> <li>• Pressure monitoring for leakage detection and pump optimisation</li> </ul>
SCADA (Supervisory Control and Data Acquisition) systems	To process information and remotely operate and optimize systems and processes	<ul style="list-style-type: none"> <li>• Pressure management</li> <li>• Pump station optimisation</li> <li>• Water treatment plant control</li> <li>• Sewage treatment plant control</li> <li>• Environmental controls, reservoirs, flows, etc.</li> </ul>
GIS	To store, manage, manipulate and analyze spatial information	<ul style="list-style-type: none"> <li>• Asset mapping and asset management</li> <li>• Fully integrated network models</li> <li>• Environmental data analysis and management</li> </ul>
Software	Storing, using and reporting data. Modelling of infrastructure and environmental systems, for improved design, decision making, and risk management.	<ul style="list-style-type: none"> <li>• Usually integrated with GIS and/or SCADA systems to manage water networks, control pressure, monitor leakage, etc.</li> <li>• Improved decision making and risk management</li> <li>• Customer data bases</li> <li>• Smart metering, billing and collections</li> <li>• Hydraulic design and optimisation</li> <li>• Water resources and hydrological modelling for water security</li> <li>• Cloud-based data management and hosting options</li> </ul>



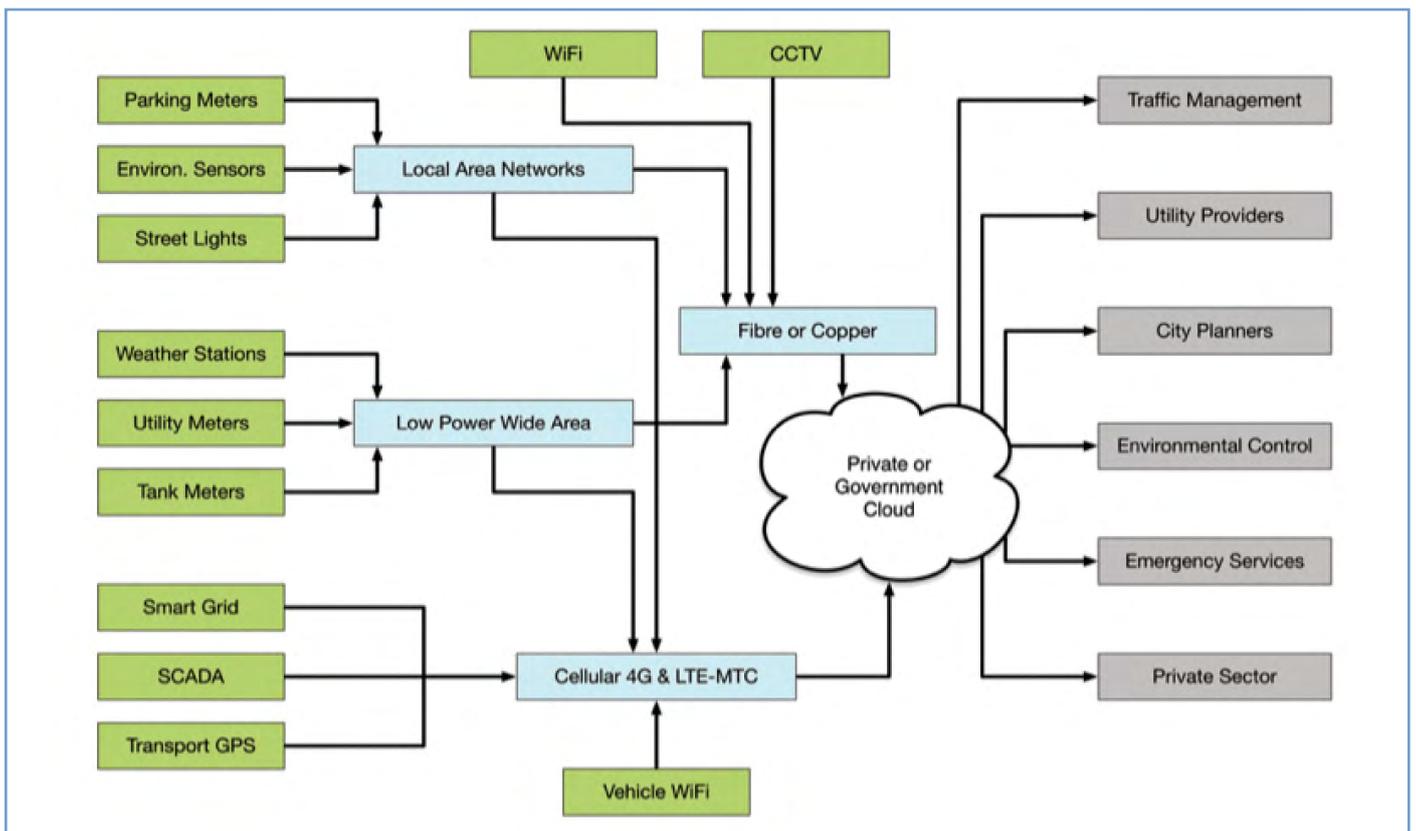
systems for every new system. In implementing the appropriate system there are several considerations regarding the data which will be generated:

- The amount of data – can range from a few bits per days to 5 million bits per second.
- Timeliness of data – once a month, once a day, once a second?
- Criticality of the data – is it essential, is it okay to lose a message occasionally?
- Security and privacy of the data – would someone want to steal or change the data?

The communication solutions to smart city development were presented by Jonathon Brewster, an international telecommunications specialist. He suggests that many communication networks are already available and where possible smart city implementation should tap into these public or private networks as illustrated below.

Such networks include local area networks, Cellular 4G/LTE networks, fibre/copper networks, and low-power wide area networks (LPWAN). Based on Jonathon’s experience in developing smart city networks his advice to Uzbekistan in implementing smart systems includes:

- There is no need to build a single physical network for everything, use existing networks and communication technology where appropriate.
- Purchase wholesale network services from private communications providers, including cellular networks and cloud services.
- Negotiate and purchase smart cities services from a single entity at the City level who will have better buying power.
- Don’t keep smart city data in a silo, a few skilled staff can support many systems.
- Allow departments to purchase/subscribe to any and all data that they need.
- Where possible, share data free, or at low cost, as this will drive innovation from the private sector.
- Have a coherent security and privacy strategy.



# Smart Systems: Discussion and Q&A

## *Where should we start in introducing smart systems?*

The most important starting place is to meter flows in discrete areas (district metered areas) to understand production, distribution, sales, etc. By building accurate water balances of each area, losses can be calculated, and problem areas targeted for rehabilitation or leakage reduction initiatives.

A next step would be in improved asset management. Building a digital spatial database of assets in GIS is important for developing strategic plans for upgrades and rehabilitation.

If assets and networks can remotely be monitored in real time (flow, pressure, etc.) through smart systems, leakage detection (for example) can be undertaken in real time. Adding simulation into this can allow real time decision making to optimize performance.

The first stage described above is not 'smart' in that it does not require innovative technology, just simply meters. However, it is a 'smart' investment which can greatly improve efficiency and a precursor to other smart investments.

*In Bukara, 100% of our residential customers are already metered. We would like to upgrade to smart meters to reduce the cost of staff undertaking meter readings and ensure accuracy of billing. The cost of water is only about \$10-15/year and smart meters are far more expensive than this, so it seems financially unviable.*

It is good that there is a willingness to move towards smart systems for better accuracy. 100% metering on residential customers is excellent progress. With this metering data, you should probably now focus on improving collections and identifying areas with high leakage - both of these actions improve finances. When appropriate you can then upgrade these meters to smart meters.

Either way, tariffs need to be decided through set mechanisms and regulated and where possible, removed from short term politics. Tariff reductions or freezes are often leveraged by government for votes which can make utilities unsustainable.

The tariff rates you quote seem very low, it may be sensible to review these in conjunction with a coordinated public awareness campaign on the cost of water. Tackle issues step by step. Develop medium to long-term investment plans. In our case, in Armenia, early smart investments included changing cheap meters that could be tampered with. We replaced these with C-class meters which are more accurate but not currently smart. However, we selected meters which have the capacity to add-on communication devices to allow future remote metering.

*Is there a minimum water price to start considering smart systems? We are not sure about the economics of smart cities, for example what would be the payback period?*

It is hard to determine the payback period of many smart applications in unknown circumstances. Without detailed knowledge of systems and data we cannot understand whether water savings and staff efficiency deliver a return on the investment? This requires data in the first place and good accounting. We can be sure that smart systems have the potential to deliver efficiency gains and cost savings, but whether they are applicable for all utilities at present will require some investigation and planning. With respect to smart cities and communication between devices, often the networks are already there so hardware investments may be minimal.

*What measures can be taken against customers that don't pay their bills. Are there smart meters that can automatically shut off water when a bill is unpaid?*

Prepaid units are available which will reduce flow significantly after prepaid allocations are used. This could be an option. In many countries water is seen as a basic human right so unfortunately cutting users off is not considered an option.

## Group Discussion: Implementing Workshop Learnings

A group exercise was held on day two of the workshop to stimulate discussion on the applicability of, and readiness to implement, the various PPP approaches and smart technologies introduced. The results are presented below in a readiness matrix. Two project examples are provided which describe perceived benefits, challenges and enabling actions (that are required to enable implementation).

### Readiness

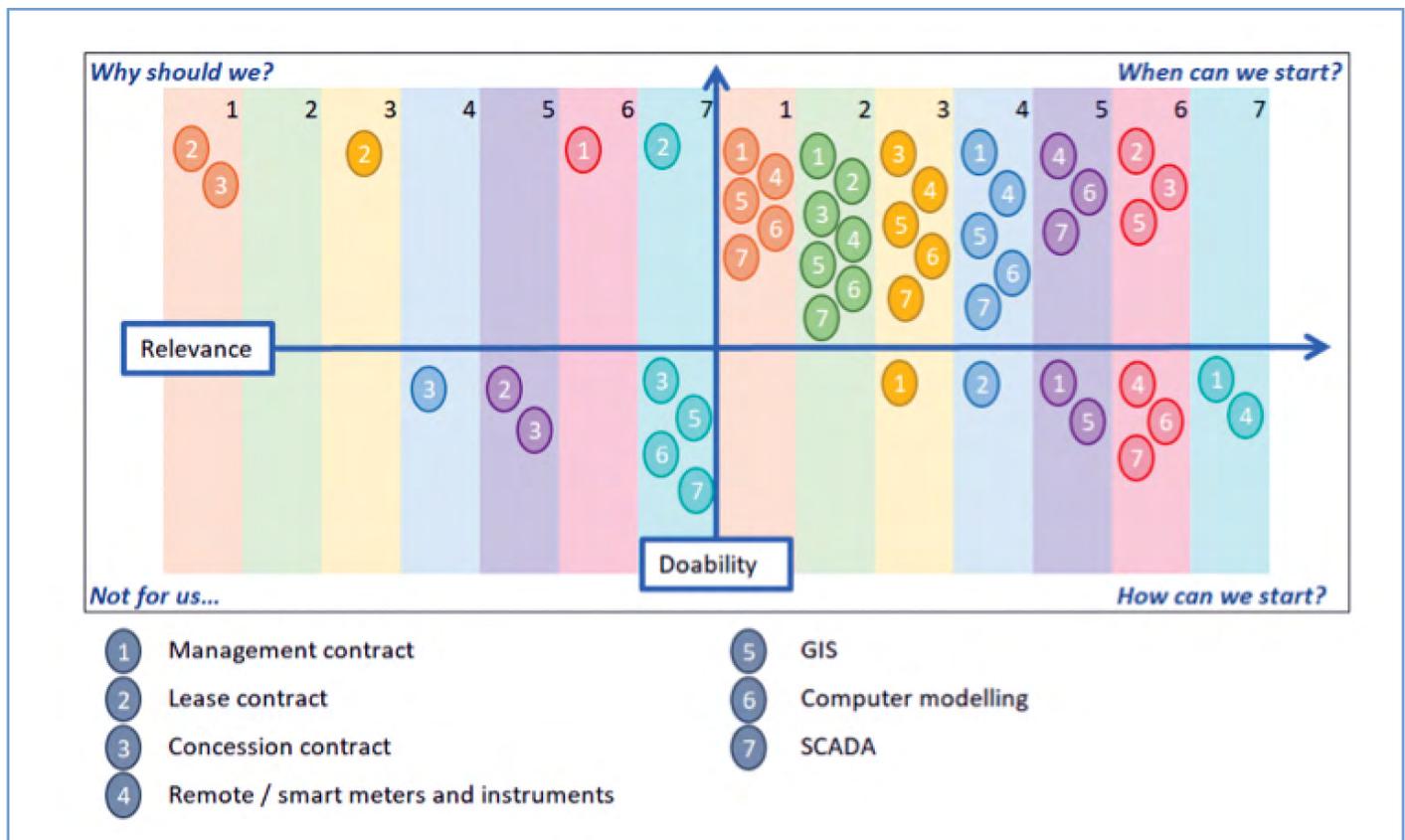
The readiness matrix below illustrates that most participants agreed that undertaking PPPs and implementing smart systems are both relevant (i.e. the approach/technology would be useful and have a positive impact) and doable (i.e. the capacity to implement already exists). This reflects the high level of optimism of the Ministry and Suvakovas during the workshop in mobilizing private sector finance through PPP projects, and also the readiness for implementing smart systems.

This optimism is probably founded in the initial successes of ongoing reforms in the sector.

This is an excellent starting point, but must be treated with some caution. For example, some of the expert speakers cautioned against an over ambitious strategy of engaging with the private sector and to take a stepwise approach. Currently, human resource capacity needs to be developed; utilities require financial support to implement ongoing reforms in management and invest in technology, systems, and upgrades; and, work is ongoing on the legal framework under which the private sector may be attracted. So there is some way to go before universal adoption of the approaches discussed and discovered during this workshop, but the willingness is certainly present, which is a crucial first step.

### Implementation

The benefits, challenges, and enabling actions required to implement smart systems through PPP contracts were identified by developing hypothetical project examples in groups. The findings of these discussions are summarized in the two projects summarized on the next page.



## Group Discussion: Implementing Workshop Learnings

### Project Example 1: Installation of Smart Meters

<b>Benefits:</b> <ul style="list-style-type: none"> <li>• Accurate billing</li> <li>• Accurate accounting</li> <li>• Reduced labor costs</li> <li>• Reduced production costs</li> <li>• Transparency</li> <li>• Leakage detection and loss reduction</li> </ul>	<b>Challenges:</b> <ul style="list-style-type: none"> <li>• The location of our underground assets is unknown.</li> <li>• Understanding financial viability of smart meters.</li> </ul>
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<b>Enabling Actions:</b> <ul style="list-style-type: none"> <li>• Combine it with a GIS study mapping our assets</li> <li>• There is no policy or regulatory requirement</li> <li>• Developing clear responsibilities for maintenance and calibration</li> <li>• Training for maintenance and calibration</li> <li>• Awareness campaign of smart meter installation program</li> <li>• Effective legislation for non-payment</li> </ul>
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### Project Example 2: Implementing a Concession Contract

<b>Benefits:</b> <ul style="list-style-type: none"> <li>• Provision of better quality water</li> <li>• Private sector to invest in appropriate but efficient technology</li> <li>• Reduce water losses</li> <li>• Reduce staff numbers</li> <li>• Reduce production cost</li> <li>• Improve collection rates</li> <li>• Improve accounting and control</li> <li>• Accessing private finance</li> <li>• Accessing private sector expertise</li> </ul>	<b>Challenges:</b> <ul style="list-style-type: none"> <li>• Technical capacity</li> <li>• Deteriorating assets</li> <li>• Legal framework for concessions exists but needs to be reviewed and updated for the current context</li> <li>• Limited understanding of the risks for both parties</li> <li>• Managing the PPP to ensure protection of poor and vulnerable groups</li> <li>• Public perception</li> </ul>
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<b>Enabling Actions:</b> <ul style="list-style-type: none"> <li>• To understand risks we need a baseline of the whole system, including infrastructure, manpower and finances</li> <li>• Awareness raising for benefits introducing private sector management of water supply</li> <li>• Review of tariffs to cover operations and profit, or subsidizing the concessionaire?</li> </ul>
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*We have learnt much from this workshop. It has allowed a forum for discussion, but this is the first step. We need more discussion and dialogue to succeed in implementing PPPs. Most importantly we need to start a dialogue with the private sector to understand their views.*

*It will be important to establish a clear legal framework to govern any agreements with the private sector. The legal framework will however have to be refined as we learn lessons through pilot projects, and there will be challenges along the way. No doubt some projects will be cancelled.*

*It is clear that we need a sound understanding of existing systems and issues to enter into any agreements, as well as transparent and accurate accounting.*

*Finally, and most importantly, we will not succeed without sufficient human resource capacity on both the public and the private side. This is not limited to technical expertise, but governance, project management, accounting, IT etc. This requires ongoing capacity development. We thank ADB for their ongoing support in this field.*

*A key role of the state is to establish and reinforce policy with a long-term strategy to facilitate private investment in our country's infrastructure.*

***Dilshod Asimov***  
***First Deputy Minister***  
***Ministry of Housing and Communal Services***

Urban Development and Water Division  
Central West Regional Department  
Asian Development Bank