Affordable Investment Programmes: The Investment Planning Process

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Summary

Regardless of the source of funding, the need to define appropriate investment programmes is a significant challenge for water service providers. This process is a complex activity that is frequently carried out in a short time period. The wider process of establishing an investment programme encompasses political, social, economic and technical dimensions in order to establish an affordable price of water. The development of a sustainable, and optimised programme and costs to meet defined standards of service is primarily a technical function. Frequently the long-term implications of the standards of service imposed are not costed prior to being imposed. Understanding willingness to pay and affordability for regulatory requirements and standards of service is increasingly important. This presents a particular problem for private sector participation contracts where the standards of service may be written in to the contract. A long-term investment plan should be founded upon a high level strategy which prioritises regulatory requirements and standards of service.

The development of investment programmes requires a planned and structured approach. Best practice indicates that the data and information required should come from “business as usual” processes. This requires a long-term view. The implementation of the data and information systems and processes is in itself a significant business change project. A number of tools and techniques are available to assist with the then rapid identification of the investment programme. Recognition of the uncertainty in the investment planning process must be built into any contractual arrangements, and effective contractual mechanisms used to allocate the risk.

INTRODUCTION

Much has been written on the advantages and disadvantages of private sector participation in the water sector. Regardless of the complex motivation for privatisation in its many forms, common threads are usually the need for investment funding to bring an improved standard of service, to maintain a rapidly deteriorating system, or to drive capital or operational efficiencies.

The decision to involve private sector participation is a complex decision that encompasses political social and economic dimensions. Setting the price of water is similarly complex, and encompasses the same dimensions. The process of determining the investment required to maintain, operate and, sometimes upgrade a system to achieve or maintain a given standard of service is primarily a technical function. The output of this technical activity is input into the social, economic and political decision making process on the price of water. This analysis is required regardless of the source of funding. However the importance of this process of identification of investment need is increased by the contractual arrangements associated with private sector participation.

The provision of water supply and sanitation is governed by engineering principles and involves physical, chemical and biological processes. It is usually accepted that the identification of the optimal investment required for this given standard of service, whether for operational or capital purposes, will come from a risk-based approach. Each investment on an asset has to be justified against the probability and consequence of failure as well as cost and operational savings. This process is technically demanding and requires detailed data. Unfortunately, the scale of investment usually means that the capital investment programme has a very significant effect on the price of water. A short timescale may often require rapid assessment of investment needs based on limited data.

AFFORDABILITY AND WILLINGNESS TO PAY (WTP)

Traditionally the water sector has been underfunded. A report on World Bank Projects noted that in many cases the effective price of water to the customer was one third of the economic cost of providing that volume of water. This situation was widely recognised in the early 1990's. It results in either heavy subsidy or under-investment in the assets. In addition there is increasing need for investment to meet higher local and EU imposed standards.

At the highest level, revenue and cost need to be balanced over the investment period:

Revenue = Capital Investment Costs + Operational Costs + Finance Costs + (Operational Profit)

Revenue is a function of customers, consumption and the price of water, possibly enhanced by subsidy. The effective price of water is governed by willingness to pay (WTP). It is assumed in this context that willingness to pay also includes the ability to pay, although it is recognised that this distinction is important. Difference between the price of water and WTP will lead to water theft or non payment of bills. It is therefore essential that there is a sound understanding of the willingness to pay for improvements in the water sector. A high level view of the conflicting demands on setting the price of water is shown in Figure 1.

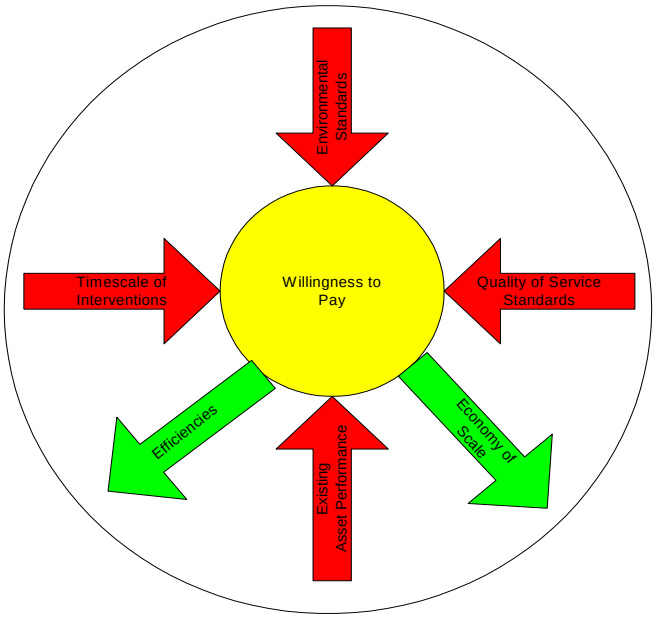


Figure 1 Willingness to Pay

Water is a natural monopoly. A sustainable price of water must be based on the actual costs to allow the system to operate now and to continue to meet demand into the future. The determination of the investment period is important. The desire to maintain an economically sustainable water sector may have to be set against the uncertainty around future demand, and current affordability. This is particularly important in private sector

participation contracts.

In order to protect the environment, and to ensure that the assets survive for future generations, it is usually necessary for regulations to be enforced by a government agency. The combination of the historic under investment in the sector and the wider water quality obligations typically increase the cost of the provision of water, or the collection of sewage. To arrive at an optimal standard of service it is normally necessary to carry out an iterative process that balances the willingness to pay against the improved standards of service. The structure of the English and Welsh water sector makes OFWAT the representative of the customer in terms of ensuring affordability. Other agencies such as the Environment Agency, Drinking Water Inspectorate and Food Standards Agency act as enforcers of quality standards, championing the customer primarily through the former regional Customer Service Committees. The primary function of OFWAT is a duty to ensure that efficient, well-managed companies can finance their functions. The 5 Year periodic reviews are part of this process.

With respect to CEE and CIS countries, the Danish EPA comments that:

"It is hence important for the countries to find a balance between ambitious plans for improving the water environment and realistic increases in Tariffs for water supply and wastewater"

Obtaining this balance means that the link between the standards of service, timing and scale of the investment programme must be understood. A number of new techniques involving choice experiments have been adopted by some utilities to obtain customer willingness to pay for specific standards of service. In one instance in the UK this method has been adopted to establish the size of the capital programme for a specific standards of service. This approach enabled cost/demand curves to be built for each service measure. More significantly, it also allowed optimisation between the willingness to pay for benefits from different service types, for instance low water pressure versus sewer flooding versus bathing water compliance. This represents a new approach to assess and quantify willingness to pay.

STANDARDS OF SERVICE

Often the imposition of the standards of service are not costed because the asset conditions, asset performance and network configuration are not known in sufficient detail, and tools and processes are not in place to allow this to be completed within the time constraints. In private sector participation projects often the standards of service are imposed through a contract in advance of the detailed investigations required to establish the cost of the standards of service.

The imposition of standards of service on a water service provider (WSP) without them being fully costed introduces a major risk that has implications for all stakeholders. The problem may arise at all levels:

- Internally – Standard of service may be imposed internally by the water service provider without due recognition of the costs of providing the service. These standards of service may be historic, or they may be imposed as part of a company change plan. Frequently standards of service are drawn from other reference sites, without due reference to the local environment and water service providers capabilities, assets and resources.
- External Standards – Standards may be imposed on the water service provider because of local or national pressures. Typical standards may be pressure flow at tap or sewer flooding. An example where the cost of the standard may be controversial is the right of a customer to be connected to the existing system. The cost of meeting compliance with the standard may be excessive in some areas, and may lead to internal subsidies. Many customers may be financing the connection cost for a very few beneficiaries or vice versa. Social and economic considerations will determine if these situations are desirable or undesirable, but the implications of the standard need to be understood and costed.
- National or International Standards. – Water quality standards for potable water be European standards transposed to national standards, or existing national standards. The Water Framework Directive is an example of a European Standard, the implementation of which will affect the water service providers, but a detailed cost of this implementation is currently unknown. Some countries have already noted a decreased willingness to pay for environmental improvements funded out of water bills. In the UK a number of water service providers, supported by the customer watchdog

WaterVoice, have recommended that further studies must be completed before implementation of various EU directives that will require extensive capital expenditure. As an example the implementation of the freshwater Fish directive has been estimated to cost Euro 200 per person for one of the large water service providers.

- Contractual Standards – Private sector participation will rely on contracts to give performance incentives to the private company. Standards of service that are written into a contract will represent a contract risk that must be balanced by incentives. If the cost of attaining that standard of service cannot be understood with certainty at the time of bid then the mechanism for revision to the standard of service, or water pricing, should be established within the contract. Finance costs are affected by implementation dates.

Detailed examination of the functions of a water service provider shows that standard of service and regulatory requirements cover a wide variety of measures. Even simplification at a high level will give 10 –20 separate standards of service areas. Often each of these service areas may be are supported by, or added to, a complex set of regulations. Compliance with each of these service areas will have a cost. This is illustrated in Box 1 below.

Box 1

Water Quality Analysis: Storm Overflows:

In order to assess the full implications of a storm overflow on the water quality in the receiving watercourse, the following information is required:

- Receiving watercourse flow and quality boundary conditions
- River Model
- Simulated Rainfall Generator
- Simulation model of sewer network, verified to give fit for purpose results
- Data on flooding or other hydraulic problems in the catchment which may influence the final solution to the model

Normally most regulations have simplified approaches which give volumetric or flow rate criteria for overflows. Experience shows that these simplified approaches may result in excessive capital cost for limited benefit.

When planning investment programmes the cost of each contributory need should be identified. Complex connected networks and environmental interdependencies mean that simple assessments of expenditure based on condition are likely to be unsatisfactory.

It is essential to understand the local environmental conditions. Assuming that a standard of service applied in one country can be applied in another without adjustment for local conditions is wholly inappropriate. Regional variations within national boundaries can also be very significant.

For example, when considering Storm Overflow improvements the receiving water flows and quality must be taken into account and in some countries these are significantly different. It makes little sense to insist on an improvement in discharge quality where the quality is compromised by the impact of an untreated continuous discharge from a neighbouring town. Quality improvements need to be considered in the context of both national standards and local circumstances. The development of metrics that enables the environmental benefit of different programmes of work to be compared should be considered. The timing for imposition of standards, and the consequences for non-compliance also need to be considered. Both will influence the investment required to attain the standards.

Private sector participation may lead to different standards of service between regions and towns. A central regulatory function must manage these potential conflicts.

Experience from the sector indicates that the following principles may be helpful to set out long term objectives:

- High level prioritisation of Standards and Standards of service should be established. It would normally be assumed that compliance with EU or national regulation will take precedence over local or internal standards. This position must be supported in contractual terms.
- Applied standards of service should be locally specific and directly relate the benefit to the customer or the environment. Existing or historic standards of service may need to be reviewed.
- Surveys should be undertaken which use most appropriate methods to determine WTP for specific standards of service. These should include both Industry and Domestic Customers.
- Where environmental standards of service are imposed these should prioritised using a cost benefit approach based on the overall environmental benefit compared to other programmes.

- Investment Programmes should be priced against the specific standards of service. The implementation of the programme should be dependant on the local willingness to pay, and the cost/benefit ratio of the improvement.
- The genuine difficulty in establishing investment programmes in a short period of time should be recognised in PSP contracts. The advantages of incentive based contracts with fixed standards of service should be weighted against the difficulty in setting standards of service in advance of detailed system knowledge.

CAPITAL MAINTENANCE

Water service providers normally have a statutory duty to provide water and/or wastewater services to the public, together with a responsibility to protect the environment. The WSP's have a responsibility, either by ownership or through a contractual arrangement, to manage the assets that are necessary to provide the standards of service discussed above. At an appropriate time each asset needs to be repaired, refurbished or replaced, or some alternative provision made for continuing service. These activities occur either reactively in response to the failure of an asset or group of assets, or as part of a planned capital investment to prevent failure from occurring.

These investments are termed '**capital maintenance**' (CM) and are usually considered separately from day-to-day maintenance and operational expenditure. Deterioration rates for above ground plant and mechanical equipment is reasonably well understood, and most plant can be inspected relatively easily, although at a cost. The implication of a failure on the standard of service is much more complex, and modelling may be required in some cases to determine consequence. The cost implications of capital maintenance present a particular problem for private sector participation. The need to ensure that these investments are optimised has led to a number of areas of activity and analysis. Capital maintenance for the water sector is driving research and new approaches to a number of areas. Three such areas are:

- Understanding of Historic Performance, Expenditure and associated Trends
- Risk Modelling – probability and consequence of failures
- Deterioration modelling to facilitate assessment of future performance

Networks provide a particular problem because of the large numbers of assets usually accompanied by minimal data. Poor understanding of pipe deterioration is a further obstacle to a clear understanding. Pipe material quality and methods of construction are very important in deterioration, and these are usually influenced by local practices. In order to develop affordable and sustainable solutions a pragmatic assessment must be made of the condition and deterioration rate of the network. The uncertainty involved necessitates that there should be a mechanism for reviewing this investment programme regularly. The long life of network assets requires that economic, environmental social and political issues are all important when considering how much one generation is willing to pay for the maintenance of the assets into the future.

OPERATIONAL EFFICIENCY

The main contributors to operational cost are labour costs, power costs and chemical costs. Business process improvements can be introduced to bring efficiencies into the operational side of a WSP. Normally this will require a change project (or programme) which brings in business change through a planned process over a specified period. The most appropriate route of operational efficiency is through the use of cost performance comparators (CPC's). Cost performance comparators allow the efficiency of individual plant to be compared. The development of CPC's requires in depth knowledge of the assets and their operational function. The use of CPC's allow the identification of the assets that require urgent attention to reduce costs (quick wins), and those assets which perform with higher than average efficiency (benchmarks for future design).

DEVELOPMENT OF AN OPTIMISED PROGRAMME:

The development of an optimised investment programme is fundamentally complex, as Capital Investment Costs (CAPEX), and Operational Costs (OPEX) are related to each other. Operational expenditure may reduce or defer the need for CAPEX. CAPEX may reduce, or increase the need for

OPEX. Finance costs are substantial, and are affected by the timing of the programme and therefore the balance between operational and capital costs. The standard of service improvement type differs between the different types of intervention. Asset renewal strategies should be developed on the lowest whole life cost to deliver the required standard of service.

Understanding of the programme requires an in-depth knowledge of the costs and benefits of refurbishing, replacing, upgrading or abandoning an asset. The detailed knowledge required to make the optimum planning decisions encompasses asset knowledge, deterioration, performance, service benefit, activity based costing and asset valuations. Usually development of investment programmes is carried out in a short timescale, and often with support from external parties. There is a significant risk that the investment programme will not achieve its objectives, or that the cost or time to deliver the objectives are not known with acceptable confidence.

Experience shows that it is vital to understand the long-term objectives of the investment process. These could be:

- Establish a robust and auditable platform for the dialogue with regulators/ politicians and stakeholders to establish standards of service that are efficient and affordable.
- If carried out by external parties, provide a knowledge transfer, training and continuous improvement plan to enhance capability in whole life asset planning within WSP
- Establish “business as usual” processes, data and information that enhance the WSP Strategic Business Planning Process.
- Assess asset performance enhancement against need for capital maintenance or operational investment and hence optimise whole-life asset plans.

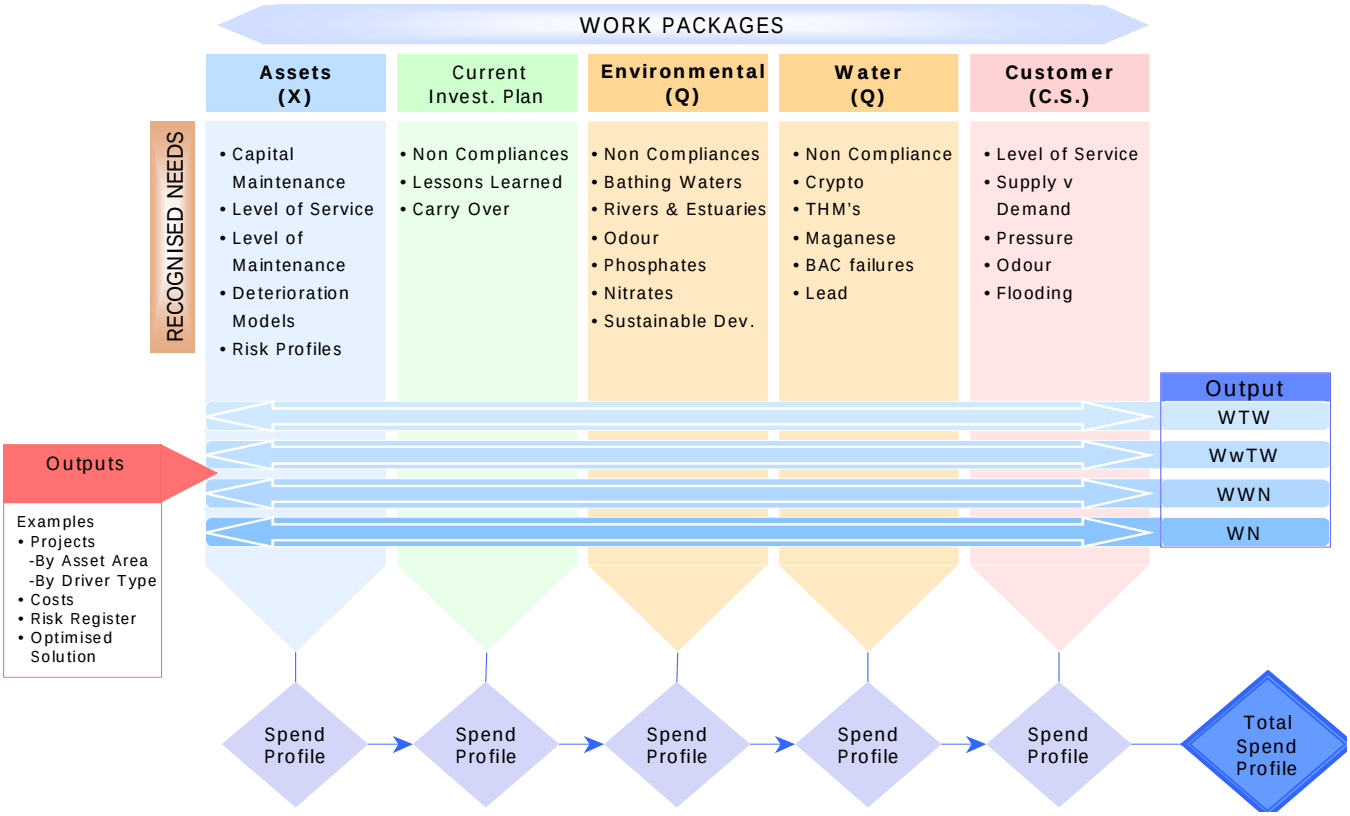
Typically a multilevel approach is taken to the development of a capital programme. There are usually three discrete activity levels from which the Capital Programme scenarios will evolve:

Level 0: Regulatory / Standard of service focus – to understand the main drivers and serviceability issues facing the WSP. The outcome is an understanding of the most critical areas for investment.
Level 1: Asset block information (examples of an asset block might be wastewater pumping stations or Service Reservoirs) – to generate high-level output based upon CAPEX driver definition and Standards of service criteria over “bands” of asset types. This determines the types of assets in the programme.
Level 2: Specific asset sites – to generate line by line projects in a Capital programme. This determines the specific assets to be upgraded at a project level.

Often the first pass at a comprehensive capital programme may only reach Level 1. Level 2 may be achieved on the second cycle. Optimisation of service risks against investments normally requires a Level 2 analysis.

It is also helpful to consider the total investment plan as a matrix. One dimension of the matrix is the investment programme, shown in Figure 3 below as the horizontal axis. The vertical axis is the application of the investment programme to the asset groups, for example Wastewater Treatment, Water Treatment, Wastewater Networks and Wastewater Networks. This diagram represents a UK approach to investment planning.

FIGURE 3: Matrix of Outputs and Needs for an Investment Planning Process.



Experience shows that the development of an investment programme requires extensive data. The process requires multidisciplinary teams who are able to identify condition and performance deficiencies rapidly. Teams would typically include process engineers, hydraulic modellers, mechanical and electrical engineers, cost specialists and a large number of specialists in asset management functions such as deterioration modelling. In depth knowledge of local market conditions is essential. Usually statistical approaches are required for below ground network data, but the risk of skewed data samples must be recognised.

There are a number of specialist tools in the market place who can provide analysis tools to assist with the development of the capital programme. The use of optimisation and learning tools enables capital programmes to be identified rapidly using a first pass approach. Further iterations of the investment programme can be made using refined functions, as the data becomes available.

In order to reduce the uncertainties associated with investment planning a long term investment strategy is required. A data collection programme should support this. The data collection programme should be considered as part of business as usual, not a one-off exercise. An organisation focused on asset management will normally adopt a structured approach to data collection and analysis which becomes part of the decision making process.

Structured approaches to asset management require performance data to be maintained, and both data and projects linked to investment needs. An example of this approach is the Scottish Water Sewerage Infrastructure Investment and Operational Planning process. The tools developed as part of the identification of the investment programme are listed in Box 2, below.

Box 2: Capital Investment Planning Tools for Wastewater Infrastucture

Outfall Assessments Database: enables the user to obtain all types of asset information relating to overflows and outfalls and to enter survey information and select sites where surveys are required.

Sewerage Costing Database: A tool that enables users to cost schemes for sewer system design and hydraulic upgrade thus enabling identification of the most cost efficient solutions to be implemented.

Sewer Asset Planning System : A GIS-based tool that presents assets, needs and solutions by location and geography. Allows visual examination of all drainage area catchments and the assets within each drainage area.

Paperless Report Application: automatically creates an electronic report from text, data, images and figures provided by the user – report can be viewed across entire business via an Intranet web-site viewed using an ordinary web site browser.

Core Database System Management Tools: provides direct access to the core asset database repository. This allows Data Administrators to maintain, back up and manipulate the back end database

A particular challenge that must be recognised in investment planning is audit trail. There is a need to maintain a complete and documented audit trail of key decisions made during the planning process.

DETERMINATION OF INVESTMENT PROGRAMMES – MANAGEMENT OF UNCERTAINTY

The lack of information on assets and asset performance and service risks brings uncertainty to the expected cost of the investment programme. Frequently the cost of construction for asset improvement also has a high uncertainty, as the proposed expenditure is significantly larger, or the work type is different from previous works. In some cases the cause of the initial service failure was not understood. The economy of scale from a programme of works may not be recognised in the evaluation of the capital programme. Phasing of the programme around statutory deadlines may offset efficiencies from scheme integration. Alternatively, the local contractors may require upskilling which represents a risk to the final outturn cost.

This uncertainty must be recognised and managed in any contractual arrangement. Although not exhaustive, a number of areas of uncertainty have been found from experience to affect investment programmes on privatisation contracts. These are:

- Inadequate time or inadequate access to data to allow a robust investment programme to be developed.
- Lack of clarity concerning asset ownership for some of the asset base.
- Requirements for expansion of connected network not defined clearly.
- Weak variation mechanism to allow alterations to standards of service.
- Asset condition monitoring is badly defined, and the method for calculation of capital maintenance expenditure is unclear.
- Lack of definition on the procurement processes for the investment programme, and the associated risk sharing.

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[i] Danish Environmental Protection Agency 2002. Danish Support for Improved Water Quality in Central and Eastern Europe.