The effect of public or private structures in wastewater treatment on the conditions for the design, construction and operation of wastewater treatment plants

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Abstract Organised in public or private structures, wastewater services have to cope with different framework conditions as regards planning, construction, financing and operation. This leads quite often to different modes of management. In recent years there has been a push for privatisation on the water sector in general, the reasons for which are manifold, ranging from access to external know-how and capital to synergistic effects through integration of wastewater treatment into other tasks of similar or equal nature.

Discussed are various models of public/private partnership (PPP) in wastewater treatment, encompassing for example the delegation of partial tasks or even the proportional or entire transfer of ownership of treatment facilities to private third parties. Decisive for high performance and efficiency is not the legal or organisational form, but rather the clear and unmistakable definition of tasks which are to be assigned to the different parties, customers and all other partners involved, as well as of clear-cut interfaces. On account of the (of course legitimate) profit-oriented perspective of the private sector, some decision-making processes in relation to project implementation (design and construction) and to operational aspects will differ from those typically found on the public sector. This does apply to decisions on investments, financing and on technical solutions too. On the other hand, core competencies in wastewater treatment should not be outsourced, but remain the public bodies' responsibility, even with 'far-reaching' privatisation models. Such core competencies are all efforts geared to sustainable wastewater treatment as life-supporting provision for the future or as contribution to the protection of health and the environment and to the development of infrastructure. Major areas of wastewater treatment and other related tasks are reviewed. The paper concludes with a list of questions on the issue of outsourcing.

Keywords Core competencies; costs; outsourcing; partnership; project manager; public-private

Introduction

It is an inevitable result of globalisation that different (local) systems and costs of infrastructure are intensively compared and discussed. Wastewater treatment is such a field (Bode and Lemmel, 2001) On the multi-faceted European wastewater disposal scene, very different organisational cooperation do exist. In France, for example, there are private water utilities in almost every part of the country, some of which were already established more than a hundred years ago, whereas in Great Britain, the privatisation process was initiated just at the end of the 1980s. The Netherlands, on the other hand, decided by vote of parliament not to allow – at least for the moment – any form of privatisation on the water supply and disposal sector whatsoever; all related tasks are being concentrated on a few enterprises over which the municipalities retain ownership and with that control. In Germany the first approaches towards privatisation of the water sector date back to the 1980s; but the share of privately organised wastewater disposal operations still is in the range of 5% only (Beckereit and Stemplewski, 2002). The situation worldwide can be summed up as follows. Around 80% of our planet's population of more than 6 billion people have no connection to sewers at all. While 16% of the population are connected to publicly owned sewerage systems, only 4% are to privately owned disposal systems. And

private engagement within this 4% share is often limited either to participations in the enterprises concerned or to wastewater treatment services.

However, in principle it can be said that neither the legal and organisational form (public/private), nor the scale of operations can be regarded as guarantor *per se* for economic efficiency and successful performance (Bongert, 2002; Braadbaart, 2002).

Most likely to be quoted as essential benefits of a transfer of tasks from local authorities to private organisations are the following points:

- enhanced efficiency by introduction of competitive elements and the principles of private-enterprise to unlock saving potentials,
- use of synergy forces – helping to comply with the tasks in hand within an extended scope of action thanks to the availability of private-sector expertise – whether the area of responsibilities is expanded horizontally (which means by taking over tasks of exactly the same type, e.g. an additional catchment) or vertically (which means by taking over additional, yet similar tasks, e.g. wastewater treatment in addition to potable water treatment),
- raising of additional (private) capital otherwise not available on the public sector,
- earmarking of gains on disposal to ease the stress on public budgets,
- modifying and streamlining of organisational and operational structures of public bodies, otherwise hardly or even never enforceable,
- limiting cross subsidisation to finance other public tasks through wastewater rates, otherwise frequently practised, thanks to additional control by private shareholders.

Experience from other countries shows that outsourcing – even if not complete – involves an immense control effort on the part of the state (Merkel, 2002). That means, state authorities would not only have to monitor the proper performance of all operations, but also the pricing policy as private-sector companies might be tempted to raise water rates in order to maximise profits against the background of the given 'natural water monopoly'. If this control is not successful privatisation might end in fees which are much higher than they would have been if the task would have remained in public hands.

Basic preliminary remarks concerning private-sector participation in wastewater services

First of all wastewater disposal is a service for all citizens and with that a vital public task for the benefit of life and health and for the benefit of the environment and infrastructure. And it falls to the state – preferably the local authorities – to perform this task fully or partly either by itself or by delegation to third parties. There are several different models of public/private partnership (PPP), ranging from the transfer of responsibility for individual tasks or specialised services to the transfer of ownership, partially or entirely, to private-sector enterprises.

Yet complete deregulation as it has been realised in Europe on the electricity and telecommunications sector in recent years does not lend itself to application on the water supply or wastewater disposal sector too. This, for one thing, because the networks (water-supply lines and sewerage systems) and, for another, the products themselves (potable water and wastewater) do not allow for a 'free exchange of commodities'; buying and selling operations are restricted by very narrow bounds and specific framework conditions. In the field of wastewater treatment, the sewerage systems of the different wastewater treatment facilities are generally not linked, and the plants (and thus the funds needed) are firmly tied to the individual location (as a function of the given geographical and topographical conditions). And for economic reasons it would hardly make sense to install competing parallel lines or sewers just to promote competition by leaving it to the customers (wastewater dischargers) to make a choice. Diverting wastewater to other,

possibly remote, treatment plants involves high capital expenditure and is thus only reasonable from a technical and economic point of view if, so to say, the overall project benefits the situation at large and not just one-sidedly one particular provider/competitor (for example in case of centralisation in wastewater treatment, diversion of industrial wastewater, re-mapping of catchment areas, etc.). Given this scenario it becomes evident that locational ties here even play a more important part than in the field of drinking water supply.

PPP in its actual form has a long tradition in Europe. The main objective has always been to mobilise sufficient capital for large-scale, capital-intensive projects, as for example the building of road and railway tunnels or huge bridge structures to span straits (e.g. in Scandinavia), the development of residential and industrial areas, etc.. However, it is known from experience that if private capital can be raised, the private parties will still seek additional (bank or government) guarantees to secure the reflux of capital during the term of contract. These guarantees may consist either of public warranties or special assets (e.g. real estate and other tangible assets). As a consequence, there must be appropriate organisational and legal structures that allow for cost recovery over the long term by charging the beneficiary (in this case the wastewater producer) for the services delivered. Among other factors, this involves the introduction of full cost accounting to follow up incoming and outgoing payments and therewith to secure full-cost recovery through wastewater rates. Just as the principle of full-cost pricing is now being recognised also in the field of water management, so it must be consequently observed in all current and future projects in which the private sector is involved.

Public/private-sector cooperation models in wastewater treatment

Saying that wastewater treatment is always organised either purely privately or purely publicly would be wrong. Privatisation rather is a blending process that combines specific elements from both organisational forms: with any supposedly exclusive private-sector solution there is at least one component of public control and with any supposedly exclusive public-sector solution there are at least a few contracts which are awarded to private third parties (e.g. building and supply contracts). So, typically there is a variety of mixed forms of public/private partnerships. And the best-suited PPP-configuration to be selected is rather a function of the desired degree of integration of private parties, ranging from delegation of partial tasks to full transfer of ownership and assignment of responsibility for wastewater disposal which includes compliance with criminal law and statutory charging rules. In the following, a variety of partnerships is described which involve a more or less strong private commitment.

Outsourcing of specific public wastewater-treatment related functions to private third parties. Meaning an organisational and legal model that involves public ancillary enterprises operated by the local authorities. While wastewater treatment is carried out like any other public service, partial tasks may as well be entrusted to third parties, in particular those relating to building and procurement as well as to project planning and implementation. Though this legal and organisational form of publicly owned enterprises still is quite common in Germany, there is a distinct demographic downward trend on account of its one-sided public alignment.

Similar relationships between public and private sector can be found with various other models of cooperation, like for example: owner-operated municipal enterprises, public agencies, and water or special purpose associations. Typical of the latter is the move towards far-reaching self-administration which implies less restriction otherwise imposed by municipal framework conditions (tax and personnel sovereignty, technical and

legal supervision) to allow for a wider scope of action and improved 'professional' independence (Bode and Grünebaum, 2000, 2001; Maus and Grünebaum, 2002), though this setting does not necessarily affect the actual relationship between public and private partners.

The key to an intelligent division of tasks and therewith to a successful partnership is to start the process with a precise definition of tasks and customer/contractor interfaces. A far-reaching approach in this context is the operation management model where the private contractor, entrusted with the technical and/or commercial management of specific operations, acts in the name and for the account of the municipalities (Solanes, 1998).

Private-enterprise organisation models in which private companies hold stakes in the wastewater treatment facilities. Tailored to the individual case, there are various models of privatisation which include :

- formal privatisation: 'organisational privatisation' by establishment of owner-operated municipal enterprises – preferably in the form of limited liability companies (LLC)– wholly owned by the local authorities and without participation of private parties; sovereignty remains in the hands of the public bodies,
- functional privatisation: with participation of private partners acting as 'executive agents' for the specific services to be delivered
- material privatisation: complete transfer of tasks and responsibilities to private partners,

Mixed forms. All operator, BOT (build-operate-transfer) and other cooperation models, as the most frequently applied form of PPP, have one thing in common, the private third parties involved work for their own account and are paid for their services by the municipalities (Stemplewski, 2001).

Obviously, the key to good service quality is not to find the appropriate form of enterprise, but rather to find out in which way and in how far private parties should be integrated.

Differences in project management (design and construction) with various forms of organisation

Investment decisions involve the tie-up of long-term funds which are to flow back within a specified time frame (useful life of the facilities). So at this point, the company's organisational and legal form is of no concern: Both in private- and public-sector cooperations, the return on investment (ROI) will play an important role in the decision-making process. In the definition phase, the physical and economic life of plant and equipment is determined and the ROI fixed under consideration of depreciation and interest rates and varying operating costs. Some more manoeuvring room is left for the specification of depreciation rates (reference to (historical) procurement and production costs or current market value for replacement; depreciation periods) and of interest payments (interest rates). Private sector cooperations preferably consider the projected annual yields or those expected to accrue during a contract term of, for example, 5, 10 or 15 years. Whereas public cooperations, assuming that their duty to fulfil that task will continue over future decades and that they are not trying to maximize gains, prefer the long-term view – planning ahead for the future often at the expense of profit chances that might be realisable in the short term (Merkel, 2002). So to let the market speak might also mean to

- postpone indispensable investments (in particular replacement investments) in favour of short-term profits, but this in most cases at the expense of higher operating costs and, ultimately, at the expense of considerably higher capital costs (for example as a result of poor maintenance),

- avoid investments that would go beyond the contract term or to apply lower standards with regard to quality and life-time of plant and equipment, instead of planning ahead (efforts likely to be mistaken as cost effective alternatives),
- adjust necessary investments to the financial structures of the own (multi-division) group, that means to prefer unilateral, in-house solutions without competition in the area of building and plant construction.

On the other hand, it should be stated that all decisions on the public sector are largely dependent on the prevailing political situation (in particular in local parliaments), on all changes of the political seas during a parliamentary term and not least on the state of the public budget. Involved in the decision-finding process are:

- capital needs as a political dimension
- increased intake of public loans (rather than changes in fixed assets)
- changes in the public budget (relation of running costs to investments) with the possibility to shift one item for another); this for example by concealing maintenance costs within the projects, by classifying labour costs as company-manufactured capitalised items within individual projects, reversal of accruals, etc.
- public promotion or subsidised investments (whereas operating costs are usually not subsidised)
- planning security for the entire life time of plant and equipment to meet the ever-increasing requirements with regard to purification performance, emission control (noise, odour, waste), health and work safety, etc. (In the private sector, it is usually agreed by contract that additional costs attributable to tightened regulations be passed over to the wastewater producers; whereas in the public sector, often a 'political price' is fixed, generally not high enough to fully cover such additional costs.

Finally, to address the relevant contract awarding practices on both sectors, it can be said that while the public sector's manoeuvring room is rather restricted by national (and European) contract awarding law, the private sector allows for a more flexible project management. This includes the possibility of direct supplementary negotiations with bidders or contractors. However, it should also be noted in this connection that the public contract awarding law creates a marked measure of legal security. This gives the public sector a certain amount of scope for successful action (e.g. by using functional tenders), though direct negotiations with the bidders do not necessarily result in solutions that are more cost-effective than those achieved in competitive bidding processes.

The high capital tie-up typical of wastewater treatment plants calls for transparency with all investment decisions in order to achieve optimised solutions, also over the long term.

Differences in plant operation

In principle it can be said that on the private sector all responsibilities and tasks have to be described in greater detail and have to be fixed more specifically by contract than this is generally the case in the public sector. Whereby, of course, full compliance with all contractually agreed tasks is assumed in all cases. If a company is owned by the public a change of its responsibilities and tasks (e.g. to fulfil higher environmental standards) can be conducted in most of the cases more easily than if it was private. Private contractors will always insist, and quite correctly so, on the precise scope of their contractual obligations – independently of the type of privatisation model used – meaning that any additional task or requirement be settled under new contractual arrangements, either in the form of contract supplements or by contract modification. And as it is known, the customer's position in this situation is not the best. Careful consideration is needed with regard to the sensitive issue of whether or not an existing contractual relationship should be modified or cancelled (limited monopoly status of the contractor) (Solanes, 1998). The necessity to clearly specify all

performance items by contract is almost independent of the degree of private commitment as it has been described above.

Integration of private third parties on the public sector is of course linked to cooperate strategies (purposes and policies) that means it will have an effect on the public bodies' long-term goals, capabilities, and internal configurations. Preferably (only) such tasks should be outsourced (make-or-buy decision) which do not constitute core tasks or otherwise fall within the core competencies of an enterprise. Core activities and operations of large cooperations engaged in the field of wastewater treatment mainly include:

- operation management as one decision unit for all basic issues relating to process adjustment to meet requirements with regard to purification performance, safety at work, maintenance and preservation of plant value,
- project management, from initiation, implementation to completion, as one decision unit which includes both first-time construction and extension/refurbishment of plants (locational choice) and larger replacement investments,
- special cases as one decision unit which includes troubleshooting and handling of incidents such as non-compliance with emission targets and other regulatory standards (relating, for example, to safety at work), and other special or critical operating states,
- fixing of charges to be paid by the wastewater dischargers.

Activities not necessarily to be seen as core tasks in the field of wastewater disposal are:

- Planning tasks relating to design and construction including specialist functions (here, specialist engineers come into play for machinery, electrotechnics, measurement and control, supporting structures, soil analysis, architecture and landscape planning, etc.),
- issues relating to manpower requirements (staffing), the use of energy and operating supplies at the wastewater treatment plants, and to procurement,
- identification of appropriate waste disposal routes (sewage sludge, grits and screenings),
- financing and management of investments and projects, including billing and collection of charges,
- maintenance management during contract terms,
- management of personnel, real estate and resources,
- laboratory services, control and investigations,
- scientific, legal and other special expert consultancy,
- technical and commercial controlling,
- other services like central purchasing and vehicle fleet, etc.

To enhance transparency in all outsourcing efforts (make-or-buy decision), the following questions should be explored and documented.

- How can a specific task be defined properly and precisely to allow for an actual comparison (identification of fundamentals or basic elements)? Areas of responsibilities and relevant prerequisites: identification of goals, operating requirements, quantitative and qualitative parameters and standards, space/time frame, etc.)? What are the exact boundaries to be defined between customer, contractor and other parties responsibilities (identification of interfaces)?
- Are performance standards expected to differ markedly between in-house and external settlement of a specified task (quality targets, safety, reliability, etc.)?
- Are there any specific pros and cons, speaking for or against an external bidder, and how are these to be defined and evaluated (availability of qualified and experienced manpower; equipment appropriate for the task under review; comparable references; locational advantages; cooperation opportunities, etc.)?
- Are there any specific conditions and criteria that can be associated with the advantages and disadvantages of a given solution and which future developments are to be

considered (sensitivity analysis; e.g. with regard to changes in wastewater quantities, loads and purification targets, and with regard to energy, transport, and personnel costs or other regulatory provisions, etc.)?
- What are the medium- and long-term structural effects of a change in business practice by outsourcing (personnel policy; formation of capital and assets, in-house competencies that might also be used at other places (know-how))?
- Will there be any additional costs if the contract is awarded to a third party (monitoring and administration)?
- Could a specific decision promote or provoke changes on the market and, if so, what would be the consequences for the cooperation's own business?
- Which other medium- and long-term effects are to be expected as a result of a specific decision (under possibly changing conditions)?

Summary, outlook and comment

Planning, construction, financing and operation of wastewater treatment facilities – if carried out on the public or the private sector – are subject to different framework conditions. Generally, none of these two basic forms of organisation can be given preference and none of them can be deemed more fit with regard to efficiency and performance. Reasons for the spread of privatisation in recent years range from the use of external know-how and capital to the believe into synergy by integration of wastewater treatment into other equal or similar responsibilities. However, the point in providing this kind of infrastructure is not to realise short-term profits or to relieve public budgets, but rather to ensure, over the long term, secure, efficient wastewater treatment for people and industries at low cost, which can not be linked to neither the public nor private form.

There are several different models of public-private partnership (PPP) which range from the delegation of partial tasks to the transfer of full ownership. The key to economical and ecological success is not the legal or organisational form selected, but the clear definition of tasks and clear definition of relationships between all parties concerned (between customer and contractor and between contractor and contractor) as well as the clear identification of the relevant 'interfaces'. On account of the (legitimate) profit-orientation of the private sector, some decisions taken by private third parties with regard to project management (design and construction) and operation are likely to differ from those taken by public bodies. The same applies to all decisions relating to investment and plant operation. The core tasks of wastewater treatment should not be outsourced, but remain within the remits of the public bodies – even with far-reaching privatisation concepts. Such core tasks are essentially all efforts geared to sustainable, cost-effective wastewater management as life-supporting provision for the future as contribution to the protection of health and of the environment.

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