An accessible version of the article is available at
http://waterresources.fona.de/reports/bmbf/annual/2010/nb/English/50/3_-economy-and-education.html

Economy and education

In this country, clean drinking water and functioning wastewater disposal are a matter of course. Thanks to tailored and professional management, costs can be regulated effectively and reduced if necessary. As well as contributing to the optimisation of domestic concepts, the BMBF intensively supports the transfer of knowledge and expertise in emerging and developing countries across the globe; the aim is to train skilled personnel and educate them in the environmentally sustainable handling of the resource water.

Communal water and waste management – escaping the cost trap with sustainable concepts

Nowadays, costs for drinking water, wastewater disposal and refuse collection account for the majority of our ancillary living costs. Responsible utility companies are already looking for ways to minimise customer expenses and raise the efficiency of their own operations while maintaining highest quality levels. Supported by the Federal Ministry of Education and Research (BMBF), a number of pilot projects have shown that adaptive management and optimised instruments, such as performance indicators and benchmarking, enable the implementation of efficient and sustainable supply and disposal processes. In this context, even the smallest of measures can have a big impact.

In Germany, clean drinking water and a functioning wastewater and waste disposal system are a matter of course. Yet in the face of high investments in system maintenance and expansion, many communities and their public or private utility companies are under great economic pressure. As a result, cost-effective management is becoming ever more important.

Cost and fee debate intensifying

To provide consumers with safe and reliable supply and disposal services, the German water and waste industry has spent the last decades investing heavily into the expansion and modernisation of plants, sewers and water supply networks. This expenditure must pay off in the long term, yet the sector is constantly called upon to tackle new requirements: the cost and fee debate is intensifying, while demographic and structural changes are necessitating expensive alterations of the supply and disposal system in some regions. All the while, consumers are demanding affordable costs and fees – without suffering a drop in quality levels.

Practicable instruments

In order to meet these requirements, sustainable planning and actions are required on the part of the waste and water sector; it is essential that optimised solutions are found on the basis of social, ecological and economic aspects. To develop practicable concepts, the various research disciplines must work closely together and seek the input of other experts. Transdisciplinary work is very much the name of the game.

The dialogue between representatives from the worlds of politics, economy, society and research must be intensified in an effort to co-create suitable instruments for practical application. These should allow the utility companies to better assess the consequences of their actions in the context of sustainability and develop appropriate strategies on this basis. Tried and tested measures from other sectors must be adapted such that they can be applied to water and waste management (projects 3.1.01 and 3.1.02).

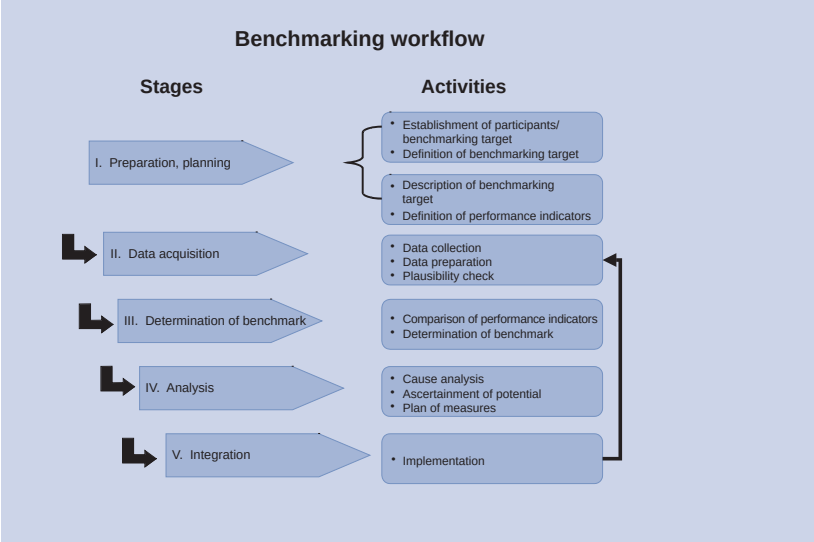
Professional management delivers cost benefits

The transdisciplinary projects funded by the BMBF have shown that professional management raises the efficiency of operations and thus also reduces the financial impact on consumers. A range of measures are available to utility companies in this regard: business tools such as integrated management systems (IMS), effective control of processes via performance indicators, systematic, cross-company comparison of processes in the form of benchmarking and application of resource-friendly technologies and procedures.

In many cases, even small changes, such as more flexible working time models, can lead to significant savings – and not just in the field of water management: instruments such as benchmarking or effective controlling also allow waste disposal companies to improve their performance (project 3.1.03).

Learning from the best – benchmarking in the field of wastewater disposal

In 2002, the German Bundestag initiated a modernisation strategy for the German water industry in the form of its resolution "Sustainable water management in Germany". This also includes the development of modern procedures for comparing the performance of different operations (benchmarking). In its corresponding project, the water board Emschergenossenschaft/Lippeverband (EG/LV) – in conjunction with its partners Aggerverband, RINKE Unternehmensberatung and the Universität der Bundeswehr München (Bundeswehr University Munich) – adapted this method to the field of wastewater treatment and devised strategies for its application in other areas of the water industry. The project thus became a building block of the modernisation strategy and set the tone for the successful development of the benchmarking instrument.



Benchmarking workflow

The boundary conditions for the water economy have changed significantly: demands for efficiency have risen and fees are now only accepted if the underlying costs are sufficiently transparent. To be able to perform their duties in a reliable and economical manner, companies must devise methods for efficient wastewater disposal without losing sight of other important requirements. Launched by EG/LV in 1999, the aim of the project "**Benchmarking in wastewater disposal on the basis of techno-economic indicator systems**" was to improve the operational processes in sewage plants. Since benchmarking was an entirely new concept in the water industry at the time, its implementation required a significant amount of development work. One particular challenge facing the project partners was to ensure the comparability of the various technical solutions and their costs despite the differing boundary conditions. This required the development of standardised assessment criteria. The partners compared over 100 sewage plants with population equivalents (PE)◄ of 420 to 2,400,000. The project consisted of four parts:

1. Application of the methodology to all plants

The results of a precursor project concerning the benchmarking of sewage plants with a PE of 10,000 to 100,000 were applied to all EG/LV and Aggerverband plants. The experts defined the technical and economic parameters to be determined, collected the data, calculated the performance indicators, analysed the reasons for deviations from the optimum values and identified improvement measures. To compare the "wastewater treatment" process across multiple plants, six sub-processes were examined: mechanical, biological and advanced purification, sludge stabilisation, sludge recycling and disposal as well as miscellaneous facilities (e.g. external plants, labs and workshops).

2. Creation of strategies for the inclusion of other operators

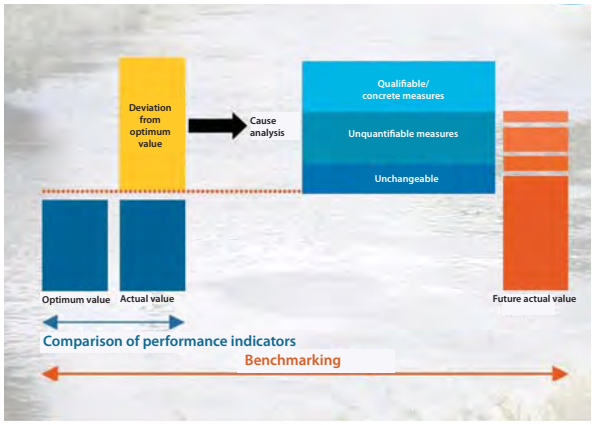
The experts also succeeded in including other operators of treatment plants with different databases in the benchmarking process. The parameters were adjusted according to the requirements of small and medium-sized enterprises.

3. Generation of techno-economic assessment criteria for planning

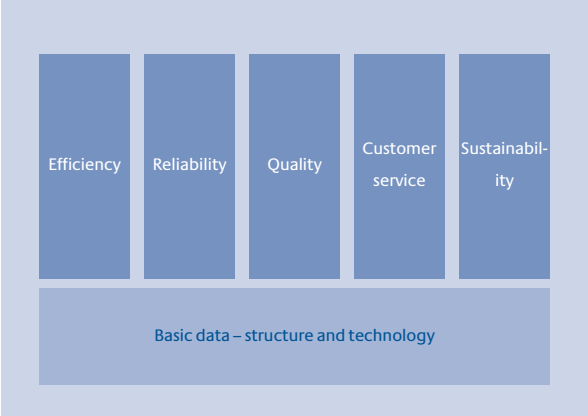
The benchmarking not only relates to plant operation but also to planning. EG/LV has documented the investment costs for all its plants, sub-divided into the cost types structural engineering and mechanical/electrical engineering. Based on the established data, the experts are able to assess the economic efficiency of structural solutions and process combinations in terms of investment costs and operational expenditure.

4. Development of the methodology for other areas of wastewater disposal

The project partners also applied the benchmarking process to other areas, such as wastewater discharge. For this purpose, they created survey forms, which were tested



Benchmarking methods and core elements



Criteria for assessing the performance of a water management company

with other local authorities along with the system itself. The benchmarking of rain overflow basins and pump stations of the sewage network was also examined.

Practical benefits

The venture succeeded in establishing a solid foundation for benchmarking in the water industry. The method is now used throughout the world and is helping to reduce annual operating costs by 3 to 12%. Furthermore, sewage plants of all sizes can be compared using a techno-economic indicator grid. Since the performance indicator system presents all wastewater disposal sub-processes in a uniform manner, comparisons of individual process steps are also possible. Targeted improvements can thus be made on a structural and selective basis.

The experts enhanced the system to be able to implement the requirements of the EU Water Framework Directive◄. The results of the project served as the basis for the benchmarking organisation aquabench GmbH, which is made up of Emscher Wassertechnik GmbH and Aggerwasser GmbH, the cities of Hamburg, Bremen, Dresden, Zurich, Cologne, Düsseldorf, Munich and Berlin – or their corresponding water companies – as well as the consulting firm on.valco. aquabench provides online access to a wide range of benchmarking products, which relate to different processes and enable comparisons at company level.

The experts continuously presented the results of their research project and experiences gained from follow-up projects to the relevant trade associations. A uniform, quality-assured process is supported by a leaflet and guidelines published by the German Association for Water, Wastewater and Waste (DWA) and the German Technical and Scientific Association for Gas and Water (DVGW) as well as an example indicator system of the DWA. Since 2005, the associations have also been informing politicians, the public and companies about the industry's performance via their "Profile of the German water sector". Benchmarking projects are now conducted and corresponding reports published in virtually all German states (e.g. www.abwasserbenchmarking-nrw.de).

The aim is to continue the proliferation of benchmarking and to establish an international performance indicator basis to enable comparisons between different projects. In accordance with the Water Framework Directive, means of extending the observation period beyond company boundaries must also be examined. An initial investigation of this subject was performed by EG/LV, aquabench, the Universität der Bundeswehr München (Bundeswehr University Munich) and the University of Duisburg-Essen in their pilot project "Benchmarking the management of river basins◄".

Project website ► **www.aquabench.de**

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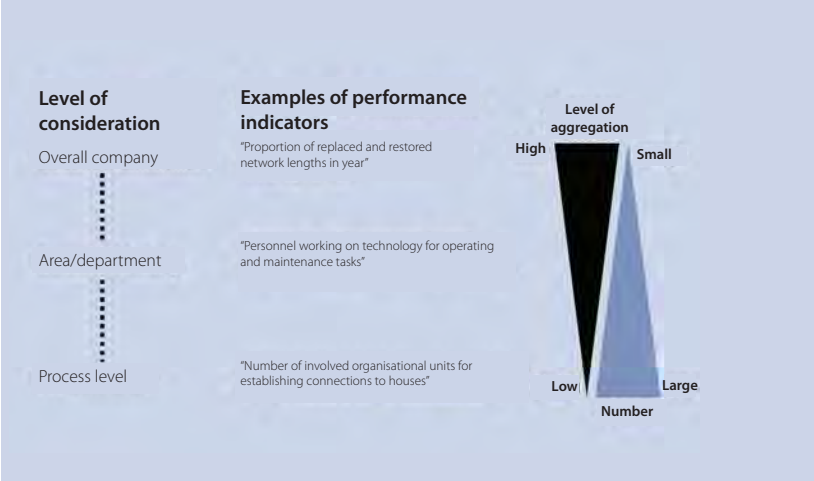
Peak performance indicators – professional management in the water industry

Quality, supply reliability, customer service, sustainability and efficiency are important target variables in the water supply sector. To raise its effectiveness in these key areas, the water industry is increasingly relying on performance indicators – a business tool that is already used successfully in industrial applications. The IWW Water Centre (Rheinisch-Westfälisches Institut für Wasserforschung) has developed a performance indicator system that has now become the industry standard. It is based on a model of the International Water Association (IWA) and supports the process analysis of water production and examination of sustainability aspects of the water supply.



From highly aggregated performance indicators for assessing the overall company to detailed process indicators

To exploit all means of cost reduction and identify any optimisation potential, the companies of the water industry require a suitable database. More and more of these operations are therefore employing indicator systems, since they supply reliable information to act as a basis for business decisions but can also be used for benchmarking purposes – i.e. comparisons with other companies in the sector. Company management can thus monitor the development of their operation, establish in what areas it performs better than the competition and identify where a need for improvement exists.

The aim of the project **"Performance indicators for water supply services: Field test of the IWA performance indicator system"**, which was conducted by the IWW and funded by the BMBF, was to create and test an indicator system for the German water industry on the basis of international standards. 14 operations joined the project group and agreed to test and develop the system over the course of three survey periods.

Performance indicator system of the IWA

The IWA indicator system has eight key characteristics:

- The system contains all tasks of a water supplier, organised into the areas of technology and administration.
- The hierarchical structure of the system enables interlinking of all performance indicators – from main tasks, subtasks and individual tasks to specific processes, with an increasing level of detail.
- All terms, derivations and data structures (e.g. financial structure) are uniquely defined.
- In the data model, all entered information is evaluated as to its reliability and accuracy.
- Depending on the user group (e.g. companies, authorities, trade associations, banks) the performance indicator system and the weighting of the indicators can be flexibly adapted to different requirements.
- The system is designed for electronic data processing – a mandatory requirement for the continuous use of performance indicators as a management tool. Companies will find the process much easier if they collect data variables before calculating and evaluating the performance indicator results.
- To support the persons responsible for the operations in interpreting the indicator results, the German IWA manual provides context information relating to corporate structures (e.g. size, legal form, management systems), supply systems (e.g. protected areas, wells, water works, pipeline data) and supply areas (e.g. topography◄, soil condition).
- A total of 55 performance indicators and 19 context information items are assigned to the five main features of the drinking water supply – reliability, quality and sustainability of the supply, customer service and efficiency.

Multiple benefits

Continuous indicator analyses and comparisons are not only an excellent means of identifying and eliminating weaknesses in a company. Based on the experiences of the operations involved in the project, the system also offers a range of additional benefits:

- The system necessitates the creation and maintenance of a structured data model that reflects the conditions within the company.
- The tasks, workflows and results for all performance features become more transparent.
- The system enables the conclusion of target-oriented agreements with the responsible company divisions, which promotes cost awareness and efficiency in the maintenance of quality and reliability.
- The decision-makers are better able to assess where co-operation with external partners (e.g. utility companies, service providers) would be beneficial, since they may be able to deliver a specific service in a more efficient manner.
- Delivered services and rectified deficiencies can be made transparent to the public.

Practical and successful

The practical and internationally compatible IWW performance indicator system, with its specific enhancements, has since been widely accepted in practice and has become the industry standard for German water supply services. More than 500 water supply companies throughout the German-speaking region have used the system in numerous benchmarking projects.
Based on this wide-spread application, the IWA system

Pipes and fittings in a water works (filter outlet and flush water distribution)

Well chamber and turbine in a water works

became the focus of a joint follow-up project entitled "Sustainability of water services" conducted by the IWW, the Institute for Social-Ecological Research (ISOE) and the Regional Planning and Environmental Research Group (ARSU). In the context of a detailed efficiency and performance analysis of the operational processes employed in water production, the project also served as the starting point for a joint research venture between the IWW and the Technische Universität Hamburg-Harburg (Hamburg University of Technology) entitled "Development and practical test of process indicators for the management, supply and treatment of water".

The project gave rise to the following publication, among others: "Kennzahlen für Benchmarking in der Wasserversorgung. Handbuch zur erweiterten deutschen Fassung des IWA-Kennzahlensystems mit Definitionen, Erklärungsfaktoren und Interpretationshilfen" [Performance indicators for benchmarking water supply services. Handbook for the extended German version of the IWA performance indicator system with definitions, explanatory factors and interpretation aids] (wvgw Wirtschafts- und Verlagsgesellschaft Gas und Wasser mbH, Bonn 2005 – ISBN 3-89554-152-4)

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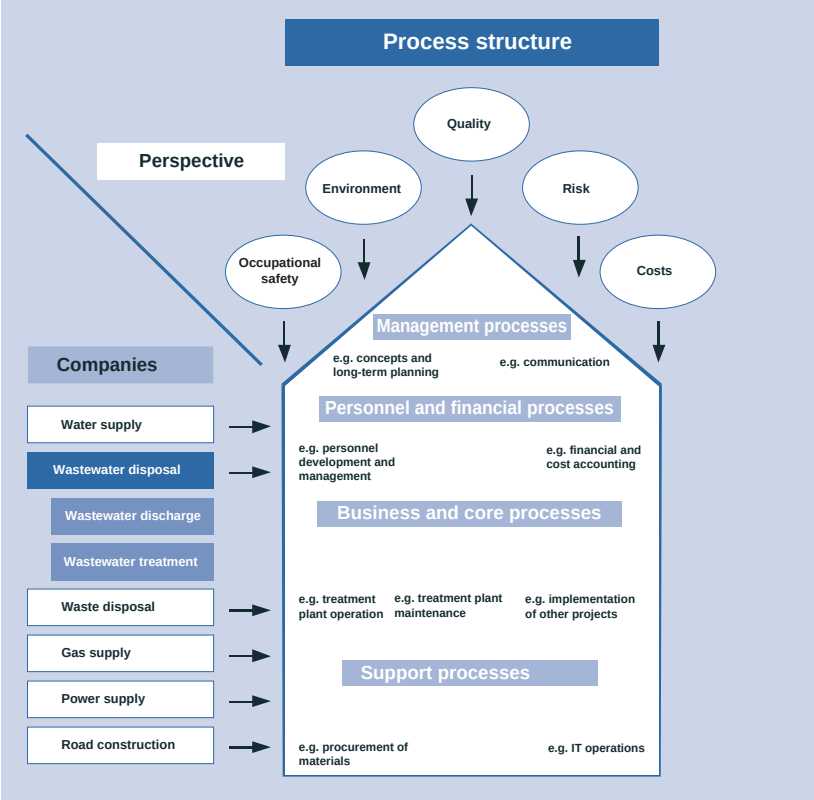
Waste disposal and city cleaning – continuous optimisation of public utility companies

As well as extremely high requirements, municipal waste management companies now face constantly changing legal provisions and regulations. In addition to the ever-present economic demands, the companies have found themselves under increasing environmental pressure in recent years. They must comply with strict environmental regulations and ensure separate collection, recycling and disposal of all waste. The responsible managers are now being called upon to increase both the productiveness and cost-effectiveness of their operations while continuing to tackle these sometimes very complex tasks. In a joint research project, representatives from 19 such companies have worked with experts to analyse possible means of implementing more efficient waste management and city cleaning, assess the feasibility of these approaches and devise corresponding recommendations.

The project was started in 1999 as a result of an ideas competition held by the BMBF to reduce costs in public waste disposal. The aim of the venture **"Cost reduction in public waste disposal and city cleaning"** was to establish some basic recommendations. The project participants included representatives from waste management companies located in German cities and communities of varying sizes. These organisations embodied a number of different business types – ranging from government- and owner-operated companies to mixed enterprises and public limited liability companies. The project was co-ordinated by INFA GmbH (Ahlen), with technical support provided by the Institut für Umweltökonomie (IfU, Mainz), uve GmbH (Berlin) and intecus GmbH (Dresden). Five working groups were set up and each tasked with identifying cost reduction potential in one of the following areas: waste logistics, street cleaning, depots and workshops, cost accounting and efficiency management as well as organisation and administration.

The first step was to perform a survey of selected operations, during which the experts recorded important performance data. They worked with the companies to examine new organisational forms, methods and techniques with the potential to raise operating efficiency. Based on experiences gained during this process, the project team devised a target concept, performed target/actual comparisons and determined performance indicators. The five working groups identified savings potential in all five areas, which in some cases was quite considerable. They also found that these savings could be successfully applied to other operations in the sector.



Corporate process structures (from: DWA-M 801, "Integrated quality and environmental management system for operators of wastewater facilities", April 2005)

Waste logistics

In the area of waste logistics, a range of possibilities were examined with regard to their potential cost savings and practicability. These included the collection and vehicle systems, collection intervals, type and scope of separate collections, the route planning and software used for this purpose, personnel and vehicle deployment planning, internal procedures, business information systems and new working time models. The project team identified significant savings potential. Depending on local circumstances, examples included intelligently controlled vehicle and personnel deployment using route planning software, adapted collection intervals, the separation of waste collection and transport using swap bodies, more flexible working time models, the use of an improved documentation and management information system as an effective controlling instrument and more intensive personnel training. In the area of waste logistics, many companies had already achieved a high level of efficiency before the project was launched, but were still able to reduce costs by 5 to 20% as a result of the joint venture.

Street cleaning

Significant savings potential – of 5 to 15% – also exists in the area of street cleaning. The corresponding measures are frequently employed to raise the quality of street cleaning, since the image of a clean city has become increasingly important in recent times. Examples of these measures are an improved and requirement-based deployment of vehicles, longer and more effective cleaning times as well as close co-operation of manual and mechanical cleaning systems. The introduction of group systems, optimised route planning and the supportive use of small sweepers can also help to reduce costs.

Depots and workshops

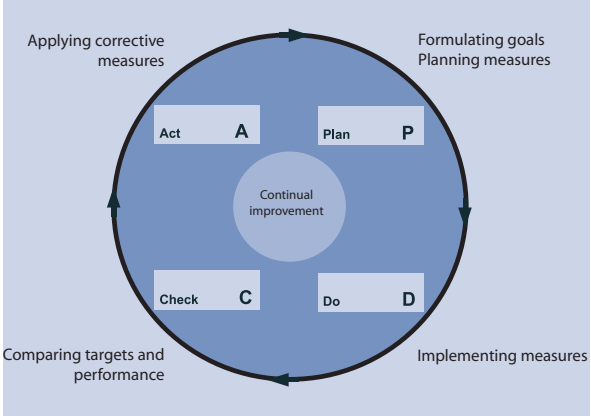
The members of this working group investigated six workshops dealing with refuse and street cleaning vehicles to assess their workshop configuration, order acceptance process, operational workflows, working hours and co-operation as well as the areas of planning, software and controlling. Among other things, they found that fewer interfaces between the computer programs for time recording, workshop order management, invoicing and payroll accounting would enable significant time and cost savings. A functioning controlling system proved to be particularly significant with regard to business decision-making.

Cost accounting and efficiency

To allow operations to work more efficiently, this working group developed a controlling system with integrated reporting. It allows employees to gather, prepare and present information in a manner that facilitates management decisions. For this purpose, the company must know, record and systemise its various services. The project participants therefore created service catalogues for their individual operations. These can be combined with the basic cost accounting and reporting pyramid to form an integrated management system.

Organisation and administration

Administrative employees should be able to focus on their core activities. Therefore, the experts of the working group for "organisation and administration" recommend that a service centre and administrative office be set up, individual service areas reorganised and procurement centralised; this should be done in line with the size of the operation and on the basis of local conditions. One public waste disposal company was given advice and how to improve its call centre, while the working group supported another operation with the implementation of suitable fleet and workshop management software. Notes on more efficient waste management can be found in DStGB document no. 58 "Handlungsempfehlung zur Kostensenkung in der kommunalen Abfallentsorgung" [Recommendations for reducing costs in municipal waste disposal] (published in 2006), while the efficiency of street cleaning is addressed in DStGB document no. 67 "Handlungsempfehlung zur Optimierung der kommunalen Straßenreinigung" [Recommendations for optimising municipal street cleaning] (published in 2007). DStGB document no. 58 appeared in the supplement of the German Association of Towns and Municipalities (DStGB) "Stadt und Gemeinde INTERAKTIV", issue 4/2006 (http://www.dstgb.de/dstgb/DStGB-Dokumentationen/).



PDCA cycle (from: DWA-M 801, April 2005)

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