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PAPERS

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World Bank warns of severe water problems in Palestinian lands

The World Bank has warned in a report of the 'complete dependence' of the West Bank and Gaza Strip on water that is controlled by Israel.

Palestinians face severe water shortages both because of bad internal management at the Palestinian Authority and Israeli restrictions, the report – the first of its kind – observed.

The report, titled 'Assessment of restrictions on Palestinian water sector development', added that 'the joint governance rules and water allocations established under the 1995 Oslo interim agreement, still in effect today, fall short of the needs of the Palestinian people.'

It noted: 'Because of asymmetries in power, capacity and information between parties, interim governance rules and practices have resulted in systematic and severe constraints on Palestinian development of water resources, water uses, and wastewater management.

'Furthermore, since 2000, the movement and access restrictions, consisting of physical impediments...have further impaired Palestinian access to water resources, infrastructure development and utility operations.'

The report warns that 'even though the PA (Palestinian Authority) and many donors have invested in establishing a sustainable and equitable water sector, access to water resources, water infrastructure and institutions remain inadequate.'

It also found that 'the sector continues to operate in a very inefficient emergency mode, with far reaching economic, social and environmental consequences'. Consequently, it noted, 'water-related humanitarian crises are in fact chronic in Gaza and in parts of the West Bank.'

Per capita fresh water in Israel is around four times that of the West Bank and Gaza Strip, the Bank found. The former has 'established, efficient water infrastructure and management,' while the Palestinian territories are 'struggling to attain the basic level of infrastructure and service of a low-income country'.

The Bank recommended adoption of an agenda to address shortcomings in water resource development and management, the low and declining investment rate and weak water services management. ●

EEA warns of unsustainable water use

A new report by the European Environment Agency (EEA) confirms that in many parts of Europe water use is unsustainable and provides recommendations for a new approach to managing water resources. The EEA report 'Water resources across Europe – confronting water scarcity and drought' highlights that while southern Europe continues to experience the greatest water scarcity problems, water stress is growing in parts of the north too. Moreover, climate change will cause the severity and frequency of droughts to increase in the future, exacerbating water stress, especially during the summer months.

Policies and practices recommended to shift the management focus from increasing supply to minimising demand include:

- Pricing water according to the volume used across all sectors, including agriculture.
- Governments should implement drought management plans more extensively and focus on risk rather than crisis management.
- Water-intensive bioenergy crops should be avoided in areas of water scarcity.
- A combination of crop selection and irrigation methods can substantially improve agricultural water efficiency if backed-up with farmer advisory programmes. National and EU funds including the EU's Common Agricultural Policy can play an important role in promoting efficient and sustainable water use in agriculture.
- Measures to raise public awareness, such as eco-labelling, eco-certification, education programmes in schools, are essential to realise sustainable water use.
- Leakage in public water supply systems must be addressed. In parts of Europe, water loss via leakage can exceed 40% of total supplies.
- Illegal abstraction of water, often for agricultural use, is widespread in certain areas of Europe. Appropriate surveillance and a system of fines or penalties should be put in place to address the issue.
- Authorities should create incentives for greater use of alternative water supplies, such as treated wastewater, greywater, and 'harvested' rainwater, to help reduce water stress. ●

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EDITORIAL

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New editor joins WAMI board

We would like to welcome a new editor to the board for Water Asset Management International.

Professor Sunil Sinha is an Associate Professor and Program Area Coordinator, and Co-Director of ICTAS (Institute for Critical Technology and Applied Science) Water Research Center of Excellence, at Virginia Tech, USA.

Professor Sinha's background is in civil engineering and he is currently working on a range of research projects, including the development of a sustainable water infrastructure management system, for which he was awarded a national Science Foundation CAREER award, a performance prediction model for buried pipes, and condition assessment of water transmission and distribution systems. ●

World Water Forum sets up water legislation 'helpdesk'

Participants at the World Water Forum have asked the World Water Council to set up an international 'helpdesk' to aid political cooperation on water legislation.

The helpdesk will provide guidance on responsibility for enacting water and sanitation laws, share best global practices and water-related legislation, quickly answer urgent questions and unite all stakeholders in a globally-cooperative inter-parliamentarian network.

Parliamentarians from all countries provided feedback to the Council suggesting they had to be more deeply involved in the water sector because legislatures provide oversight.

The Forum also highlighted the message that meeting water challenges should be a priority for urban action. Loic Fauchon, the president of the World Water Council, said at the opening: 'Mayors and local authorities are the pillars of water governance. Our cities are the battlefield where this struggle will be won or lost.'

Over 250 mayors and local authorities from 43 countries attended the event. The Forum organised a series of debates leading to endorsement of the Istanbul Water Consensus, a non-binding agreement to catalyse action on urban water and sanitation issues.

UNESCO (United Nations Educational, Scientific and Cultural Organization) director-general Koichiro Matsuura also addressed the Forum, stressing that water must be given higher priority on the development agenda: 'Developing countries themselves need to increase investment in water, and systematically integrate water in poverty reduction strategies. The international community must also dramatically scale up its support…I urge leaders in all sectors to use this report as a guide and impetus for bold and sustained action to meet the world's water needs.'

Taking forward the impetus of the 2008 Year of Sanitation, a panel of experts convened at the Forum to accelerate momentum on the issue, focus direction and make progress.

The High-Level Expert Panel on Water and Disaster identified six specific priorities and 40 action guidelines to prevent, prepare for, manage and recover from water-related disasters. It also called on all governments to endorse and adopt the measures immediately.

The Forum focused on key parts of the world over various days. On Africa Day the vice president of the AfDB (African Development Bank), Mandla Gantsho, noted that although the continent's situation was precarious, it was not all gloomy and that positive changes have been recorded in the past few years. The conclusion of the day called for African heads of state to translate commitments into action.

China's minister of water resources, Chen Lei, told the Forum on Asia-Pacific Day that water is a critical material foundation for sustainable social and economic development and that the Asia-Pacific region is a dynamic area with huge development potential and water challenges.

Business leaders attending the Forum urged the international community to acknowledge the link between water, energy and climate change, encouraging them to take these up at the global climate negotiations in Copenhagen, Denmark this December.

The Forum also made a number of awards. The Chinese city of Guangzhou was given the Mexico Water prize for its 'excellent management of water resources'. The city's vice mayor, Su Zequn, received the prize on the third day of the Forum. Guangzhou has launched a number of water initiatives since the late 1990s, which have significantly improved its once-heavily polluted inlets to the Pearl river.

Marcella D'souza, executive director of the Watershed Organization Trust in India was awarded the Kyoto World Water Grand Prize during the Forum's closing ceremony on Sunday for her contribution to bringing women to the forefront in developing the dynamic of a watershed effort.

However, to the annoyance of some environmental groups, the Forum's closing ministerial statement did not acknowledge water as a human right, saying instead: 'We acknowledge the discussions with the UN (United Nations) system regarding human rights and access to safe drinking water and sanitation. We recognise that access to safe drinking water and sanitation is a basic human need.'

The heads of government also agreed to support the implementation of integrated water resources management and improve water demand management, productivity and efficiency of water use for agriculture, strengthen the prevention of pollution from all sectors in surface and groundwater, resolve to work to prevent and respond to natural and human-induced disasters and strive to improve water-related monitoring systems. ●

Atkins wins Nigeria watsan technical assistance contract

Atkins, in a joint venture with UK-based ITAD and Abuja-based Enplan, has been awarded an €7.2 million ($9.76 million) contract over two years to provide technical assistance to Nigeria's water supply and sanitation sector reform programme.

The project is funded by the European Union (EU) in collaboration with the Nigerian government and will potentially benefit over three million people across six states – Cross River, Anambra and Osun in the south and Kano, Jigawa and Yobe in the north, with central co-ordination from the capital Abuja.

The main objective is to aid poverty eradication, sustainable development and achieving the Millennium Development Goals (MDGs). To make this happen, the water and sanitation sector reform process in each state will be facilitated by establishing State Technical Units manned by consultants. The teams will work closely with the state water ministries to introduce the planned institutional and legislative reforms and provide improved water supply and sanitation delivery in 39 local government areas.

Nigerian professionals will be the main staff on the project, covering engineering, community development, procurement and finance and accounting. The work fits in with other work Atkins has been undertaking for the EU in Nigeria, notably the drafting of the National Water Resources Bill.

Although some progress has been made during the first phase of the project, a large amount remains to be done. Atkins project director, Ian Mathieson, said: 'The main challenge will be to introduce institutional change in a very short time frame.

We look forward to working with our clients to ensure an effective implementation of the reforms which will ultimately improve water supply and sanitation for a significant proportion of the Nigerian population.' ●

Report claims 'hundreds of millions' of dollars are wasted on rural African water projects

A briefing from the International Institute for Environment and Development, released ahead of World Water Day, warns that hundreds of millions of dollars have been wasted on rural water projects in Africa.

This threatens the health and livelihoods of millions of vulnerable people, the briefing warns. 'Tens of thousands' of boreholes in rural areas are in disrepair because donors, governments and Non-Governmental Organisations (NGOs) have built infrastructure but ignored the need to maintain it.

The paper gives a 30-point list of features that rural African water supply systems must have to succeed including the correct technology, community ownership and the local capacity to repair and maintain wells.

Tens of thousands of new water points – such as boreholes with motorised or hand pumps – are created in Africa each year but many fall into disrepair after just a few years. Of 52 deep water borehole and supply systems built by the charity Caritas since the 1980s in Senegal's Kaolack Region, only 33 still function today.

The Global Water Initiative has found that 58% of such water points in northern Ghana needed repair. In western Niger, it found that of 43 boreholes, 13 are abandoned, 18 are non-functional for more than three days once a year, and 12 are non-functional for more than three days, more than three times a year.

Jamie Skinner, the paper's author, said: 'The water community has often focused on building infrastructure, rather than on maintaining it. This failure is forcing women and children to carry water over great distances with serious impacts on their health and education.

'It is not enough to drill a well and walk away. Water projects needs to support long term maintenance needs and engage local communities. Without this, it is like throwing money down the drain.'

He added: 'Across rural Africa, some 50,000 water supply points have failed, representing a waste of $215 to $360 million. It seems simple and obvious but it needs to be said: there is little point in drilling wells if there is no system to maintain them. Every day that a borehole does not provide safe water, people are obliged to drink from unclean pools and rivers, exposing them to waterborne diseases.'

The paper stresses the importance of better investments in knowledge, community-led management and government capacity to sustain water supplies. It says local communities must take part in choosing and maintaining appropriate technologies, and how much they are willing or able to pay to maintain them, rather than having them imposed on them by outsiders. ●

EPA drinking water needs assessment predicts massive infrastructure spend

The Drinking Water Infrastructure Needs Survey and Assessment, which is undertaken every four years by the US EPA, has found that the nation's water utilities will have to invest an estimated $334.8 billion over the next 20 years to remediate ageing infrastructure.

The recent survey will help the regulator to determine the distribution formula for Drinking Water State Revolving Fund (DWSRF) grants for 2010 to 2013 budgets.

The assessment documents anticipates costs for repairs and replacement of transmission and distribution pipes, storage and treatment equipment, and projects needed to ensure delivery of safe supplies of drinking water.

The survey reflects data collected in 2007 from states. Around 52,000 community water systems and 21,400 not-for-profit non-community water systems are eligible to receive the loan and grant funds. ●

Obama budget pledges huge increase in water and wastewater spending

Details of US President Barack Obama's first budget indicate a 60% increase in funding for EPA (Environmental Protection Agency) spending on improving potable water and wastewater plants across the nation.

The new administration proposes a spend of $3.9 billion in fiscal year 2010 for improving outdated infrastructure, including $2.4 billion that will pass through to state revolving funds, which provide low-interest loans to utilities for improvements.

The EPA's overall budget would increase by 34% to $10.5 billion for the fiscal year beginning 1 October. The budget also provides for $475 million to go to the Great Lakes restoration project.

The budget proposal also reintroduces the polluter pays principle for Superfund cleanup sites.

Extra funding will support the creation of scientifically-rigorous tools and models to help progress the use of green water infrastructure. ●

Halcrow wins New York climate change study

Halcrow has been selected by the New York City Department of Environmental Protection (NYCDEP) to undertake a £2.4 million ($3.4 million) climate change study project, as part of a joint venture with environmental engineering firm Hazen and Sawyer.

The company will help the NYCDEP to identify and quantify the impacts of climate change and population growth on New York city's sewer, drainage and wastewater systems.

Halcrow's climate change adaptation specialists will lead a team of international experts in devising adaptation strategies and processes to mitigate the anticipated risks. The team will also be collating data on local rainfall, sea level rise, and storm surge for use in simulation modelling. Work on the project is expected to begin in mid-2009 and last until 2011. ●

Scientists blame Sichuan earthquake on major dam

Scientists have claimed that last year's major earthquake in China's Sichuan province may have been triggered by the 156m high Zipingpu dam, which is sited on a tributary to the Yangtze river.

The evidence suggests impounding the dam's reservoir activated a fault line near the site. Large dams can create a phenomenon known as reservoir-induced seismicity, and evidence links tremors with reservoir filling or level changes in over 70 dams.

The Sichuan earthquake, 7.9 on the Richter scale, killed around 70,000 people last May and left five million homeless. The chief engineer of the Sichuan Geology and Mineral Bureau, Fan Xiao, recently issued the conclusion of his investigation into the disaster, which said pressure from the reservoir had probably affected the timing and scale of the earthquake. Mr Xiao opposed construction of the dam in 2003 amid safety concerns. Other scientists have reached similar conclusions. Christian Klose of Columbia University's Lamont-Doherty Earth Observatory told a meeting of the American Geophysical Union recently that the fault line that triggered the Sichuan quake had not been active for millions of years previously. He explained to the meeting that 'the ensemble of geophysical observations suggests that the root cause of triggering the M7.9 Wenchuan earthquake may have stemmed from local and rapid mass changes on the surface.'

An article on his findings in the journal *Science* noted that the added weight of the reservoir both weakened the fault and increased the stress that would rupture it. ●

EPA announces further stimulus money allocations

The US EPA (Environmental Protection Agency) has announced further significant tranches of stimulus money for use in water and wastewater projects under the Reinvestment and Recovery Act.

An award of $19.5 million has been made to the Kansas Department of Health and Environment to help state and local governments finance many overdue improvements to water projects that are seen as essential to protecting public health and the environment across the state. The funds will go to the state's Drinking Water State Revolving Fund programme.

A further $20,045,025 has been awarded to the Nebraska Department of Environmental Quality under the Clean Water State Revolving Fund programme, which provides low-interest loans for wastewater treatment, non-point source pollution control and watershed and estuary management.

Nebraska's Department of Environmental Quality has been given an additional $19,500,000 for potable water projects under its Drinking Water State Revolving Fund programme.

$70,729,100 million has been awarded the North Carolina Department of Environment & Natural Resources, again for wastewater projects under the Clean Water State Revolving Fund.

Kentucky's Infrastructure Authority has been given $49,878,100 under the Clean Water State Revolving Fund programme and $48.8 million has been given to the West Virginia Department of Environmental Protection under the same framework.

The EPA also awarded more than $430 million to the state of New York for wastewater infrastructure projects. At least 20% of the funding has to go towards 'green' projects. ●

World Bank approves loan for China wastewater system

The World Bank has approved a $90 million loan to China to build on existing wastewater system improvement works in Yunnan province. The Yunnan urban environmental project will build on the work of an earlier project approved in 2005, which financed wastewater and solid waste systems in the province.

The new project will support construction and expansion of urban drainage, wastewater collection and treatment facilities, solid waste management systems, flood control and other sanitation facilities in ten county towns in Kunming, Lijiang and Wenshan. The new project also targets at the largest lake in Yunnan province, lake Dianchi, which has suffered deteriorating water quality since the 1980s. To reverse the worsening trends, the project will support development of integrated lake basin management systems for the water body. ●

EBRD funding for Kazakhstan network rehabilitation

The EBRD (European Bank for Reconstruction and Development) is providing an $8 million loan to the local private water utility, TOO Vodnye Resursy Marketing, to improve the water and wastewater services in the city of Shymkent in southern Kazakhstan.

The loan will finance a comprehensive investment programme that focuses on improving the efficiency and quality of the service. It includes rehabilitation of the potable water network, replacement of parts of the sewage system and the installation of frequency controllers.

The improvements will significantly benefit the living standards of the population of Shymkent, the fourth largest city in Kazakhstan, with a population of almost 550,000. ●

AfDB provides funds for Mozambique water supply project

Mozambique has obtained $27 million in funds from the AfDB (African Development Bank) to finance a water supply and sanitation project in the country's northern Niassa province.

The Niassa provincial towns water and sanitation project is designed to improve access, quality, availability and sustainability of water supply and sanitation services in the province's Cuamba and Lichinga towns. The project, to be implemented over a four-year period, includes institutional development support, water supply scheme rehabilitation and extension, sanitation programme and project management and audit. ●

World Bank supports Kyrgyz Republic watsan improvements

The World Bank has approved the equivalent of $10 million in financing to support water supply and sanitation efforts in the Kyrgyz republic.

The second rural water supply and sanitation project is targeted at improving access to potable water in the participating communities and at improving hygiene and sanitation in rural areas and will reduce the number of waterborne diseases in project communities. The project will improve the condition of rural water infrastructure and equipment, by fixing or expanding existing water supply systems and will also provide technical assistance in water systems maintenance. Sanitation and hygiene will also be promoted, including the importance of sanitary latrine construction, and the project will develop capacity in the Kyrgyz government in order that they can better manage rural water systems. ●

The IBISS project: Italian-Egyptian capacity building in integrated water supply and sanitation

The IBISS (Italian-Egyptian capacity building in integrated water supply and sanitation) project has been supported by the European Commission's LIFE Third Countries Program and the Italian Ministry of Environment, Land and Sea, with the aim of building the capacity of the Egyptian Holding Company for Water and Wastewater (HCWW) and its subsidiaries in the sector of leakage control and rural sanitation. The project consortium led by HCWW has included an Italian multi-utility and Italian and Egyptian water consultants with worldwide experience in integrated water resource management. IBISS has carried out pilot projects in three selected areas managed by Cairo, Alexandria and Gharbeia water utilities to provide Egyptian engineers with on-the-job training on leakage control techniques. The pilot projects have achieved water savings and have resulted in the training of more than 80 Egyptian water professionals in the management of water losses, and increased knowledge about leakage in Egyptian networks. IBISS has also conducted a feasibility study for improving sanitation in one pilot village to introduce Environmentally Sound Technologies. The ultimate aim of IBISS has been to produce replicable models for leakage control and rural sanitation in Egypt, the Middle East and North African (MENA) region.

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Introduction

Egypt faces major challenges in the sustainable management of water resources, which form the basis for its future development. As an arid country, Egypt has limited water resources, mainly derived from the Nile River with limited contributions from renewable and non-renewable groundwater sources. Egyptian population has experienced a high growth rate over the last 40 years, increasing from 37 million in 1970 to over 81 million in 2008, and is expected to reach 95 million in 2025. People live densely concentrated in just 5.5% of the country's land along the Nile valley and delta. The present per capita water share is below 1000m^3/year and it might reach below 700 m^3/capita by 2025, thus indicating 'water scarcity'.

Water quality is also a major concern. Poor sanitation will lead to severe pollution issues of receiving waters, with detrimental impacts on health.

Despite this, Egypt has made significant progress in providing access to potable water to both urban and rural populations, as well as sanitation in the cities. Nearly all Egyptians – 98% of the population – have access to piped water, and sanitation has improved significantly in cities. Yet too many people, particularly in rural areas, lack access to sanitation. It is estimated that 30% of the rural population in Egypt, almost 15 million people, do not have access to sanitation. Whilst Egypt appears on track to meet its Millennium Development Goals for providing sanitation to 77% of its over 80 million people by 2015, significant efforts are still needed to enhance water use efficiency and rural sanitation.

The reform of the water and wastewater sectors in Egypt

Since the late 1990s the Government of Egypt (GoE) has taken stock of the water problem and has extensively worked on developing strategies to cover the gap between scarce water resources and increased consumption demands of population, agriculture and industry.

In the process of reforming the water and wastewater sector, the Holding Company for Water and Wastewater (HCWW) was established in 2004 under the responsibility of the Ministry of Housing, Utilities and Urban Development (MoHUUD). HCWW is responsible for the operation and management of the provision of water supply and wastewater services. In 2006 the 14 existing water utilities were transferred to subsidiaries of the new Holding Company, and a further nine new subsidiary companies will be formed in governorates from 2009 to 2011. The short-term goal of the HCWW and its subsidiaries is to provide a sustainable financial and operational system for the provision of water and wastewater services in all governorates, thus improving service delivery and efficient use of water resources.

HCWW is currently responsible for

Figure 1
The IBISS project website (www.ibisslife.com.eg)

the operation and maintenance of 15 water and wastewater facilities in 13 governorates, with the intention of covering all the governorates in the coming years. At present the Holding Company provides drinking water to 44 million people and sanitation services to 25 million. This translates into the daily production of 14.7 million m^3 of drinking water and treatment of 5.3 million m^3 of wastewater.

Since its establishment, HCWW has been committed to expanding and improving services to customers by enhancing the operational and financial performance of the subsidiaries. In this context, one of the priorities of HCWW is building the capacity of technical staff in advanced technologies and best practices, to rationalise the use of water and improve rural sanitation. In this undertaking the Government of Egypt is supported by numerous international funding institutions, such as the European Commission (EC), the World Bank (WB), and the United States Agency for International Development (USAID), as well as cooperation programmes of many European member states (Germany, Italy, Denmark, France and Holland).

The IBISS project

This paper presents the work conducted in the IBISS (Italian-Egyptian capacity building in integrated water supply and sanitation) project, conducted by the HCWW with the financial support of the European Commission's LIFE Third Countries 2006 Program and the Italian Ministry for Environment, Land and Sea (IMELS).

IBISS is a capacity building project to transfer know-how and technology from Italy to Egypt in the fields of leakage reduction and rural sanitation. The project's Consortium has been led by the Egyptian HCWW and comprises one Italian water and wastewater utility (SPS) and Egyptian and Italian water consultants (SGI and SGI Egypt). The project lasted two years (2007-2008), with a budget of approximately €800,000 ($1,059,311).

IBISS aims at reducing losses in water mains and promoting environmentally sound techniques for rural sanitation. In achieving this objective, the IBISS project has trained the technical staff of the participating HCWW subsidiaries in flow and pressure monitoring, leakage detection, mathematical modelling, district metering methodologies and unconventional practices for rural wastewater disposal, collection and treatment.

Leakage and rural sanitation are two major areas of focus in this project. Water loss through leakage is one of the most critical issues to be addressed by the HCWW and subsidiary companies. The national average leakage is estimated at 35% although this figure is likely underestimated, since the flow measurements along the system (production, distribution and consumers) are hardly accurate or available. In a country where water is so precious, leakage impacts water usage to an even greater degree. IBISS has implemented training workshops in Egypt and Italy and three pilot projects in areas managed by the water utilities of Cairo, Alexandria and Gharbeia.

For the area of rural sanitation, IBISS has developed a Manual of Best Practice and a feasibility study for the village of Gawad Hosney, located in Beheira Governatorate (north of Egypt, bordering the Mediterranean Sea). With a population of 3000 inhabitants, Gawad Hosney is representative of most Egyptian villages (73% of which have populations with less than 10,000 inhabitants). This manual has been produced in CD-Rom form and disseminated to municipalities and wastewater utilities across Egypt.

In this article, the methodologies used in the project and the results achieved are described in detail. For further information, the reader can refer to the project website www.ibisslife.com.eg (Figure 1).

Table 1
Calculation of the leakage priority factor to select pilot projects

Water company	Priority Calculation: Current level of leakage (L)	Cost of water (CW)	Cost of Leaks (Loc) and rep exercise (CS)		Time since last survey (T)	Zone Ranking Factor (ZRF)
	m^3/y	€/m^3	€	€/m^3	Years	
Alexandria	282,207,901	0.033	34,440	0.023	3	28.5
Asswan	41,240,941	0.110	6091	0.023	0.003	1.4
Bani Sewaif	36,735,258	0.082	5805	0.023	0.083	5.9
Beheira	56,423,605	0.060	8741	0.023	3	32.9
Dakahleia	89,597,274	0.034	13,556	0.023	0.003	0.7
Dammietta	29,932,768	0.063	4086	0.023	3	35.3
Fayoum	85,177,611	0.032	10,035	0.023	0.25	8.1
Gharbeia	122,452,407	0.065	15,622	0.023	3	38.3
Kafr El-Sheik	3,297,348	0.048	2953	0.023	3	12.7
Menia	7,402,670	0.041	3791	0.023	3	0.0
Qena	47,406,475	0.056	6998	0.023	3	31.9
Cairo	1458,103,931	0.049	145,958	0.023	0.083	6.3

Capacity building in leakage control

The Italian partners have worked with Egyptian engineers from the Holding Company and subsidiaries to identify the main factors affecting leakage, how to appraise the operational performance of their assets, and the methods and technologies which can be used to reduce and maintain leakage levels. The capacity building has been carried out through classroom sessions and on-the-job training in three pilot projects conducted with the water utilities of Cairo, Alexandria and Gharbeia.

Theoretical training about leakage control and evaluation of the sub-sidiaries' operational performance

A training workshop on leakage control was organised at Alexandria Water Company in May 2007 and attended by representatives of the HCWW subsidiaries participating in the project. The workshop introduced Egyptian engineers to the methodology promoted by the International Water

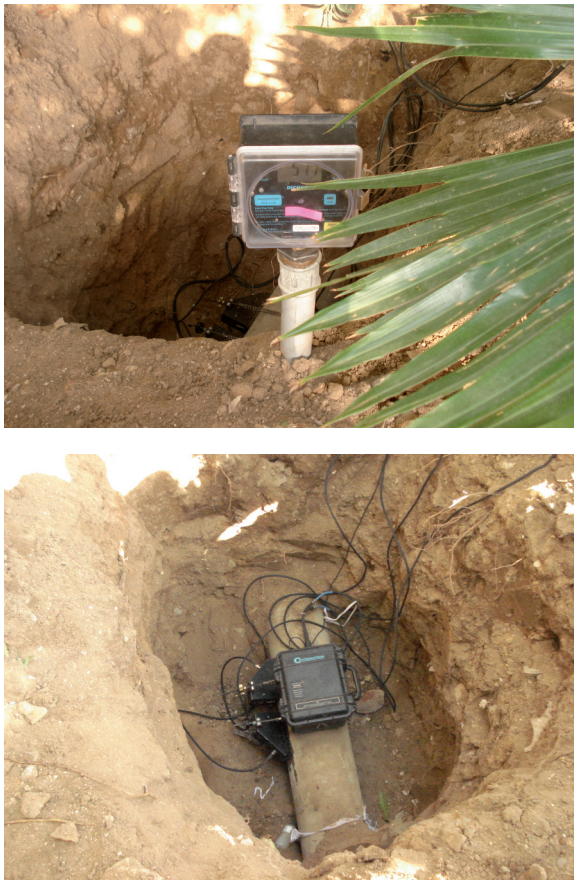

Figure 2
Installation of pressure gauge (upper) and flow meter (lower) in provisional manholes. Credit: Claudio Serrani

Association (IWA) to manage water losses in distribution networks. It trained them in the implementation of water balances (top-down approach) and district metering techniques (bottom-up approach) and in the use of technologies for mathematical modelling of water systems, network monitoring (flow and pressure meters) and leakage detection (noise loggers, correlators).

Following the training course, the engineers of the water subsidiaries completed a questionnaire aimed at evaluating their operational practices and performance in leakage management. The questionnaire covered the following aspects:

- Information about the utility: the property of assets and main features of the network (population served, network length, pipe materials and age, tariff, operational problems and costs);
- Network operation and management: description of problems in the system, data records, needs and requirements perceived by the operators;
- Network monitoring: provision of details about the instruments and practices for flow, pressure and leakage monitoring, water quality sampling;
- Leakage management: description of the leakage operations implemented by the utilities, number of staff involved in operations, training, information about repairs, tools used for leakage management;
- Assessment of economic costs and target levels of leakage: details about the procedure of the various utilities for setting leakage targets, costs and frequency of their leakage repairs capability to meet maximum demand, and demand management practices;
- Benchmarking and econometric tools, indicating the way operators measure their leakage performance;
- Network maintenance, including information about methods for replacing and renovating mains, and the driving factors for maintenance operations;
- Water balance, providing the average volumes of water put into supply by each utility and calculation of volumes for Non-Revenue Water (NRW) and water losses.

Information was gathered from the subsidiary utilities of Alexandria, Aswan, Bani Sewaif, Beheira, Cairo, Dakahleia, Damietta, Fayoum, Gharbeia, Kafr El-Sheikh, Menia, Qena and Sharkia. Based on the answers from the questionnaire exercise, the utilities were able to unify a great quantity of information into a unique database. This information created the useful tool of comparative assessment of utility performance vis-a-vis national benchmarks.

Evaluation of the resulting information highlighted the most critical problems: insufficient maintenance, a lack of skilled staff, and a lack of necessary technologies. Utilities are overstaffed and rely on manual methods. Many utilities lack the resources of modern water companies, such as digital mapping and databases (GIS), telemetry and SCADA (Supervisory Control and Data Acquisition) systems, hardware and software to allow information flows in the company and with customers. Additionally, there are financial problems related to low tariffs, weak billing and revenue collection systems, inadequate accounting systems to calculate unit operating costs, and inability to recover costs.

IBISS has helped to identify the most critical operational areas and select the three subsidiaries where the pilot leakage control projects have been demonstrated. The criteria for selecting the pilot utilities considered the following factors:

- The potential for replicating the methodology in other parts of the utility and other utilities within the country and in the MENA region;
- The impact of leakage control in socio-economic, technical and environmental terms;
- The capacity of the utility to assimlate the approach proposed by the project;
- The visibility of the pilot project.

The data provided by the utilities was elaborated using DMS (data management system), a tool developed under the EC funded research project 'TILDE' coordinated by the consultant SGI that prioritises areas according to the need for leakage interventions. DMS takes into account the current level of leakage in the areas, the costs for producing water and detecting and repairing leakages, and the time passed since the last survey. The ranking of the utilities is shown in Table 1.

The selected water companies for implementing the pilot demonstrations were the utilities of Cairo, Alexandria and Gharbeia. As indicated in Table 1, Gharbeia had the highest priority factor (38.3), followed by Alexandria (28.5). The priority factor was lower for Cairo (6.3), however the visibility of a pilot project in the capital city and the higher technological status of this utility were considered important factors that will favour replication on a national scale.

The leakage control pilot projects in Cairo, Alexandria and Gharbeia

The principles taught in the workshop of Alexandria were put in practice in the pilot projects carried out by the subsidiaries of Cairo, Alexandria and Gharbeia.

The first pilot project was carried out in December 2007 by Cairo Water Company (CWC) with the support of the Italian multi-utility SPS. The selected pilot area was the 'Ramses 2' area, in the north-west of Cairo's Nasr City quarter. The Ramses 2 area has an estimated population of 16,000 people, mainly living in six-storey buildings. The distribution mains are approximately 15 km long and constructed in asbestos cement (AC) in the early 1990s. Responsible for the short service life of the network, the AC pipelines present substantial loss ratios due to defects in connectors and joints.

The pilot activities started with the hydraulic isolation of the Ramses 2 area from the rest of the network through the closure of the boundary valves with the exception of the two main pipes that fed the system. Two flow monitors were placed in these feeding mains to measure the flows into the pilot area. Five pressure loggers were also installed in the network in order to record pressure changes during the pilot project execution. The photos in Figure 2 show some locations where monitors were installed in the network.

35 noise loggers were installed on pipe fittings, valves, service connections and hydrants to detect the presence of leakages. Noise was recorded by the loggers at five-second intervals over a period of two hours during the night (from 02:00 to 04:00), when background noise was lower. After two days the loggers were checked and noise data was collected and analysed. 11 out of the 35 loggers indicated the possible presence of leaks. A correlation campaign was carried out the next day along the pipe sections with the possible presence of leaks. The correlator did not confirm any of the leakages, which proved the loggers had signalled noise caused by customer consumption or by leakage after the domestic meter. A sounding monitoring campaign utilizing ground microphones was carried out from 6-11 December 2007, from midnight to 4.00 a.m., to avoid the noise generated by traffic and other activities. The CWC leakage detection team found 11 leaks. The major leak was caused by the roots of a tree that had broken a 100 mm diameter pipe of asbestos cement.

The leakages were repaired (see Figure 3) and the recovered water was calculated by subtracting the flows feeding the pilot area before and after the repairs. The volume of water saved was equal to 37 litres per second (or 3200 m^3 per day) which meant that 35% of the water fed into the pilot area was saved. This can be seen in Figure 4, which shows the flows feeding the pilot area and the cumulative volumes in the ante-post situations.

Along with field activities, the consultants built a mathematical model of the pilot network in order to teach CWC about modelling tools. The model was constructed using MIKE Urban software code, developed by the Danish Hydraulic Institute and included data describing the network (elevations, pipe diameters and roughness, metered consumptions, etc.). The model was calibrated using measured data, to ensure that the computed flows and pressures corresponded to the actual ones. Calibration was carried out in the peak flow and minimum flow conditions and then in the dynamic one hour interval mode over 24 hours. A good calibration of flows, pressures and daily volumes was obtained. Figure 5 shows the calibration of cumulative flows at the two flow monitoring sites.

The Alexandria pilot project was carried out in February 2008 by the staff of Alexandria Water Company (AWCO). The water company is addressing the development of GIS and SCADA to modernise the management of the network. Leakage continues at a high rate and is not yet dealt with on a systematic, programmatic basis. The pilot has helped to build the staff capacity in this area.

The selected pilot site, 'Faysal', is located in the north-east part of Alexandria. The area covers 20 hectares and has an estimated population of 20,000 people, mainly living in ten-floor blocks of flats. The pilot distribution network is over five kilometres long and is fed by one DN 200 mm pipe coming from the nearby area. The main material of the distribution pipes is asbestos cement with an average age of 18 years. The pilot site is a residential area with tourist and seasonal occupation, characterized by a low pressure, especially in the top floors of high buildings. Domestic flow meters are found at the entrance of every block, but many of them do not work.

The same methodology as in the Cairo pilot was applied, with the installation of flow meters in the feeding main, and pressure transducers and noise loggers in the network. The leakage detection was initially conducted by noise loggers and correlator, but the low pressures in the network, and the lack of manholes or fittings to place the equipment at appropriate distances, prevented effective leak location. A sounding campaign identified the location of three leakages that led to an estimated water recovery of 500 m^3/day.

The third pilot project was carried out in April 2008 in the Shawqi Area of the city of Tanta, managed by the water company of Gharbeia. The area covers 7.5 ha and has an estimated population of 7500 people, living mainly in four-storey buildings. Domestic flow meters are present at the entrance of every block, but many of them are out of order. The pilot network is fed by one DN 200 mm pipe coming from the near area. The main material of the distribution pipes is asbestos cement with an average age of 20 years. The pilot area is a residential area, characterized by low pressures.

Following the hydraulic isolation of the pilot area and the installation of monitoring equipment, the location of leakages was carried out firstly using noise loggers and correlators, and then with a sounding campaign. The survey identified one leakage that, after being repaired, produced a saving of 14 m^3/day. Mathematical models of the pilot networks in Alexandria and Tanta were carried out and calibrated using measured data.

The three implementation projects featured above show the achievements made and the difficulties faced in using the new technologies in Egyptian networks. The impossibility of installing equipment at appropriate distances, the low operating pressures and the pipes being made of asbestos cement hindered leakage detection in the pilots of Alexandria and Gharbeia. Nevertheless, a major achievement made by IBISS is the capacity building of over 80 water professionals all across Egypt. This was the main goal of the project and will favour the dissemination of best practice after the completion of the project.

Figure 3
Repairs of major leaks in Nasr City pilot project. Credit: Claudio Serrani

Capacity building in rural sanitation

IBISS has delivered a Manual of Best Practice in rural sanitation that encompasses the experience gained in the past decade by major international organisations such as UNEP and UNICEF. This document looks at the adoption of Environmentally Sound Technologies (ESTs) that were first introduced by the Agenda 21 established at the United Nations Earth Summit of 1992. Therein, it is stated that 'ESTs protect the environment, are less polluting, use all resources in a more sustainable manner, recycle more of their wastes and products, and handle residual wastes. ESTs are not just individual technologies, but total systems which include know-how, procedures,

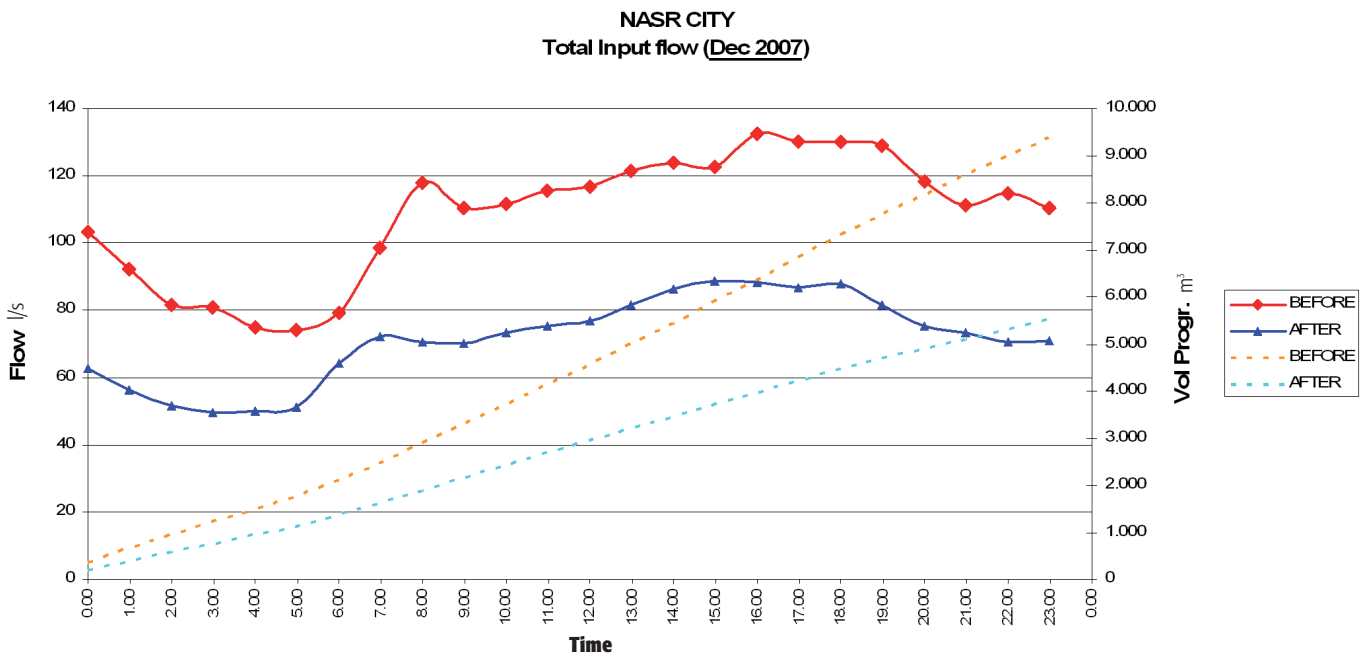

Figure 4
Inlet flow (full line) and cumulative volume (dotted line) before and after repair

goods and services, and equipment as well as organizational and managerial procedures.'

The Manual of Best Practice for Rural Sanitation provides an overview of ESTs for the collection, treatment and disposal of wastewater and storm water that can be applied in Egyptian villages and replicated in similar places in the Middle East and North African region. The solutions deployed consider local conditions, acceptability and affordability by population, simplicity of construction and operation, and effectiveness in energy use and waste generation. The sanitation solutions in the manual include on-site treatment and disposal technologies, unconventional wastewater collection technologies and off-site wastewater and sludge treatment facilities.

The on-site technologies allow wastewater treatment and disposal at the same place where it is produced. This option focuses on separating the various types of waste (faeces, urine and graywater) thus consenting reuse of waste as fertilizer and optimising treatment of graywater. On-site treatments examined were: external and in-house composting toilets for faecal sludge stabilization and eventual treatment and storage of urine for direct reuse of the stabilized solid and liquid matter as fertilizers; biogas technologies for energy recovery; septic tanks for separation of solids from the liquid stream, and Imhoff tanks for sludge settling and stabilization through digestion. The simplest on-site disposal method is seepage pits, in which the liquid part of wastewater is left percolating into the soil through a hole (the pit). A similar system is the seepage trench, where a trench filled with gravel is built underground. A more developed on-site technology for wastewater disposal/treatment for isolated houses is that of sub-irrigation, which can be improved in cases of high water depths with the implementation of raised beds, also called 'Wisconsin Mound' technology.

The wastewater collection technologies covered in the manual look at the potential savings that can be achieved through modification in the design and operation of conventional sewer systems. The optimisation of costs examined factors such as reducing the diameter, length and depth of pipes, the number and depth of manholes and the average slope relative to ground topography. Two options are examined in the manual. The first is simplified sewerage or shallow sewerage, in which splitting the network into two or more separate smaller systems is considered; sewers are located away from traffic loads, generally under the sidewalks rather than down the centre of the street, and extend only to the last upstream connection rather than to the end of the block. The second solution concerns settled sewer systems that are designed to receive only the liquid portion of household wastewater for off-site treatment and disposal. Grit, grease and other troublesome solids which might cause obstruction in the sewers are separated from the waste flow in interceptor tanks installed upstream of every connection to the sewers; the accumulated solids are removed periodically for safe disposal.

Off-site extensive wastewater treatment technologies comprise stabilization ponds and constructed wetlands that represent a valid alternative to conventional treatments for communities with 500-5000 population equivalent (PE) due to their low energy requirements and high environmental value. These systems require extensive land and are appropriate in warm climates. They have lower investment and management costs than conventional technologies due to the technical simplicity of the treatment process that involves the natural degradation of wastewater. Ponds and wetlands enhance the environmental value of the land and can be used for recreational and study purposes (observation of natural habitats, bird-watching, walks). The treated water can be reused for agricultural and aquaculture purposes as well as in the generation of biogas.

The last part of the manual looks at sludge management, which is an integral part of every sanitation plan to prevent indiscriminate dumping of faecal sludge into the environment and the unhygienic use of sludge in agriculture. Sludge treatments can be classified as primary treatments, which designate further stabilization of the faecal sludge and separation of solid and liquid phases; and secondary (or post-) treatments, which lead sludge and liquid to a complete stabilization.

After primary treatments the liquid part can be treated specifically, usually with wastewater treatment technologies. The solid part can be further treated to enhance its characteristics for agricultural/aquaculture reuse. There exists a number of technologies for implementing the primary and secondary treatments: among others, settling/thickening tanks; sedimentation ponds; and drying beds. In the case of constructed wetlands both the primary and secondary sludge treatments are conjunctively implemented.

Among the options described in the Manual of Best Practice the most appropriate technologies for the pilot village Gawad Hosney have been chosen and the overview of the proposed solution follows. The feasibility study for Gawad Hosney

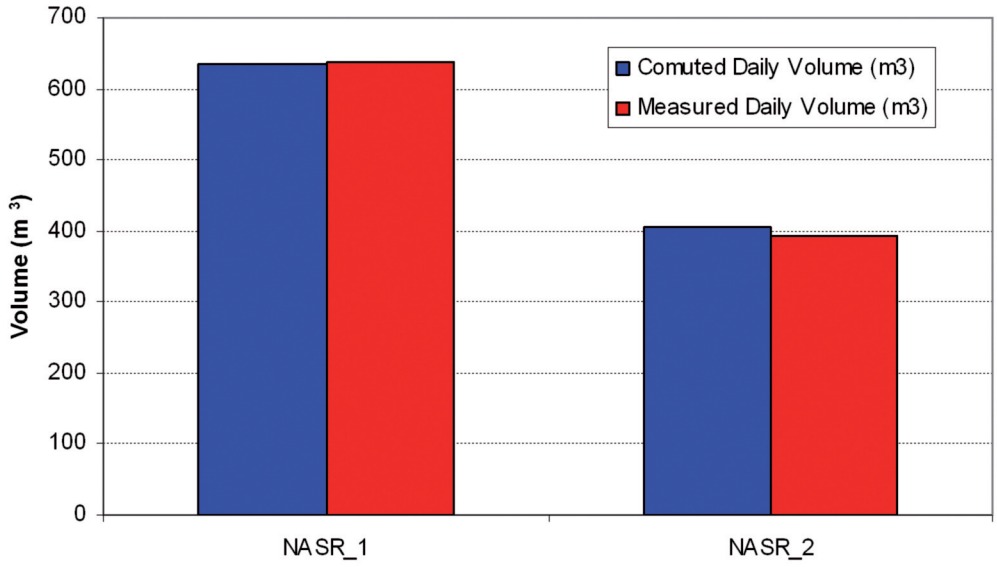

Figure 5
Cumulative daily volumes measured (red) and modelled (blue) at the two flow monitoring locations

intends to promote replication in similar villages all over Egypt and in the MENA region. To this purpose the manual and the description of the selected option for the pilot village have been produced as a CD-Rom and disseminated among relevant stakeholders.

Results

The main result achieved by IBISS has been the widespread dissemination of best practice in two major areas of the Egyptian water and wastewater sector; namely, leakage in distribution systems, and rural sanitation. Egypt cannot afford to waste or pollute its precious water resources, and to this end, the project beneficiary, HCWW, and its subsidiary companies have been highly receptive to the training provided with IBISS and intend to progress in these two areas after the end of the project.

Discussion about leakage control activities

Through the leakage control workshops held in Egypt and Italy as well as the three pilot projects conducted in Cairo, Alexandria and Gharbeia, more than 80 Egyptian engineers and technicians have learned about international best practice and technologies to measure and detect leakages in distribution networks.

The training courses and interviews with the technical staff of the participating subsidiaries have indicated that the scale of operations and technological status of utilities cover a broad range. They vary in size, with Cairo Water Company the largest and serving over 16 million people, and Damietta Water Company the smallest, supplying over one million people. In general, the companies are facing similar problems, related to old networks that suffer from pressure problems, bursts and high leakage rates. Balance tanks are generally not functioning at their full capacity due to insufficient supply pipelines or because of low pressures in the network. Preventive maintenance does not exist in general; repair and maintenance is carried out only when breakage is discovered. The maps and records of the distribution system are inaccurate and sometimes do not exist.

Apart from infrastructural needs such as new water treatment plants and wastewater facilities, operators perceive the urgent need to modernise their operations with the use of innovative technologies. Network monitoring, GIS mathematical modelling and leakage management are key priority areas to improve operational performance and quality of services.

Data provided by utilities was not always accurate or comprehensive. In general many utilities lack accurate measurements in the network and at consumers' meters. This hinders the calculation of the water balance, which is an initial step in determining the volume of NRW and leakage. The calculated NRW volumes using the water balance method ranged between 22% and 36% of the water put into supply. These volumes appeared too low and the Italian consultant conducted the minimum night flow analysis method to verify the levels of leakage where measurements for small areas were available.

The field activities for leakage control were demonstrated to the companies of Cairo, Alexandria and Gharbeia that were selected according to the methodology explained earlier (see Table 2). The number of leakages identified and the volume of water recovered varied in the three companies: it was quite significant in the Cairo pilot project, where 35% of the water fed into the pilot area was recovered (3200 m^3/day), but less important in the other pilot areas, where the low pressures in the network, the pipe material (asbestos cement) and the lack of manholes for properly installing equipment hindered the location of leaks. Water saving was 500 m^3/day and 14 m^3/day in the pilot sites of Alexandria and Gharbeia respectively.

The pilot projects have identified the major complications in using advanced technology for leakage control in Egypt. Consideration of these issues is essential for developing the future strategies of leakage control in the various cities across the country. They can be summarised as follows:

- GIS is not always available in electronic format and when it is, it is often not updated.
- The location of the gate valves is not delineated on the GIS network, and in most cases maintenance staff find problems in isolating areas to be fixed. This is a main drawback for implementing the conventional district metering methodology.
- Most of the valves in the network are not installed in separate chambers; instead, they are installed directly on the network. Moreover, there are no periodic maintenance programmes for these valves, and malfunctioning valves are not replaced. In the majority of cases they are not tightly closed.
- There are no accurate and regular measurements of water produced from different treatment plants, water supplied to the main areas in the network and customer consumption. Therefore, it is very difficult to estimate the actual water consumption and unaccounted-for water.
- Modern leak detection equipment, such as the correlators and noise loggers, is not completely reliable because some areas have very old networks and the leakage has been occurring for a long time period, creating an area filled with water around the leakage point. As such, noise cannot be detected by any equipment relying on ultrasound waves. Instead, ground microphones should be used to detect such leakages. This type of leakage happens usually in the house connections, which requires huge human effort for leakage detection.

The lessons learned that could be useful in future deployment of noise loggers are summarised as follows:

- Noise loggers should be installed at the distances recommended by the logger producer taking into account the material types, and cleaning if necessary the chambers prior to the logger deployment.
- Noise loggers should not be installed on service connections and in the vicinity of partially opened valves that could generate a noise wrongly

Negative evaluation: very low=0 low=1 medium=2 high=3 Onsite treatment units	Construction cost	Operation cost	Solid effluent pollution	Liquid effluent pollution	Not-directly recycled effluent	Energy consumption	Place needed	Disturbance (odours, insects)	Sum
Composting Dry toilet	0	0	0	0	1	1	0	1	3
Composting Flush toilet	0	0	0	0	1	2	0	1	4
Composting Reed bed	0	0	0	2	0	2	1	3	8
Septic tank	1	1	3	3	3	2	1	0	14
Imhoff tank	2	2	2	2	3	2	2	0	15
Multi-chamber tank	2	2	1	1	3	2	2	0	13
Dry box	1	1	0	0	1	2	1	1	7
Sanitary Biolatrine Unit	3	1	1	1	3	0	2	0	11
Biofertiliser Plant	2	1	1	1	3	0	1	0	9
Biodigester Septic Tank	2	1	1	1	3	0	1	0	9

Table 2
Evaluation of onsite wastewater treatment technologies

identified as a leak by the logger.

- If the distance between two loggers is greater than the one indicated by the producer, it is essential to carry out a sounding check along the pipe that is not 'covered' by the loggers.
- Analysis of logger results should be performed on a comprehensive basis, with the evaluation of the significance of results obtained by the entire group of loggers. Based on the loggers' analysis, the correlation survey should be planned on the map to identify the chambers for installing the correlator. Cleaning of the inaccessible chambers should be done prior to the start of the correlation activity.

Discussion about rural sanitation activities

The feasibility study for the sanitation of the village of Gawad Hosney was carried out to provide a replicable model for other villages in Egypt. This village has a high population density (more than 160 persons per hectare) and a high water table, thus increasing concerns of groundwater pollution.

The selected configuration for sanitation in the pilot village comprises:

- Onsite treatment facilities reducing the amount of wastewater to be collected: this happens in dry or flush toilets and in dry boxes, through separation of faeces and possibly urine for composting and fertilizer production; in biogas tanks, through settling and anaerobic digestion of solids for methane production, or finally, in the least convenient way, in septic or Imhoff tanks. The evaluation process for selecting the on-site treatment facility is shown in Table 2.
- Sewer network made of small size sewage collection pipes, connected with each household or building and conveying the wastewater to the final off-site treatment facilities. The smaller size of primary and secondary pipes, and their lower slope and depth in comparison with conventional sewers, is possible thanks to the upstream separation of solids (faeces, grease) and possibly urine from the rest of wastewater, by means of the on-site treatment facilities.
- The off-site wastewater treatment facilities will consist of constructed wetlands that ensure the reduction of the pollution potential before the final discharge into the receiving water body. Such an extensive, decentralized wastewater treatment system has been selected to minimize the number of lift stations to be installed on the sewer network, thus helping to reduce costs for operation and management.

Table 2 indicates that, as concerns onsite treatments, composting technologies (such as external dry or flush toilets, and dry box for in-house toilets) are preferable, followed by biogas technologies. On the contrary, septic (mono and multi-chamber) and Imhoff tanks have the highest negative score, because they do not allow direct recycling of material/energy and produce a low-quality effluent which needs further treatments. Concerning energy consumption, the value of 0 has been assigned to biogas technologies (which actually produce energy), the value of 1 to technologies using little or no water (dry toilet) and the value of 2 to technologies which might lead to major water/energy consumption due to the changes in habits of users.

The development of long piping systems to convey the sewage to one centralized treatment facility would need the installation of several lift stations (approximately one every 500-700 m). This is primarily due to the territory topography, very flat, and to the fact that the water table level is very high and makes excavations deeper than 1.5-2 metres difficult and very expensive. Even the conformation of the villages, which stretches along a main road could make the decentralization alternative preferable with respect to the construction of a centralized treatment facility.

The decentralization of the treatment facilities is consistent with the adoption of constructed wetlands for the treatment of the collected sewage. Very few advantages in terms of investment can be obtained by aggregating smaller constructed wetland facilities, contrary to conventional facilities where the centralization usually has a strong scale effect both in terms of construction and operation/management costs.

The main costs associated with the construction of a new constructed wetland are due to the purchase of land, filling material (usually gravel) to be used as the substrate for plants roots, and earthworks for constructing the wetland. The extension of the wetland is proportional to the number of people to be served and therefore there is not a significant saving by aggregating different constructed wetlands into a single facility.

Conclusions

The IBISS project has reinforced the knowledge of Egyptian water professionals in leakage control and rural sanitation. Through the implementation of pilot demonstrations, workshops and a feasibility study, IBISS has given insight about the tools currently employed in Europe for enhancing the operation of water and sanitation assets and managing water resources in a sustainable way.

The staff of HCWW utilities have gained direct experience in the application of technologies and methods for quantifying, measuring and pinpointing leakages in distribution networks. This experience will be fruitful for improving the operations of networks, but also for developing future strategies to tackle unaccounted for water. Thanks to IBISS, utilities have increased awareness about this problem and the ways to solve it.

The same applies as regards EST to enhance sanitation in villages. A review of options promoted by recognised institutions such as UNICEF and UNEP has been gathered in a Manual of Best Practice, and an exemplary feasibility study for a typical village has been produced.

Whilst Egypt appears well placed for reaching the Millenium Development Goals with access figures for water supply and sanitation at 98% and 70% respectively in 2004 (report of the UN's Joint Monitoring Programme, 2006), many challenges still exist concerning the deficient situation in rural areas, the financial sustainability of the current strategy and water quality. Since 1994 the Government of Egypt has increased the capacity of water supply and wastewater collection and treatment systems which has contributed to a fast-growing public deficit (8.8% of gross domestic product in 2004/2005). Utilities are heavily subsidized by the Government and the sector suffers from a low tariff cycle that needs to change. The Ministry of Water Resources and Irrigation and the Ministry for Housing, Utilities and Urban Development are jointly collaborating with international financing institutions to develop the National Master Plan and Financing Strategy for the Water and Wastewater Sector in Egypt. This Plan will set out realistic targets for water supply and sanitation infrastructure rehabilitation and/or development accounting for the affordability of customers and public budget. The capacity building achieved with IBISS will be useful in the future implementation of strategies to preserve water resources in Egypt. ●

Developing asset management competencies in water utilities – fitting training approaches to need

Asset management has been well established in developed countries as a method of improving a utility's performance, but this has not been so widespread in developing countries. Jo Parker discusses training methods to encourage effective asset management in these utilities.

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Introduction

Asset management is a term which started to be recognised within asset-focused industries such as the water industry a decade or so ago. For utilities within developed countries the skills of asset management, which help balance the conflicting requirements of managing risk, costs and service and which optimise these over the life of an asset, are becoming well recognised, and many utilities have developed a more asset-focused approach to managing their activities. It is considered good engineering and management practice, with regulators in a number of countries including Australia, New Zealand and the UK requiring utilities to submit asset management plans at regular intervals. Generally it is seen as a requirement to get best value from assets and to meet stakeholder needs.

However, in developing countries such a focus is far less widely adopted and the term 'asset management' is met far less often. Is asset management just a western fad which has no place in the activities of the water utilities in developing countries? These utilities face huge problems with large numbers of the population still not served in spite of the Millennium Development Goals. Even where the population is served, the service may fall far short of what the population desire. In Delhi (India), Dhaka (Bangladesh), Karachi (Pakistan) and Kathmandu (Nepal) only 1% of connected people enjoy 24-hour service availability, and in many places there are huge disparities between high and low income areas as well as between rural and urban standards. Many water utilities struggle to work within their budgets, with wide spread reliance on government subsidies.

Infrastructure performance can have a very far reaching affect on a country, with impacts on the economy, environment, gross domestic product, productivity, manufacturing costs, business confidence, inward investment, disposable income, public safety, quality of life and an overall 'feel good factor'. If asset management is a way of getting best value from such important installations, why have developing countries been so slow to adopt asset management techniques?

In some cases utility staff face such an array of problems, they struggle to meet even the most immediate needs and work reactively without time to

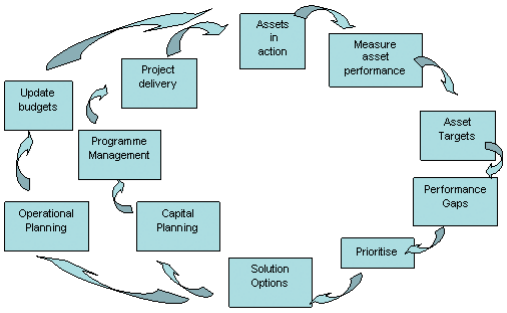
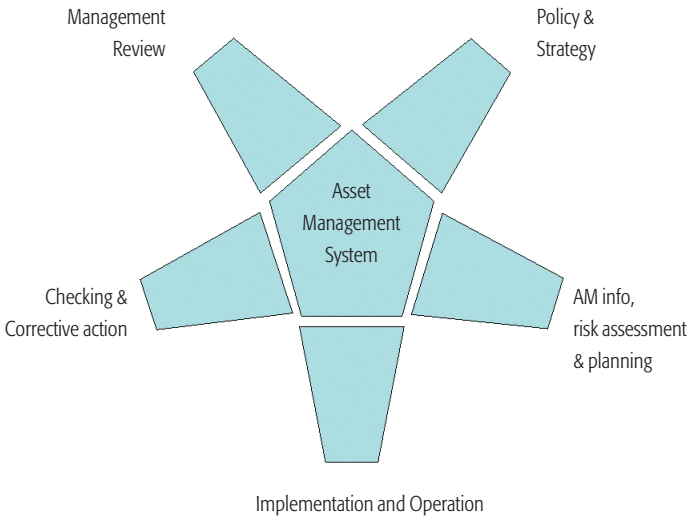


Figure 1 Asset management model developed by Sarras Asset Management

develop the planning and analysis which is part of asset management. In addition, some funding agencies in the past, whether local or international, have focused on the development of large new installations, as these can supply work for supplier organisations and kudos for funders and politicians. The day-to-day activities of managing maintenance and repairs and delivering an optimal asset life are far less glamorous, and in the past have been overlooked and undervalued.

Figure 2
Asset management model from PAS 55 (2004)

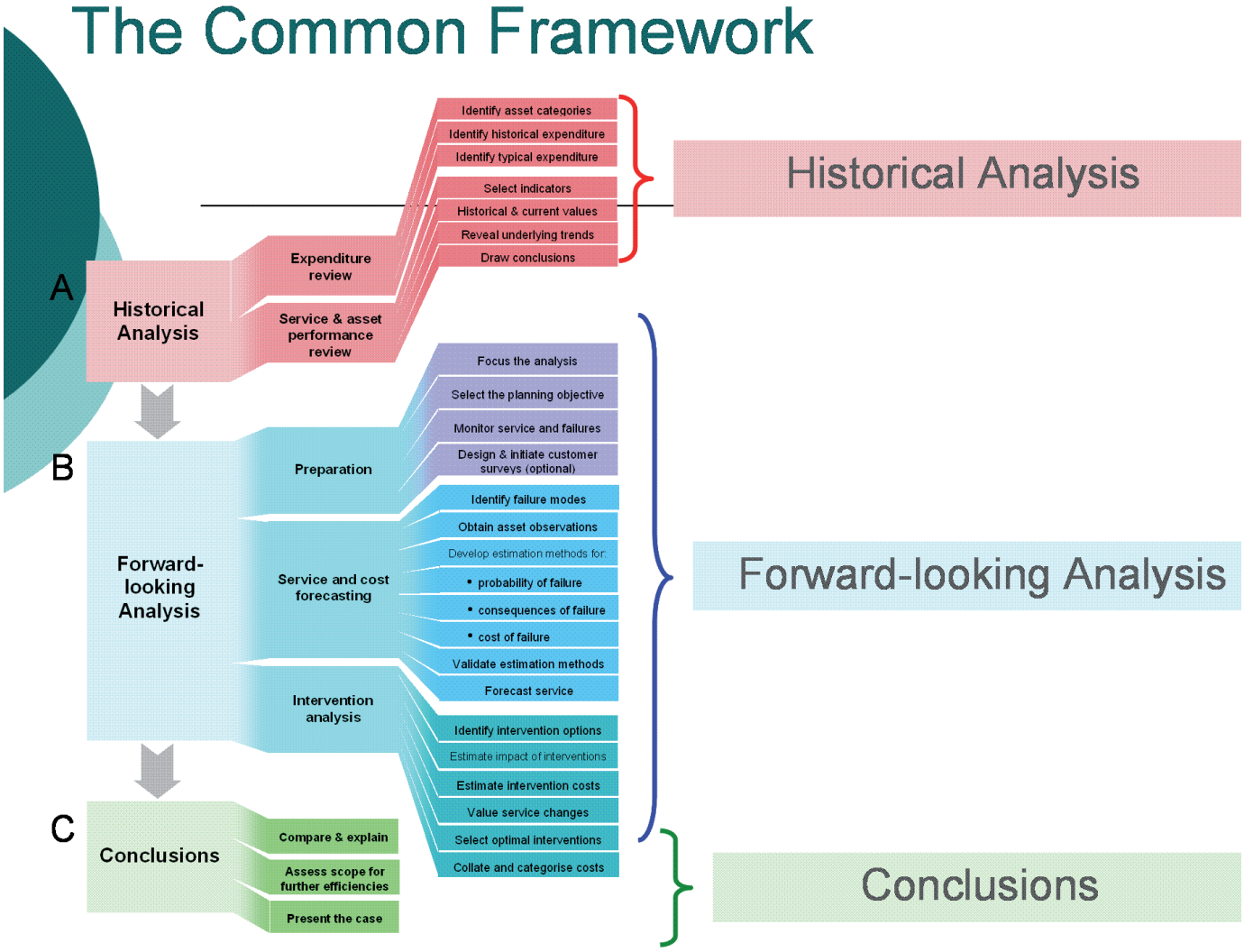


Developing a training package

The World Bank Institute (WBI) is responsible for a number of institutional strengthening programmes with water utilities throughout the world. In particular it introduced the concept of non-revenue water (NRW) management into a number of countries including Iran and Indonesia. However, it was clear that the NRW training only covered some of the issues which affected the water distribution system. In particular, there was a need in both these countries to understand how the location and repair of leaks in the water distribution system fitted in with the overall process of managing distribution assets. In particular some of the staff within the utilities would blame their levels of leakage on the fact that the pipes were 'too old' and needed renewing. However, the staff could not present any evidence of this and in fact the incidence of mains failures appeared relatively low.

An initial training course delivered in Indonesia introduced a number of key concepts of asset management such as whole life costing and maintenance and renovation of assets as an alternative to replacement. The

Figure 3
The UK asset maintenance Common Framework



feedback from the water utilities who attended the course was that they were keen to learn more about the concepts. At the same time plans were developed for a training course in asset management to be held in Iran.

The author of this article was therefore commissioned to review the training materials developed to date and to expand these into a two-day course for Iran. In addition, she would develop further training material for Indonesia.

Methodology

Although the concepts of asset management apply equally to a developing country, it was important to develop an approach which focused on the priorities for these countries. In addition, an overall structure was needed which would allow the focus to vary from country to country or even utility to utility. The author therefore decided to develop a model for the overall process with training modules, case studies and exercises for each process step. Also, a self assessment matrix would allow organisations to identify for themselves where their strengths and weaknesses lay.

The author considered a number of asset management models as the basis for the training process model, including a number used by consultants such as shown in Figure 1 (Deadman 2007, Sarras Asset Management 2007, Heather et al 2007), as well as the model used in PAS 55 (2004) shown in Figure 2, the model developed for use in the UK water industry (UKWIR 2002) shown in Figure 3, a model used in the original World Bank training shown in Figure 4, plus that used in the International Infrastructure Management Manual (Institute of Asset Management 2002) shown in Figure 5.

From these, and also using her own experience, the author developed a simple nine-step process, which would establish a structure for the course as well as explaining the overall concept of asset management. Sessions were developed expanding the concepts required within each step. This process is illustrated in Figure 6.

The topics covered within each step are detailed below:

Assets in action
- The skill of operating assets
- The importance of maintenance
- Asset information
- Maintaining an asset registers

Measuring performance
- Why so important?
- Typical measures

Asset targets
- Stakeholders and their needs
- How to set targets

Gap analysis
- How to monitor progress against targets
- Risk monitoring

Identifying options
- Opex solutions versus capex

Evaluating options
- Whole life analysis
- Costing and comparing projects

Preparing Asset Management Plans
- Putting a plan together
- Capital approval procedures

Delivering an Asset Management Plan
- Project management
- Post project appraisal

Enablers
- Personnel
- Systems
- Procedures and documentation
- Important factors to remember

A number of interactive exercises were designed to encourage delegates to explore the concepts in each session and to identify issues within their own organisations. For instance they were asked to list what performance measures were currently collected and to identify how these helped to improve efficiency. There was discussion between different organisations about the variations in performance measures.

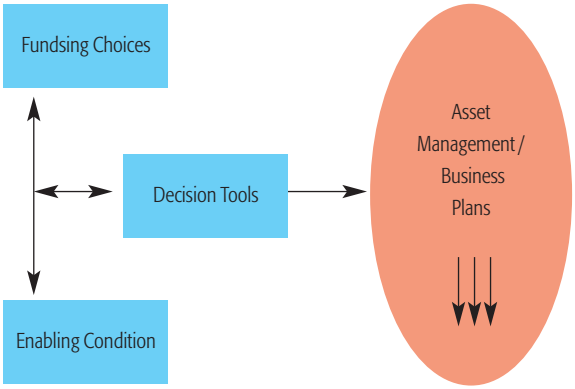


Figure 4
The model used in the original World Bank training module

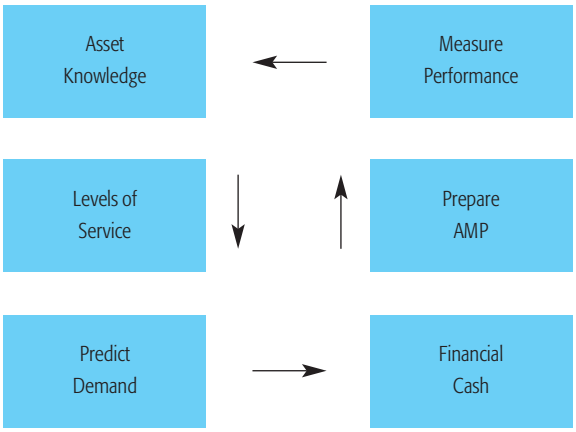


Figure 5
Asset management model from the International Infrastructure Management Manual

Delivering the modules

The training modules were first delivered in Iran as part of a week long training programme, which also covered business planning and risk management. The original brief had been to prepare for 40 delegates, but in the event over 200 attended the first day of the asset management module, which made participation difficult in the exercises.

The Iranian delegates included a number of representatives from the finance departments and initially they expressed surprise that the course covered technical subjects such as maintenance. Their principal concern was 'how should the life of an asset be calculated?' However, the author was able to develop examples to illustrate that design, maintenance and operational practices can all affect the life of an asset. In particular she used an example of two sewage pumping stations both with identical sets of pumps, but one had been poorly designed, poorly maintained and with poor trade effluent management such that the effluent was very aggressive to metals. The pumps in this station would clearly not last as long as the pumps in the other station and therefore even if a set asset life was used for accounting purposes, it would not be appropriate for asset management purposes.

The delegates were also keen to identify how to start developing asset management practices in their own water utilities so the author developed a number of simple assessment matrices which the delegates could use to assess their activities. In addition she developed a 'ten-step approach to developing asset management', which was issued to all delegates. This was based on some of the key requirements on the Publicly Available Specification 55 (2004) (BSI 2004) as well as feedback on issues from the delegates.

The ten-step approach:
- Form a multi-disciplinary team
- Review your asset register
- Collect up to date asset performance information
- Make your maintenance system deliver best value
- Document your operational systems
- Establish robust capital approval procedures
- Establish a strong relationship with your suppliers
- Ensure asset delivery minimises cost and risk
- Involve all your staff
- Be honest

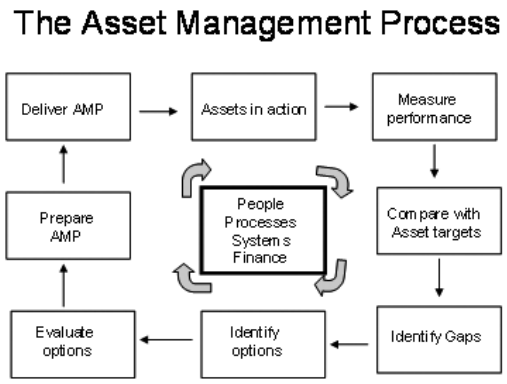


Figure 6
Asset management model used for the World Bank training course

The Indonesian training was based on the same presentation materials, but as previous trainers had found that there was scepticism about whether some new concepts were applicable to conditions in Indonesia, it was decided to develop case studies with a limited number of water utilities with the results of the case studies being presented by representatives from the water utilities.

The subjects for the case studies were initially identified through use of the simple assessment matrices developed earlier. These are sometimes referred to as 'maturity scales'. A number have been produced by different organisations to assess asset management and in fact one consultant had used their own in-house system to assess the some of the utilities involved in the WBI initiative. Members of the utilities who participated in the earlier assessment found this too complicated and did not understand what they were considering, thus a valuable opportunity was lost. The benchmarking outputs were not understood by the managers and they had a poor understanding of the process of asset management.

Some assessment indices were in the process of being developed by the IAM (Institute of Asset Management) (to be released this year). However, these were based on PAS 55 and the author felt that these would be too general. Therefore again the author developed her own system, producing a number of matrices against which utilities could grade their own activities and procedures (see Figure 7).

The matrices proved popular and participants in the training sessions had active discussions about what the appropriate level was for their organisation. These helped identify where the utilities had good practice which could be shown as an example, or where quick wins could be achieved through introducing new practices. The case studies were focused on distribution network management a nd included active leakage control using IWA Water loss Task Force methodology (Farley and Trow 2003), the development of a Geographic Information System (GIS) to deliver added value, and the use of mains failure records to identify which water main should be renovated or replaced based on the methodology developed by UKWIR (UKWIR 2003). Once again, interactive exercises were included as the initial visits showed the delegates were keen to participate from, but these could be more tailored to the circumstances encountered in the local utilities, as the author had been able to collect data for the exercise during her preliminary visits.

Conclusions

The water utilities who participated in the training in both Iran and Indonesia were keen to embrace the concept of asset management, although the level of sophistication in each country varied substantially. The concept can be introduced at different levels which are tailored to the systems and processes in use in the particular locality, but a basic process map, which was common to both situations, was helpful in providing a training framework. This was based on a variety of best practice documents.

Training was greatly facilitated by greater knowledge of the country. Where local water utility practices were understood these were used to develop exercises which were relevant to the group being trained. Pilot studies, again based on best practice documents, provided useful material for delivery by local utility representatives as case studies for the delegates.

Asset management is as relevant to developing countries and those which although developed, have lacked access to best practice, as it is to countries endeavouring to implement best practice. However, the existing material available in asset management literature is not always appropriate and asset management models, training materials and pilot studies should be tailored to the country in question wherever possible. The approach of some consultancies that 'one size fits all' runs the risk that approaches are not applicable or not understood and may not result in sustainable improvements in practice. ●

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Figure 7
A simple assessment matrix used for the training exercise

			Asset Management Performance			
Leader	Integrated information system supporting strategicasset management	Best value for money obtained by exceeding financial benchmarks	Establishing industry benchmarks	Proactive management	ASP anticiaptes infrastructure requirements	Capital investment anticipates demand
Competent	Continuous and complete asset information	Operational units managing asset costs and budgets	Processes are resopnsive to feedback on asset performance	Service strategies linked to key result areas	Asset centric strategic planning	Prioritising and developing investment strategies
Developing	Focus on quality, completeness accuracy & timeliness of info	Systems provide timely and accurate information on asset costs	Seeking feedback from service users	Development of service delivery strategy	Linkage betw een corporate planning and asset planning	Asset strategy for replacement or grow th linked to service
Aware	Asset register exists and is amintained	Recognition of need for system to record all costs	Limited asset performance data	Identified need to measure outputs	Undertaking strategic asset planning	Planned asset replacement or grow th not linked to service
Unaware	Asset register does not exist	No information on cost of assets	No history of asset performance	No service delivery strategy	No asset straegic planning process	No capital investment strategy
	Asset Information	Financial Management	Asset Performance	Demand management	Asset Strategic Planning (ASP)	Capital Investment

A programmatic perspective on asset management, from the national to the utility level – the case of Portugal

In the early 1990s, the Portuguese water sector was reorganised to improve the efficiency and quality of services. Jaime Melo Baptista and João Simão Pires discuss the changes implemented.

Jaime Melo Baptista, President of the Portuguese Institute for the Regulation of Water and Solid Waste Services (IRAR).

João Simão Pires, Director of the Portuguese Institute for the Regulation of Water and Solid Waste Services (IRAR).

Water services are amongst the most capital intensive activities, with a very high capital-to-revenue ratio and a typical ex-post irreversibility of investment in physical assets. Hence, it is imperative to maximize the long term performance-to-cost ratio of assets, ensuring an adequate balance between operational sustainability, good service quality and total service provision costs over the long run. Evolving stakeholder expectations, namely increasing consumer awareness and involvement, and more challenging legal requirements on service quality and effectiveness, all reinforce the need for the adoption of more advanced management practices by water utilities.

In Portugal, the changes in the sector over the past 15 years created not only the need, but also the necessary conditions for the increasing adoption of better asset management approaches by utilities. This article intends to describe how institutional reorganisation and the introduction of regulation have been paving the way for the gradual upgrading of asset management skills and practices in the Portuguese water services industry.

Changing structure of the sector

Globally, the Portuguese situation in the sector before 1993 was inappropriate and there was no clear strategy for its resolution: access to public water supply services was available to only 80% of the population; only 50% of tap water volumes were both monitored and exhibited quality levels in compliance with legal standards; and only 30% of the population had access to public wastewater services with treatment.

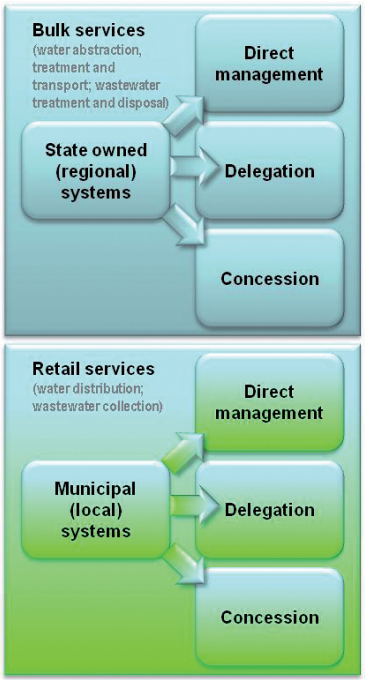

Figure 1 Management models

At that stage, a political commitment was undertaken to reorganise the sector. Although this reorganisation is not yet fully concluded, over these past 15 years (1993–2008), significant improvements have been achieved: access to public water supply services is now available to 91% of the population; 98% of tap water volumes are monitored and comply with legal

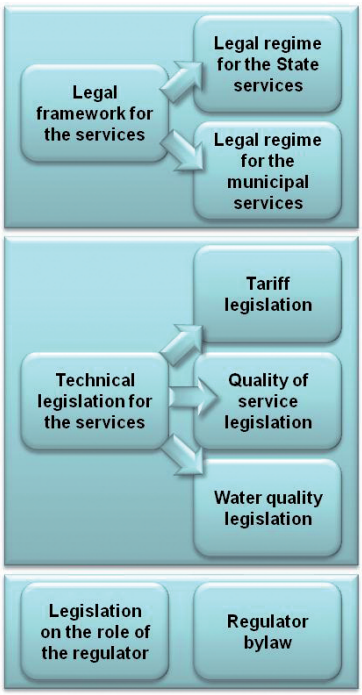

Figure 2 Legal framework

national and European standards; and 76% of the population has now access to complete public wastewater services.

The main underlying drivers for this change have been the following:

- a new strategy for the sector was discussed, specified, adopted and has been periodically monitored, re-examined and updated;
- a territorial reorganisation of utilities at the bulk level (water abstraction and treatment and wastewater treatment and disposal) is almost concluded and is currently being extended to the retail level (water distribution and wastewater collection);
- new models of utility governance were introduced and have been implemented with successful results;
- a new legal framework was introduced at the outset and a second-generation of draft-legislation is now ready to undergo the political process;
- the implementation of the full cost recovery principle was promoted;
- the regular assessment of the levels of service provided to the consumers and the benchmark among the utilities was promoted;
- explicit regulation, covering quality of service and price setting, was introduced on the activities of utilities that operate under a concession contract and will be extended to all utilities in the near future.

National strategic plan

Let us go into greater detail on each of these driving forces.

In building a strategy for the sector, a clear and regularly updated national roadmap was set in order to provide access to continuous services to the remaining un-served population, promote a higher quality of service, namely in terms of water quality, guarantee affordable prices and promote environmental sustainability. For that purpose, a national strategic plan for water supply and wastewater management was approved, with the secondary objective of creating opportunities for the development of a modern and competitive water cluster, encompassing world-class operators, engineering firms, local enterprise, research and knowledge centres, etc.

The objective of the process of utility restructuring was to have a more rational, optimised and cost-effective territorial organisation for the sector with fewer but larger utilities. The main feature has been the promotion of scale economies with the geographic integration of utilities, moving from local to regional level, with central government sponsoring new bulk systems created at the regional level and the existing municipal systems tending to be slowly aggregated. Another important feature was the promotion of scope economies by integrating water supply and wastewater utilities. Potential economies from greater vertical integration, by merging bulk and retail activities, have been sacrificed to allow central government intervention, but a vertical (re)integration process is expected in the future, namely via public-public partnerships.

Changes implemented

The introduction of new models of utility governance allowed the transition from a situation in which

Protection of the user interests	**User service accessibility** AA 01 - Service coverage (%) AA 02 - Average water charges (€/m³) **Quality of service supplied to users** AA 03 - Service interruptions (nr./delivery point or/1000 serviced connection) AA 04 - Water tests performed (%) AA 05 - Quality of supplied water (%) AA 06 - Response to written complaints (%)
Sustainability of the operator	**Operator's ecenomical and financial sustainability** AA 07 - Operating cost coverage ratio AA 08 - Unit running costs (€/m³) AA 09 - Debt equity ration AA 10 - Non-revenue water (%) **Operator's infrastructural sustainability** AA 11 - Fulfillmant of the water intake licensing (%) AA 12 - Treatment of utilisation (%) AA 13 - Transmission and distribution storage capacity (days) AA 14 - Mains rehabilitation (%) AA 15 - Service connection rehabilitation (%) **Operator's opertional sustainability** AA 16 - Mains failures (nr./100km) **Operator's human resources sustainability** AA 17 - Personnel (nr./1000 service connection or/m³)
Environmental sustainability	AA 18 - Inefficiency of use of water resources (%) AA 19 - Standardised energy consumption (kWh/m³/100m) AA 20 - Disposal of sludge from the water treatment (%)

Protection of the user interests	**User service accessibility** AR 01 - Service coverage (%) AR 02 - Average water charges (€/10³) **Quality of service supplied to users** AR 03 - Flooding occurences (nr./100km of sewers or m²/100 km of sewers) AR 04 - Response to written complaints (%)
Sustainability of the operator	**Operator's ecenomical and financial sustainability** AR 05 - Operating cost coverage ratio AR 06 - Unit running costs (€/10³) AR 07 - Debt equity ratio **Operator's infrastructural sustainability** AR 08 - Treatment of utilisation (%) AR 09 - Treatment of collected wastewater (%) AR 10 - Wastewater pumping capacity (%) AR 11 - Sewer rehabilitation (%) AR 12 - Service connection rehabilitation (%) **Operator's opertional sustainability** AR 13 - Sewer blockages (nr./100km of sewers) AR 14 - Pump failures (hours/pump) AR 15 - Sewer collapses (nr./100km of sewers) **Operator's human resources sustainability** AR 16 - Personnel (nr./100 km of sewers)
Environmental sustainability	AR 17 -Wastewater tests performed (%) AR 18 - Fulfillment of the wastewater discharge performed (%) AR 19 - Energy resource efficiency use (kWh/m³/m) AR 20 - Sludge disposal (%)

Figures 3a and 3b Performance indicators

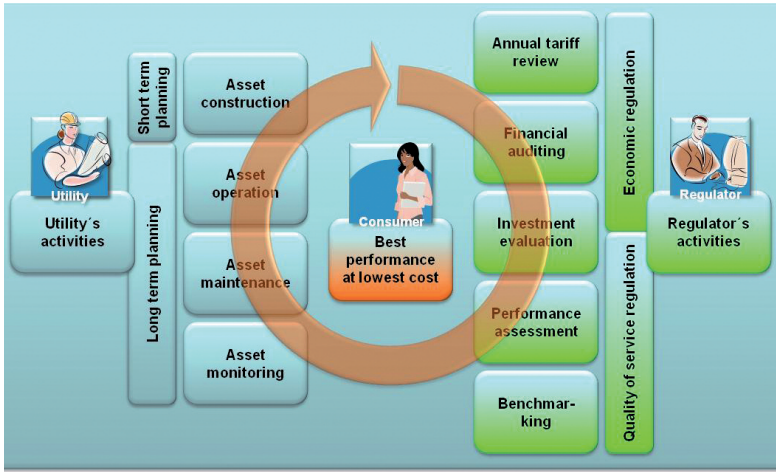

Figure 4
Regulation for adequate strategic asset management

these services were directly and exclusively provided by municipalities, to a situation in which this responsibility can be shared between central and local government or transferred to the private sector via the promotion of competition for public-private-partnership contracts. In order to achieve this, institutional and legal constraints required the organisational separation of bulk activities (water abstraction and treatment and wastewater treatment and disposal) from retail activities (water distribution and wastewater collection). The central government became largely responsible for most of the bulk services provided on a regional scale via state-owned enterprises, while municipalities remained responsible for local retail services. This compromise sought to balance the achievement of greater economies of scale with the respect for the degree of decision making autonomy that municipalities have on the provision of these services. At present, both central government and municipalities can decide between three different management models: direct management, delegation or concession (Figure 1).

These reforms have been supported by legislation largely issued in the second half of the 1990s. Notwithstanding the significant achievements to date, a second-generation of legislation is being finalised with the goal of further supporting the reorganisation and clarification of the general rules of the sector. This comprises: an improved legal framework for the organisation of water services, including legislation on central government sponsored services and legislation on the services provided under municipal responsibility; new technical legislation for water services governing aspects such as tariff setting, quality of service requirements, water quality, and an upgraded legal framework governing the role of the regulator, including a revised regulator bylaw (Figure 2).

In promoting the full cost recovery principle, the objective has been not only to guarantee the needed investment resources at this stage of strong infrastructural development, but also to promote the financial sustainability of service provision over the medium and long term. In this respect, the main issues have been the optimisation of the use of available investment funds (national and European), the promotion of regional solidarity (urban versus rural regions) in achieving affordable tariffs, the promotion of a greater degree of cost recovery where necessary and the design of specific instruments targeted at the households to whom the affordability of these services is likely to be an issue (which represent approximately 7% of the population).

The promotion of quality of service led the regulator to assess on a regular basis the level of service provided to the consumers, to benchmark the utilities among themselves on each performance indicator, to guarantee public visibility via an annual report and to develop and participate in international benchmarking initiatives. A set of twenty performance indicators are used to assess each service provided by each regulated utility (water and wastewater) covering aspects related with the interface with the consumers, utility sustainability and environmental sustainability (Figures 3a and 3b).

Given that we are in the presence of monopolistic market structures, the key objective behind the introduction of explicit regulation was to prevent the dominance of utility over consumer interests and to promote utility efficiency, thus minimizing the risks of lower quality of service and/or higher prices. Although the overarching goals have been protecting consumer's interests, namely regarding tariffs and service quality, other factors are taken into account such as: safeguarding the financial sustainability of service provision; promoting the development of a competitive water service cluster; guaranteeing sustainable management of natural resources; and promoting environmental quality. The main regulatory tools include the structural regulation of the sector and the regulation of operator behaviour, with pedagogy prevailing over a strictly punitive approach. Structural regulation of the sector is based on monitoring the success of the implementation of the national strategy for the sector and proposing and better legislation. Regulation of operator behaviour seeks to steer utilities throughout their life cycle towards adequate levels of performance in terms of water quality, quality of service (customer service, operational efficiency and environmental footprint), price-setting practices and financial sustainability.

In the context of this reorganisation of the sector, the current situation is that, while utilities are still undertaking major investments in infrastructure, especially on improved wastewater services, the operation, maintenance and monitoring of a large number of complex systems is increasingly becoming the focus of greater attention. The driving forces described above provide a sound platform for the development and adoption of more advanced and robust asset management practices by operators, as this will become increasingly crucial to their ability to better carry out their demanding public mission.

Regarding the current state of deployment of modern asset management practices, several initiatives are being carried out in Portugal but few can be considered a part of integrated strategic asset management systems.

Regulation can play a role in promoting the adoption of adequate strategic asset management practices by utilities. The regulator can incentivise utilities into systematically collecting and reporting information about their assets. It can set out reference values for selected key performance indicators in order to highlight where there are opportunities to optimise asset management. Additionally, it can place continuous pressure on utilities to undertake specific initiatives, where, from an overall welfare perspective, benefits from their implementation clearly exceed the costs (Figure 4).

Notwithstanding, the regulator must understand that the diversity in terms of each utility's characteristics and specific circumstances are a major challenge to the generalisation of asset management practices in Portugal. A long but promising way is still ahead of us. ●

Paving the way for a sustainable asset management of urban water infrastructures: outcomes of the 5th World Water Forum

The Portuguese Pavilion at the World Water Forum dedicated the 17 March 2009 to water science and research. Because asset management of urban water infrastructures is a key research and development topic worldwide, and Portugal is not an exception, LNEC, the Portuguese national laboratory of civil engineering, and the Strategic Asset Management (SAM) Specialist Group of IWA jointly organised a panel discussion aiming at identifying research challenges and opportunities for a sustainable asset management of urban water infrastructures. The objective was to get a multi-stakeholder perspective. Contributors included the IWA President, the IWA SAM SG Chair, a senior officer of the European Investment Bank, utility CEOs, consultants, academics, researchers, and representatives of national professional associations, in order to try and identify the best paths to move forward.

Portugal has a word to say in terms of asset management because the water sector has had a remarkable evolution in the past 15 years in terms of quality of the services provided, institutional and organisational framework, investments made in new infrastructures, regulatory environment, management skills and scientific developments. The organisation in Lisbon of LESAM 2007, the IWA Leading-Edge SAM Conference, and the on-going national project AWARE-P (advanced water asset rehabilitation in Portugal (www.aware-p.org)) are two examples of remarkable initiatives for paving the way for a sustainable management of urban water infrastructures. There is a need for joint initiatives, particularly in Europe, that create synergies, and allow for sharing and complementing competences and experiences. Research and development (R&D) has to be based on the joint work and cooperation between the key types of stakeholders, such as utilities, regulators, researchers, users, authorities and financial agencies. This is fundamental to create stakeholder awareness, change the existing culture of taking the water services for granted, implement adequate financial mechanisms, create know-how and develop effective decision support tools.

Speakers were encouraged to identify the main SAM drivers, R&D gaps and priorities, and products needed. Discussion was rich and the contributions complemented each other, whilst demonstrating common views on the key aspects. Outcomes of the meeting are summarised in the table below.

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SAM drivers:

- Promote adequate levels of service and strengthen services reliability.
- Improve the sustainable use of water and energy while minimizing the carbon footprint.
- Plan and promote climate change adaptations in a phased way.
- Manage risk of service failure, taking into account users' needs and risk acceptability.
- Give preference to rehabilitation of existing assets instead of building new, when feasible.
- Promote investment and operational efficiency gains of water utilities.
- Make a clear and straight forward justification of investment priorities.

R&D gaps

- Innovative technologies for asset condition assessment (e.g., online monitoring) and better understanding of the relationship between asset condition and level of service.
- Information management improvements and understanding organizational constraints.
- Better understanding and incorporation in the SAM process of the stakeholders' needs and expectations.
- Managing interactions between urban infrastructures (drinking water and wastewater, urban water and other).
- Better understanding and improved control of asset deterioration processes.
- Economic assessment of indirect and external costs and benefits.
- Reliable, long lasting and low cost rehabilitation materials.
- Quantifying uncertainty in the different models.
- Water security innovation.

R&D priorities and products needed

- AM regional directives, international standards and guidelines (e.g. AM policy, AM methodologies and procedures, protocols for data collection and information management).
- Guidelines and communication materials to promote the change of culture of the organizations with a continuing effort to implement SAM.
- Comprehensive, user-friendly and flexible SAM computer-based systems that promote a step by step SAM implementation.
- Common framework and plug and play software systems, and models for SAM of small and medium size utilities and systems.
- Communication, training materials and guidelines expressly directed to the operational/field staff.
- Finance models.
- Reference methods for economic assessment.
- Enhanced construction and renewal materials and performance assessment of new materials.
- Standard risk management guidelines for urban water systems, including how to deal with risks associated to low probability hazards and catastrophic consequences.
- Effective international networks of SAM stakeholders, including service users.
- Processes for assessment of asset condition.
- New generation of information management systems for SAM that allow for integrating and incorporating different existing information systems.
- Best practice manuals and training materials (including for e-learning) addressed to the policy-makers, technical staff and operational staff and to utilities with different levels of complexity and development.
- Decision support tools to support water systems adaptation to climate change and efficient use of water and energy, assuring added flexibility and resilience.

Strategic Asset Management for Water and Wastewater Utilities

Invited papers from the IWA Leading Edge Conference on Strategic Asset Management (LESAM), Lisbon, October 2007
Editor: H Alegre

Water and Wastewater companies operating all around the world have faced rising asset management and replacement costs, often to levels that are financially unsustainable.

Management of investment needs, while meeting regulatory and other goals, has required: A better understanding of what customers demand from the services they pay for, and the extent to which they are willing to pay for improvements or be compensated for a reduction in performance; Development of models to predict asset failure and to identify and concentrate investment on critical assets; Improved management systems; Improved accounting for costs and benefits and their incorporation within an appropriate cost-benefit framework; Incorporation of risk management techniques; Utilisation of advanced maintenance techniques including new rehabilitation failure detection technologies; Enhancements in pipeline materials, technologies and laying techniques.

These papers developed from LESAM 2007 for inclusion in Strategic Asset Management are focused on the techniques, technologies and management approaches aiming at optimising the investment in infrastructure while achieving demanded customer service standards, and they provide an opportunity to gain access to the latest discussion and developments at the leading-edge in this field. This book will be essential reading for utility operators and managers, regulators and consultants.

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Private Sector Participation in Water Infrastructure

Author: Organisation for Economic Co-operation and Development (OECD)

Many countries have sought the involvement of the private sector to upgrade and develop their water and sanitation infrastructure and improve the efficiency of water systems. However, high capital intensity, large initial outlays, long pay-back periods, immobility of assets and low rates of return generate high risks. These factors, when combined with poor initial information and weak investment environment, limit the scale of private sector participation in water and sanitation infrastructure.

Recognising this, the OECD has developed practical guidance, building on the OECD Principles for Private Sector Participation in Infrastructure, to help governments and other stakeholders to assess and manage the implications of involving private actors in the financing, development and management of water and sanitation infrastructure. The resulting OECD Checklist for Public Action provides a coherent catalogue of policy directions for consideration by governments, including appropriate allocation of roles, risks and responsibilities, framework conditions and contractual arrangements necessary to make the best of private sector participation and harness more effectively the capacities of all stakeholders.

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Field Computing Applications and Wireless Technologies for Water Utilities

Water Research Foundation Report 91224 + CD-ROM
Authors: C Stern, K Mallakis, M Hernandez, B Iadarola, U Srinivasan and S Sakpal

Water utility field service employees, in many cases representing more than 50 percent of a utility's workforce, provide mission-critical frontline services such as asset maintenance and repair, emergency response, facility data collection, inspection, line locations, meter reading, record drawings, security, surveys, water quality sampling, and customer field services. Although the costs for field service employees account for a large and significant component of the industry's operating budget, relatively little has been accomplished in evaluating the ability of field computing applications and wireless technologies to measurably improve service and enhance operating efficiency.

The purpose of this project was to assess the current state and use of field computing technologies throughout the water industry, describe key work practices performed by mobile utility workforces and field service professionals, review existing and emerging field computing and wireless technologies, and quantify improvement opportunities and benefits.

The research approach included a literature review, an end-user survey, and case studies. Secondary research was conducted on current and emerging mobile technologies and on wireless data management systems/solutions. The researchers developed and implemented a discussion guide for the primary research interviews. Based on these discussions, the team developed and tested a web-based survey questionnaire. Five case studies, the core of this project, were developed to: illustrate existing field computing and wireless implementations; demonstrate associated operational and service improvements; identify areas where benefits could be gained from further use of field computing and wireless technologies; and conduct a Return on Investment (ROI) analysis on the field computing and Mobile Resource Management (MRM) related projects implemented by the utilities participating in the case study.

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AM DIARY

A listing of upcoming asset management-related events and conferences. Send event details to WAMI for inclusion.

IWA Water Loss Task Force – WaterLossUK Seminar, Workshop and Exhibition
9-10 June 2009, NEC, Birmingham, UK
Tel +44 191 3840993
Email: enquiries@waterlossuk.com
Web: www.waterlossuk.com

AWWA Annual Conference & Exposition (ACE09)
14-18 June 2009, San Diego, USA
Contact: Cilia Kohn/Tricia Loughead
Email: awwamktg@awwa.org
Web: www.awwa.org/ace09

Singapore International Water Week - Singapore
22-25 June 2009
Web: www.siww.com.sg

Asset Management of Medium and Small Wastewater Utilities
3-4 July 2009, Alexandroupolis, Greece
Contact: Konstantinos P. Tsagarakis
Tel: +30 28310 77433 or +306945706431
Email: iwa@econ.soc.uoc.gr
Web: http://iwasam.env.duth.gr

2nd International Conference on Water Economics, Statistics & Finance
3-5 July 2009, Alexandroupolis, Greece
Contact: Konstantinos P. Tsagarakis
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Email:iwa@econ.soc.uoc.gr
Web: www.soc.uoc.gr/iwa

5th IWA Specialist Conference on Efficient Use and Management of Urban Water Supply
19-21 October 2009, Sydney, Australia
Web: www.efficient2009.com

IWA World Water Congress
19-24 October 2010, Montreal, Canada
Web: www.iwa2010montreal.org