

## BESSE newsletter 4

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March 2012

## IN THE NEWS

### Rome Meeting

The BESSE project is now in its final months and the research results are being documented and finalised. The project has six work components, providing the raw material that will frame the final project outcome, being the formulation of policy guidelines. The policy guidelines document will include a position paper summarising the technical and methodological knowledge brokerage lessons learnt through BESSE.

The core of the lessons are drawn from three pilot studies undertaken in Castel St' Angelo, Pernik and Water Board Limburg. Two questions were pivotal throughout the research:

- What is meant by knowledge brokerage in the BESSE context? And
- What was the research aim of the BESSE project?

In BESSE, knowledge brokering is referred to as a mediation process helping to move knowledge and technology from one place to another in order to help individuals and organisations to learn and improve. It is a process whereby knowledge is transferred and shared between different contexts.

In BESSE, knowledge brokerage methods are meant to overcome hindering factors and to maximise the exploitation of knowledge relevant for sustainable development.

## Funding



# Newsletter 4

## Brokering Environmentally Sustainable Sanitation for Europe

### BESSE as a Knowledge Brokerage Project

#### How did the BESSE project broker sanitation knowledge?

The current sanitation technologies and management systems are largely based on approaches developed in the 19th and 20th centuries. Existing sustainability concerns, such as reduction of energy use and environmental impact (apart from effluent quality), were not considered

knowledge was synthesised to develop a number of knowledge brokerage mechanisms that was tested in pilot studies in real time in three contextually different European regions, namely Mediterranean Europe (Italy – Castel St Angelo); Northern Europe (Netherlands - Limburg) and Eastern Europe (Bulgaria - Pernik). (See Pilot Studies)

Environmentally sustainable sanitation is a contro-



in these initial approaches. Research and technology developments of recent years can potentially contribute to a more sustainable wastewater chain. Yet, it seems that they only develop into full applications on a very limited scale. Why do some new technologies and bodies of knowledge find practical applications and others not?

The BESSE project has been investigating this question and argues that knowledge brokerage can play a central role in creating a more sustainable wastewater sector. The project has also been investigating the gaps that exist between the processes linked to the production and transfer of knowledge and what knowledge is actually being transformed into applicable implementation models. The same applies to the knowledge produced in scientific research areas and the knowledge that is being employed.

The research partners provided state of the art technologies and brokerage mechanisms and this

versial concept for Europe as it is a type of solution that has been spreading from developing countries to developed countries. There is a lack of convergence on whether the different technological solutions are really sustainable or not. However, there is an urgent need for a solution which would move away from traditional sanitation technologies which are, for the most part, not seen as sustainable.

There are two research questions that one can ask against the sketched background:

1. What are the factors generating the problem?
2. What is the role that knowledge brokerage can play for supporting environmentally sustainable sanitation?



## BESSE nearing its final conclusions

In an attempt to answer these questions, the researchers set out to identify hindering and facilitating factors that play a role in the transfer and dissemination of knowledge and technologies connected to environmentally sustainable sanitation.

All the information and data collected during the first phase of the research—through different sources such as literature and documentation reviews; pilot studies (see boxes) and interviews with roleplayers — support the aims of achieving the second objective of the project, being the identification of hindering and facilitating actors in the effective dissemination of knowledge geared towards environmentally sustainable sanitation.

The first results of this component of the research includes a ‘Map of the hindering and facilitating factors to the transfer and dissemination of knowledge and technologies connected to environmentally sustainable sanitation’ that contains the conceptual framework that emerged from the work done so far.

This map consists of 142 items: 61 obstacles; 29 facilitating factors and 52 practices adopted by sanitation players facing obstacles or enhancing facilitating factors.

### Techno-scientific Innovation Cycle

The map of hindering and facilitating factors was developed by devising a techno-scientific innovation cycle, to properly ‘place’ each factor within a general picture. (See Model of techno-scientific innovation cycle on page 5). The model shows how knowledge brokerage plays a key role, in transferring knowledge from research to application, and in the other three phases of the innovation cycle, being:

1. in promoting a social pressure for innovation in the sanitation sector;
2. in transforming this pressure into new demands for policy makers; and
3. in facilitating the devising or the enhancement of research policies in support of sanitation research.

Therefore, in the framework of the model, knowledge brokerage is a mediation process comprising transferring knowledge between different contexts (cultural, social, professional, disciplinary) which can play a strategic role to accelerate innovation and to orient sanitation implementation decisions towards more environmentally sustainable perspectives.

### Pilot Studies

The next phase of the project included pilot studies that were designed to identify effective communication pathways between researchers, policy-makers and water companies taking into account the inter- and intra-disciplinary nature of environmentally sustainable sanitation brokerage as well as its public and socio-political contexts.

The project developed a pilot study framework, which acted as a methodological guide during the interviews, assessments and writing up processes. A single methodology was used to facilitate cross comparisons between the different scenarios.

Considering the barriers identified during the pilot studies in the three pilot regions, the questions then beg: what is knowledge brokerage? Who brokers and to whom do we broker? Is knowledge brokerage only necessary if there is a demand?

### Knowledge brokerage as applied in the BESSE pilot studies

The hypothesis of the BESSE project is that sanitation knowledge is not always passed from one actor to another which may hinder the use of knowledge on sustainable sanitation.

The traditional idea of knowledge brokerage is that there is a gap between those that need the knowledge and those that have the knowledge. A broker or mediator in-between is then necessary to bridge the gap. For this one needs a willing recipient. BESSE broadens this definition: knowledge brokerage entails more than communication as knowledge needs to be adjusted and translated – in terms of language but also in terms of translation to local contexts – as it is brokered. In other words, knowledge needs to be socialised in order to facilitate the ‘working’ and appropriation of the technology. Further, knowledge brokerage is

## Rome Meeting cont. ....

BESSE intended to begin a knowledge brokerage learning process in general and as a tool for the socialisation of scientific and technological research (STR). This means learning how to use knowledge brokerage methods to engage the public to understand and appreciate the benefits of research.

Crucial for the development of sustainable sanitation is the development of visions both of the problems to be tackled (problem-setting orientations) and of the solutions to be developed (problem-solving orientations) which could be shared by the multiple actors involved in sanitation, such as researchers, public utilities, professionals, policy-makers, national and local administrations, utilities’ workers and end users.

Developing such visions necessarily implies effective forms of knowledge brokerage allowing a meaningful communication of scientific and technical contents between different epistemic communities, each bearing a different technical and social competence regarding sanitation-related issues.

“... the lack of orientation towards an environmentally sustainable sanitation is not due so much to the inadequate production of a body of usable knowledge in this regard, but rather to an inadequate management of social dynamics (in the broadest sense, and namely economic, cultural, political, organisational, psychological, cognitive ones etc.) connected to the production, accumulation, dissemination, use and valorisation of this very body of knowledge.” (Prof Wiebe Bijker, Maastricht University, The Netherlands)





## BESSE nearing its final conclusions

not a linear process from the producers of knowledge, via an intermediary, to the end user. The brokering of knowledge may happen between different actors and on different levels simultaneously, also without a central mediator. Knowledge brokerage is thus a process that helps to move knowledge and technology from one place to another in order to help individuals and organisations to learn and improve. Alongside this, knowledge brokerage methods (in the BESSE context) are meant to overcome hindering factors and to maximise the exploitation of knowledge relevant for sustainable development.

This is interpreted to mean learning how to use knowledge brokerage methods to engage the public to understand and appreciate the benefits of research.

The pilot studies looked at what happens to the knowledge in a brokerage process and what knowledge can and do the actors use. The difference in contexts had an important impact, as different problems looked at different routes for solutions. What the research found was that knowledge moves between the contexts and decision makers and that it is important what the actors do with the knowledge when it gets to the point when the components connect.

Some of the more pertinent lessons from the pilot studies are summarised below:

### Innovation barriers: replacing infrastructure or technology

- Dutch water boards are acutely aware of their need for accountability given that their income is from taxation. The water boards, in common with other wastewater treatment authorities in for example, the UK, are risk averse in public health terms and take the view that there is no point fixing something that is not broken.
- Innovation can be expensive. There will normally be costs relating to technology development, pilots etc. To mitigate the financial risk of innovation, different actors will often come together to share the costs usually under the knowledge transfer partnership scheme set up by the European Commission.
- Water boards are reluctant to spend resources on modifications to existing plants to accommodate new processes unless they are add-ons or tweaks. The preference is to wait until it is time to replace the plant.
- Another identified barrier is inadequate technology. For instance in one of the pilot studies where only Unix-based systems were available to perform the required computing tasks. However, they were clunky and not portable and engineers had to use pen and paper for fieldwork. Today, software runs on laptops that can make this process much easier.

### Communication factors

- The pilot studies illustrated the difficulties that different professional groups can face in communicating with each other: for example, the software developers were often unable to fully understand or appreciate requests from the technical staff of the water company regarding software capabilities.
- The same issues arose in another case study where it was identified that actors such as the academics and policy makers had very little knowledge of the social- and town-planning aspects of the project and did not initially comprehend the need for these aspects until much later into the project.

### Innovation facilitators: perceptions of sustainability

- The level of openness and willingness of the decision-makers are directly responsible for the success or failure of a brokerage activity.
- The public perception of sustainability issues means that government agencies such as water boards are more likely to win support for developments if sustainability drives the process. An aspect of sustainability that gained particular traction is that of energy use and a number of water boards are looking into ways of producing energy as a by-product of the treatment processes.
- There is good knowledge sharing around the operational aspects of wastewater technology in the Netherlands. This finding chimes with a similar finding in the UK. Overall, wastewater companies are open to technical knowledge sharing but are much more circumspect about sharing information on their business and operations models.

### Knowledge flows

- Where different actors are involved, it is important for them to understand their contribution to the infrastructure project and the expectations of their contribution.
- The role of lobbyists in sensitising the populace and creating demand for environmental projects is important and can influence the shifting of the balance of power in agenda setting from decision-makers to the population whom they serve.

### Cultural contexts

- The pilot studies showed that the wastewater sector adopts only proven technologies and staff in the innovation units of wastewater companies find that their colleagues in operations are often a hindrance to adopting innovative technologies.
- Trust is an important ingredient in effective knowledge brokerage. Part of this is the ability of participants to empathise with the others' drivers and perceived risks and to accommodate these. This helps to foster trust and feelings of being able to work together.
- A cultural barrier to innovation which exhibits a strong drag effect was technology adoption by older people in the workplace who have relied on manual systems all their lives. Resistance to change is a key feature of change programmes where people need to re-learn their roles.

## What constitutes knowledge brokering in the BESSE project?

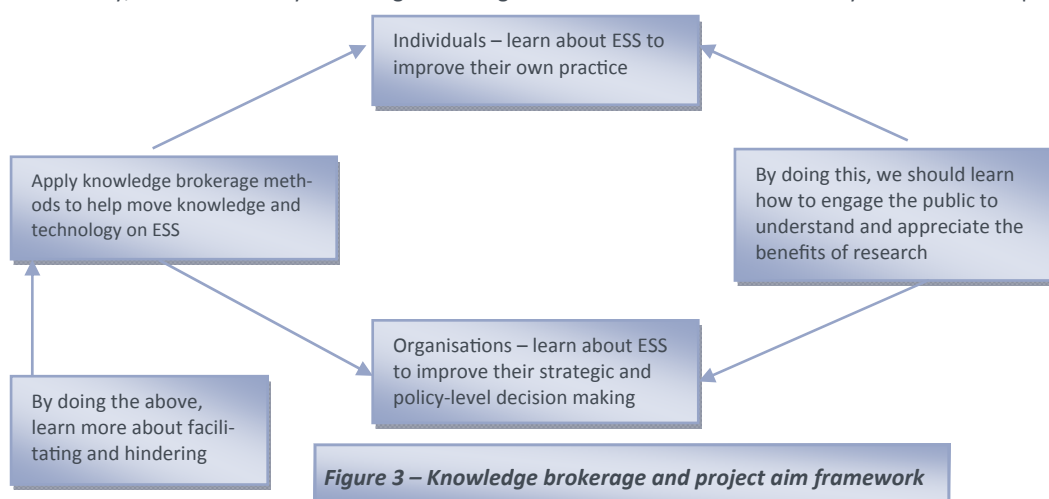
Considering the barriers identified during the pilot studies in the three pilot regions, the questions then beg: what is knowledge brokerage? Who brokers and to whom do we broker? Is knowledge brokerage only necessary if there is a demand?

The hypothesis of the BESSE project is that sanitation knowledge is not always passed from one actor to another and that this may hinder the use of knowledge on sustainable sanitation.

The traditional idea of knowledge brokerage is that there is a gap between those that need the knowledge and those that have the knowledge. A broker or mediator in-between is then necessary to bridge the gap. For this one needs a willing recipient. BESSE broadens this definition: knowledge brokerage entails more than communication as knowledge needs to be adjusted and translated – in terms of language but also in terms of translation to local contexts – as it is brokered. In other words, knowledge needs to be socialised in order to facilitate the ‘working’ and appropriation of the technology. Further, knowledge brokerage is not a linear process from the producers of knowledge, via an intermediary, to the end user. The brokering of knowledge may happen between different actors and on different levels simultaneously, also without a central mediator. Knowledge brokerage is thus a process that helps to move knowledge and technology from one place to another in order to help individuals and organisations to learn and improve. Alongside this, knowledge brokerage methods (in the BESSE context) are meant to overcome hindering factors and to maximise the exploitation of knowledge relevant for sustainable development.

This is interpreted to mean learning how to use knowledge brokerage methods to engage the public to understand and appreciate the benefits of research. From the foregoing, a framework was developed that provides an answer to the questions: What is knowledge brokerage? Who brokers and to whom do we broker? Is knowledge brokerage only necessary if there is a demand?

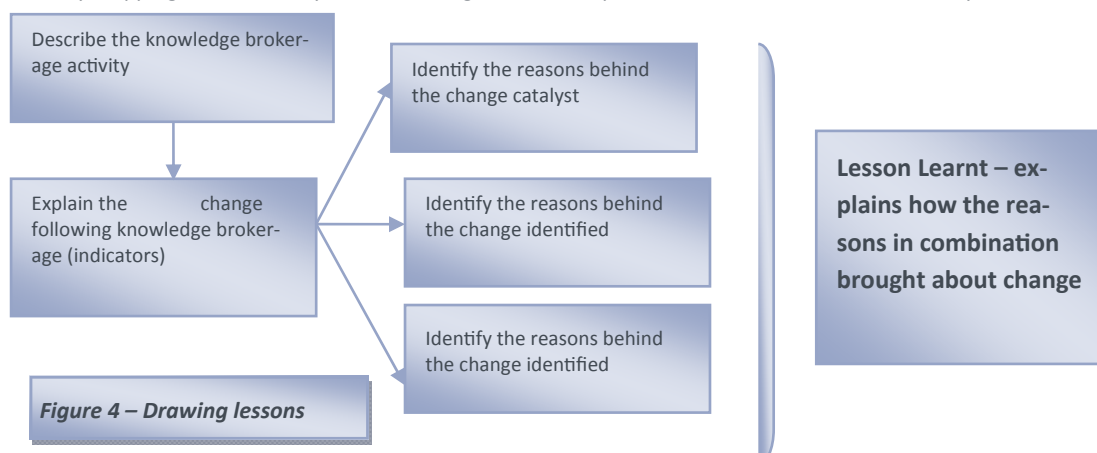
The schematic shows that firstly, what is meant by knowledge brokerage in the BESSE context and secondly what the BESSE project did:



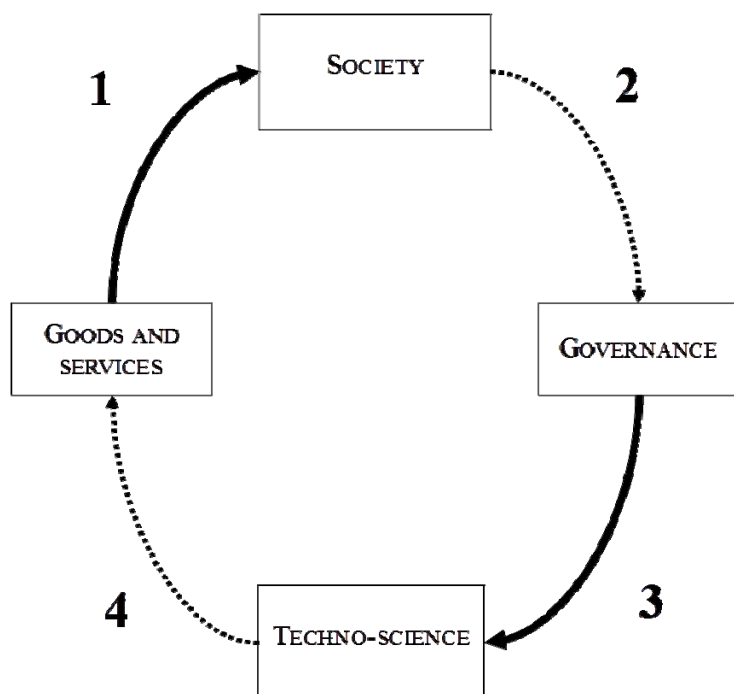
### Drawing lessons

The starting point for identifying lessons will be to identify the changes brought about by the knowledge brokered in each of the cases studies in Italy, The Netherlands and Bulgaria. Once the changes have been identified, the reasons for the change will be distilled, being the things that enabled the changes as shown in Figure 4 below. The three boxes illustrate that there may well be more than one reason contributing to a change.

The information from the three pilot studies will be consolidated and a meta-analysis will be done to begin to identify universal knowledge brokerage lessons. This will be done by mapping the case study information against a list of potential lessons thus far identified by the researchers.



## Techno-scientific innovation cycle model



## The four processes of the model

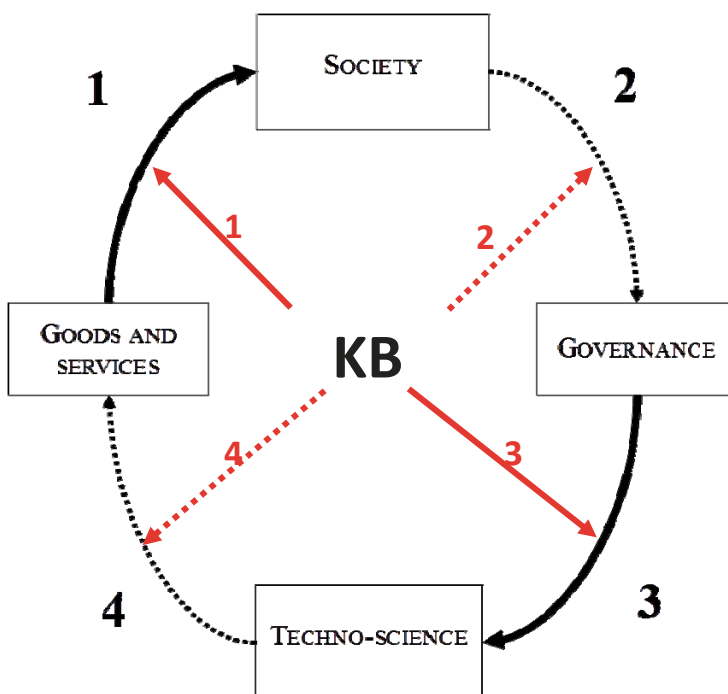
The model divides the innovation cycle into four processes:

1. The process of transformation of new knowledge into technological innovation
2. The process of formation of a social agency
3. The process of institutional, economic and cultural involvement in innovation
4. The process of activation, convergence and actualisation of the scientific and technological research

## New roles for knowledge brokerage

- In the proposed model, the scope of knowledge brokerage is broader than the one usually associated with it
- In the domain of innovation studies, knowledge brokerage is commonly recognised as a tool to speed up the transfer of existing knowledge from science to application (process 1)
- Following the model, knowledge brokerage emerges as a process playing a significant role also along the arc proceeding from society to techno-science (processes 2 and 3) and in the one proceeding from techno-science to goods and services (process 4)

## The four strategic roles of knowledge brokerage



1. Sustaining change tendencies among companies and utilities, such as increase their awareness of the economic and environmental benefits deriving from ESS technologies
2. Enhancing the strength of social mobilisation in support of ESS, such as acting as a catalyst for the social and environmental demands produced in society.
3. To favour the transformation of a social demand in new standards, investments in research and policies, such as to play a lobbying role within political, economic and cultural institutions.
4. Contribute to making research more relevant in order to increase the impacts on innovation, such as increasing the social and economic contextualisation of research programmes.

## Knowledge brokerage in action

### Pilot study Italy:

- Adoption of innovative collector technologies and new materials capable of preventing groundwater intrusion [1]
- Favouring increased technological responsibility in the local community linked to ESS problems and acceptance of the new technology [2]

### Pilot study Bulgaria:

- Extension of Pernik town sewerage system [1]
- Increasing the rate of connections of small industrial enterprises [3]
- Increase in the level of awareness in the local population [2]

### Pilot study Netherlands:

- The building of a 'most sustainable waste-water treatment plant in Europe' [1]
- To stimulate 'green thinking' in WBL and help formulate design principles and criteria for a more sustainable plant [1]



## Pilot study 1: The Dutch water sector

Three main groups of actors are involved in innovation in the wastewater sector in The Netherlands: water boards – independent regional water authorities – are charged with the responsibility for water-ways, water levels and wastewater treatment and use treatment technologies in practice (they are the end users); research organisations and universities often develop new ideas and materials and investigate the mechanisms behind new technologies and lastly, entrepreneurs and engineering firms further develop, apply and market the technologies. Innovation can have starting points in developments initiated by or problems experienced by any of these groups of actors.

Each group of actors bring its own goals and motivations into an innovation trajectory. As the water boards are public authorities, they have specific requirements when it comes to new technologies. Historically, costs and effluent quality have been the largest concerns in wastewater treatment. The treatment is paid for by tax-payers and the effluent quality, which is related to public health, is the most important requirement water boards need to meet. Water boards do not solely innovate for the sake of innovation and/or sustainability. New technologies are considered when they are cheaper; provide cleaner water, and usually when an old technology needs to be replaced. In that case, generally, a pilot project is initiated to evaluate whether the technology does what it promises (in the Dutch context) and does not interfere with or compromise the good results of the existing treatment process. Such practices and considerations ensure the reliability of the treatment plants, but may also hamper sustainable innovation.

It is against this background that the Dutch pilot project is being executed and involves the Waterschapsbedrijf Limburg (WBL). The company is planning to renovate and extend two wastewater treatment plants and build one new plant. The future scenario is to create a multi-purpose plant, including new techniques and technologies, and the way in which the plant will be constructed.

The pilot project entails changing the way in which decisions are made to implement treatment plants and a crucial challenge is how to engage with more aspects of sustainability within or by changing existing practices and contexts. Against this background, the WBL pilot project is not being approached in a 'business as usual' manner.

Directly opposed to the 'business as usual' approach is the focus on sustainable sanitation; a new 'green' concept in designing the treatment plants. For the pilot projects, the thinking includes a green focus, consideration model and a communication model. This will then also include energy reduction, GHG reduction, flexibility in building methods and materials, the re-use of raw materials and multi-purpose water, and the full adaptation to environmental factors.

This means that instead of focusing almost exclusively on the costs of various options, WBL will experiment with a new approach in which the different remodelling options are evaluated on the basis of a set of criteria (traditional ones such as overall costs and effluent quality, but also energy use, CO<sub>2</sub> emission, use and reclamation of raw materials and greenhouse gasses), as well as increasingly 'green' approaches to these criteria in terms of minimum requirements, (for example, effluent quality is set at measures of phosphorus and nitrogen in the effluent of (phosphorus) P=1 and (nitrogen) N=10 and energy use should be according to the agreement between water boards) and various levels of ambition (such as reducing emission in the effluent to P=0,5 and N=5 as a first level, and water re-use as a second one). This presents a number of new challenges and changes the relative importance of existing ones.



## Pilot study 3: Monitoring quantities and quality of industrial wastewater discharge in Pernik, Bulgaria

The pilot project in Pernik concerns the rehabilitation of the wastewater treatment plant and the collection and application of knowledge about wastewater treatment with the Bulgarian project partners and Pernik Municipality.

The treatment plant was constructed in the late 1970s, using technology and equipment typical for Eastern European standards. Issues of concern are that the station works at a third of its initial capacity. Productivity and organisational deficiencies are problematic.

The plant treats the wastewater from industry and a population of 99,000 inhabitants and includes the mechanical and biological wastewater treatment; anaerobic stabilisation of the sewage sludge in two-stage methane containers and dehydration of sludge in drying fields. Nitrification, denitrification and phosphor removal is not included. The plant is at risk of overflow if minimal capacity is exceeded.

This pilot project is being implemented in conjunction with another EU project and its main focus is to increase the connection rate of small-scale industrial enterprises to the municipality sewerage system through effective knowledge brokerage mechanisms.

This entails firstly, identifying specific knowledge brokerage mechanisms that will facilitate the connections and improve the quality monitoring of the discharged wastewater and secondly, to improve relationships and concomitantly knowledge exchange amongst the stakeholders in the municipality. The third component focuses on supporting the training of WSS company inspectors to monitor wastewater discharged and lastly, the project is tasked with increasing the level of awareness of the local population concerning wastewater sanitation issues.

The project will cost €29 million to complete.

### Pilot study 2: The role of sewerage in the management of the integrated water cycle in Castel Sant'Angelo, Italy

An important Italian groundwater source is located in Castel Sant'Angelo (central Italy), with some of its springs connected to the Peschiera aqueduct, which is one of main water sources for the City of Rome. Therefore, protecting the quality of water in this aquifer is crucial. To this aim, a sustainable and effective management of the integrated water cycle is essential for this area.

The current sanitation system is complex as it comprises several sub networks that collect wastewater from the different small urban areas in the municipality. The reliability of system is low due to numerous factors, amongst other the morphology of the territory, the age of the pipes, etc. The connections between the different elements of the pipeline cannot guarantee optimal functioning and groundwater intrusion in the pipeline has been registered for several years. The wastewater is diluted and, consequently, the wastewater treatment plant does not function well.

The main goal of BESSE project in this pilot project was to set in motion awareness raising processes regarding the role of sewerage in the sustainable management of the integrated water cycle, and to enable the creation of a sense-of-ownership of the local community toward the new technology and, consequently, to accelerate the impacts of innovation on the society.

To this aim, BESSE facilitated the communication and knowledge exchange among the four most important actors involved in the sanitation management, namely the municipalities, technicians, scientists and the local community. The activities focused on:

1. Integrated validation of the intervention with the aim of supporting the municipality in evaluating the effectiveness of the intervention.
2. A long-term monitoring programme to scrutinize the effectiveness of the innovation in terms of reduction of groundwater intrusion.
3. The development of a communication and information plan to facilitate the creation of a sense of ownership of the community toward the technological innovation.

### The MARBLE Project explores some knowledge transfer bottlenecks

As a spin-off from BESSE, MU and the WBL started a teaching and research project on sustainable sanitation in 2010.

The project was introduced in the previous BESSE newsletters.

The Marble Project published a book that presents the findings of the four subprojects of the 2011 Maastricht University Research Based Learning (MARBLE) project on Sustainable Sanitation. This book can be downloaded from the BESSE website.

Partially financed by a subsidy from the Dutch Ministry of Education, Culture and Science (the Sirius Program), the goal of Marble is to stimulate excellence in higher education by involving small groups of students in research projects. Marble emphasizes the connection between research and learning, the importance of (academic) community (the value of teamwork and collaboration), and the (societal) relevance of research to the wider community outside the university.

This Marble project was developed by a close collaboration between Maastricht University and the Water Board Company Limburg (WBL - *Waterschapsbedrijf Limburg*). It was set up on the basis of and informs the ongoing European project 'Brokering Environmentally Sustainable Sanitation for Europe'.

The general aim of the project is to contribute to the Renewed Sustainable Development Strategy of the European Union through the enhancement of the links between policy and research on sustainable development in the field of sanitation.

Implementing more sustainable solutions within the sanitation sector has been described as challenging and occurring rather coincidentally, mainly because conventional sanitary solutions and planning approaches have been developed in the late 19th and early 20th century and ever since they have worked successfully. Innovation for sustainability and the wish to integrate sustainability into new planning approaches thus often confront a system with high obduracy and momentum. Theoretically, there are numerous sustainable technologies available that decision makers can choose from. However, only a few are taken into consideration, predominantly because conventional, large-scale centralised waste water systems in the developed world work efficiently in meeting legally required water quality objectives.

Initially systems were designed to protect public health and in this regard they function well.

Wastewater treatment plants and systems can be seen as large





## The MARBLE project cont. ...

technological systems which are defined by the existence of a dominant technology which is broadly implemented. Furthermore large technical systems often have acquired increased momentum over time. Change towards a different system is hard to achieve. The system has evolved in its own specifically defined technological trajectory, the adoption of technologies which do not fit in to this trajectory will encounter barriers. Furthermore, due to the large momentum of the centralised waste water treatment system there is a lack of knowledge on alternatives which further impedes technological change.

Still, the necessity of rethinking sanitation in the light of sustainability is increasingly recognised. Over the years research has shown that the sanitation sector has, for instance, the potential to significantly contribute to the reduction of energy use and the reduction of greenhouse gas emissions. However, not all organisations in the sanitation sector may have access to or know how to use the available knowledge about such sustainability issues. Therefore, several initiatives have developed in order to offer the sanitation sector knowledge that can contribute towards more understanding on sustainability in the sanitation sector, for instance a project on Brokering Environmentally Sustainable Sanitation for Europe -BESSE. One very important tool in bringing about this awareness and in helping to trigger change towards sustainability is the concept of knowledge brokerage.

Knowledge brokerage is a social phenomenon in which knowledge is not only being transferred (which is implied by communication), but in which knowledge is identified, redistributed and. This process plays a very important role in bringing about awareness, understanding and knowledge. Therefore, if the sanitation sector aims at changing its traditional way of working towards a more sustainable way of working, it needs to make knowledge on sustainability vividly present. In other words, there is the need for active knowledge brokering activities.

### Project Partners



International  
Water Association



Maastricht University



WATERSCHAPSBEDRIJF  
LIMBURG



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