STRENGTHENING CAPACITIES FOR DEMOCRATIC DECISION-MAKING ON INTEGRATED URBAN WATER MANAGEMENT THROUGH LEARNING ALLIANCES; A MID-TERM REVIEW FROM BELO HORIZONTE, BRAZIL[1]

Stef Smits[1], Sônia Knauer[2], Nilo de Oliveira Nascimento[3], Janise Dias[4] and Tarcisio Nunes[4]

[1]IRC International Water and Sanitation Centre, Delft, the Netherlands (smits@irc.nl)
[2]Belo Horizonte Municipality (PBH/SUDECAP), Brazil (knauer@pbh.gov.br)
[3]School of Engineering, Federal University of Minas Gerais (UFMG), Brazil (niloon@ehr.ufmg.br)
[4]Institute of Geosciences, Federal University of Minas Gerais (UFMG), Brazil (janisedias@yahoo.com.br and tj.tarcisio@gmail.com)

INTRODUCTION

Water management and urban planning in Belo Horizonte

When the city of Belo Horizonte was established between 1894 and 1897 as the new capital of the State of Minas Gerais, it became the first modern "planned" city in Brazil (Wikipedia, 2008). Streets were laid out on a grid, so as to facilitate construction of houses and water supply pipes. Streets were broad enough for trees, so as to create a comfortable living environment. Relatively a lot of space was dedicated to squares and parks. The plans of the chief engineer, Aarão Reis, foresaw a broad sub-urban fringe around the city, as a transition between the urban and the "natural" environment. This fringe was also meant to be adequate to contain unlimited urban growth.

Figure 1: Location of Belo Horizonte (Nascimento *et al*, 2007)

---

[1] This paper was prepared in 2008 for the SWITCH project and is available at www.switchurbanwater.eu

However, the city boomed. In the 1950s, a new area was developed. The then mayor, Juscelino Kubitchek, called a competition for the architectural development of the area. This completion was won by Oscar Niemeyer. Amongst other ideas he planned a lake (Lake Pampulha) in the middle of the neighbourhood, partly as a flood controlling reservoir and also to improve the landscape. The Pampulha area acted as a laboratory for Niemeyer, applying lessons learnt in the design of the new capital city, Brasilia. In the meantime, Belo Horizonte continued to boom, particularly during the 1970s and 1980s, reaching its current 2.2 million inhabitants, and 3.9 million people, if you consider the population of the 33 municipalities that make up the Belo Horizonte Metropolitan Region (RMBH).

For a long time, water management in Belo Horizonte focused on providing water services to keep up with the population growth, and in many respects with much success. The drinking water supply system now connects 99.7% of Belo Horizonte residents (Nascimento et al, 2007) and is operating to high standards, in terms of operation as well as water quality. Coverage by sewerage systems is also high, reaching about 92% of the population (Nascimento et al., 2007). However, 40% of interceptors need to be constructed. The lack of these is an important cause of seepage of sewage into groundwater, and subsequently into streams. In addition, there are illegal interconnections to the separate stormwater drains. Coverage of sewerage systems in neighbouring municipalities is also much lower. This means that a sizeable percentage of wastewater still ends up in stormwater drains and rivers.

During the period of intense urban growth from the 1970s to the mid 1990s, stormwater drainage investments went into lining rivers and the construction of closed drainage channels. Despite these efforts, the occurrence of floods did not reduce. In addition, these engineering works also had very high costs, which became unaffordable during the period of hyperinflation in the early 1990s. Since the mid 1990s there has been a shift in approach to urban drainage towards a more environmental approach. Firstly, this has aimed to improve the quality of drainage effluent, and secondly to fit drainage works better into their natural contexts. Investments have gone into wastewater interception and treatment, restoration of urban creeks and piloting of technologies such as detention ponds and wetlands. Around these drainage works, parks and recreation areas have been established, in a sense reflecting the original greening principles of urban planning of chief engineer Aarão Reis and Oscar Niemeyer.

Strengthening democratic water governance

This change in the water management paradigm has been facilitated and reinforced through efforts to democratise decision-making processes in water management. After the end of the military dictatorship in 1985, the Municipality of Belo Horizonte (PBH) has put much effort into democratisation, focusing particularly on establishing mechanisms for citizen participation in decision-making about local planning and services provision. This is exemplified by Participatory Budgeting (with the acronym OP in Portuguese) where citizens can propose works to be included in the municipal budget. Out of the shortlisted projects, the ones which receive most votes from citizens are prioritised. In addition to these general mechanisms to strengthen participatory democracy, new coordination structures have also been set up for different sectors, including water and sanitation. A good example is COMUSA (Municipal Sanitation Council), council with a mandate to prioritize investments in sanitation specifically, in which representatives of local government and civil society participate (see Smits et al. (2008).

SWITCH in Belo Horizonte

The Sustainable Water Management Improves Tomorrow's Cities' Health (SWITCH) project is a major research partnership funded by the EC, with a budget exceeding €20 million, undertaking innovation in the area of integrated urban water management (IUWM) in 12 cities across the globe, including Belo Horizonte. Rather than solely focusing on new research, the project is helping to put research into use across different aspects of the urban water cycle in order to improve integration and scaling-up impacts, and ultimately achieve more sustainable urban water management.

The focus on getting research into use has implications for the way in which SWITCH is structured as a project. First of all, it calls for more integrated and inter-disciplinary research, trying to study water management from different angles, in its technological, hydrological, economic and governance aspects in an integrated way. In addition, it aims to engage the relevant stakeholders and establish linkages between research providers, knowledge managers and research users through so-called learning alliances (LAs) (Smits et al., 2007; Butterworth and Morris, 2007). The aim of these platforms is to guide the definition of the research agenda, participate in the research itself and to act as the main channel for dissemination and scaling up.

SWITCH started work in the second half of 2006 in Belo Horizonte, with the local aim to provide a further impetus to the change processes that had started before around the approach towards urban drainage, and democratisation of water governance. As will be further explained in the next chapter, the intervention logic of SWITCH aims to build upon the changes that had already started and to develop complementary activities of research, demonstration and capacity building. Learning alliances play the integrating role of linking these together. More details on how SWITCH operates in Belo Horizonte, and who is involved, are mentioned in section 3 of this paper.

Objective of the review and structure of the paper

As discussed in the remainder of the paper, achieving integration towards more sustainable water management is not straightforward. Broad concepts such as learning alliances and IUWM need to be applied in and adapted to any particular context. In this process, all kinds of opportunities and hurdles appear which call for further adaptation and contextualization. Belo Horizonte is a case where the project had to build upon existing change processes and governance structures, trying to reinforce these without creating a duplication of efforts or overlap.

Mid-way into this project, a review has been undertaken of the experience in Belo Horizonte in applying the SWITCH Project approach to contribute to strengthening IUWM. This paper aims to present the findings of that review. Its objective is to analyse progress in the application of the SWITCH Project approach, and its potential for contribution to strengthening IUWM in Belo Horizonte. The lessons learnt and recommendations are in the first instance meant to further inform implementation of the remainder of the project in the city. In addition, they aim to offer insights for other SWITCH cities and similar initiatives.

The paper starts by outlining the methodology used for this review. This is then followed by a description of the "inputs", i.e. the key elements of the SWITCH project approach in Belo Horizonte including the projects' theory of change and the approach to develop the learning alliance. After that, the paper presents the results achieved to date, before identifying some of the lessons learnt and recommendations. The annexes contain the outcomes of the monitoring of the learning alliance and photographs illustrating the main components of the project.

METHODOLOGY

SWITCH uses two innovative methods of tracking its approach and assessing its effectiveness in achieving change in cities: scoring ladders to assess mainly qualitative change (Butterworth and Da Silva, 2008) and process documentation (Schouten, 2007; Schouten *et al.*, 2007). These have been the main methods used to develop this paper, and will be further elaborated below.

Scoring ladders

Scoring ladders are a way to assess outcomes of a project, using qualitative indicators of change (Butterworth and Da Silva, 2008). In SWITCH they are used to assess the outcomes of the learning alliance process. They try to measure to what extent the project is achieving changes, for example in the way city stakeholders work together. Scoring ladders consist of qualitative descriptions (also dubbed mini-scenarios) linked to a score. Stakeholders can indicate the description that most closely describes their reality, and in that way a scoring is obtained.

In Belo Horizonte seven objectives (four are shared with other SWITCH cities, while three were was added to specifically monitor issues considered relevant in Belo Horizonte) were defined, each with related qualitative descriptions of indicators. These have been used since the end of 2007 to monitor learning alliance progress. The objectives are:
1. We know who learning alliance members are, and how to communicate with them effectively
2. Regular, effective and innovative events capture the interest of learning alliance members
3. Demonstration activities are undertaken within a framework for scaling-up
4. We understand why change is occurring in relation to integrated urban water management, not just what happens
5. There is a regular flow of information of good quality between learning alliance members
6. Stakeholders are involved in priority setting in research.
7. Knowledge about sustainable urban drainage is obtained by the different stakeholders at community and institutional level

For this paper, the scoring was carried out by the Learning Alliance facilitator herself in August 2008. Time hasn't yet allowed for full participation of stakeholders in the scoring exercise. However, results from interviews (see more details below) were also used to inform the scoring. The full results can be found in Annex 1.

Process documentation

Since SWITCH aims to change traditional patterns, attitudes, relationships, approaches and ways of thinking, it should therefore try to understand the context and background of these attitudes, relationships and approaches. In addition, it needs to track what it is doing (inputs) to achieve changes (outcomes). The tool being used to do this is process documentation. Process documentation is a tool that helps project staff and stakeholders to carefully track meaningful events in their project, 'in order to discern more accurately what is happening, how it is happening and why it may be happening' (Annie E. Casey Foundation, 2003; Schouten, 2007; Schouten *et al.*, 2007).

This paper itself is an example of process documentation, and is the first process documentation output produced by the Belo Horizonte team. The main methods used to carry out the process documentation have included:

- Review of project documents. This has been mainly a desk-top based activity, in which the authors reviewed project documents, and tried to (re)construct and make activities and inputs more explicit.
- Interviews with project stakeholders. These formed the bulk of the data used for the process documentation. The interviews aimed to get stakeholders' perspectives on their role in the project, and the main changes they have seen as a result. In selecting stakeholders, we have distinguished between researchers, facilitators (i.e. those project staff which play a role in facilitating uptake of research) and research users, and an attempt was made to interview persons from each of the groups. Distinctions between the groups are not always clear, as some users are actually involved in research, while some facilitators are also research users. Table 1 provides an overview of the interviewees.

Table 1: interviewees

Researchers	Facilitators	Research users
- Heloisa Costa (Institute of Geosciences UFMG) - Janise Dias (Institute of Geosciences UFMG) - Leo Heller (School of Engineering UFMG) - Tarcisio Nunes (Institute of Geosciences UFMG) - Mike Revitt (Middlesex University) - Martin Seidl (Cereve University Paris Est/visiting professor UFMG)	- Valdete Bontempo (DRENURBS Programme PBH) - Weber Coutinho (Environmental Secretariat PBH) - Sonia Knauer (SUDECAP PBH) - Silmara Machado Teixeira (Environmental Secretariat PBH) - Nilo de Oliveira Nascimento (School of Engineering UFMG) - Rodrigo de Oliveira Perpetuo (International Relations Secretariat PBH)	- Sérgio Augusto Domingues (Parks' Foundation PBH) - Edgar Garcia Maciel (Pedro Guerra School) - Dulce Guimarães (Lidia Angelica School) - Antonio Leite Alves (Projeto Manuelzão) - Sandra Mara Vicente (Anne Frank School) - Sandra Regina Silva (Anne Frank School) - Ronaldo de Sousa (COPASA) - Ronaldo Vasconcelos (Deputy Mayor and chairperson of Global Change Committee PBH)

Note: the description of the organisations for which the interviewees work, can be found back in section 3 of this paper

- Analysis with the SWITCH team. A final step in the process documentation has been the analysis of the results of the interviews, the scoring ladders and review of project documents with the team. These have lead to the formulation of conclusions and recommendations.

Limitations of the research

Some of the authors' roles as facilitators and researchers within the city make us far from impartial. However, following the best practice principles of process documentation (Schouten *et al.*, 2007) we have sought to be self-critical and reflective and to check own our perceptions and views. In addition, the lead author of this paper has so far only been involved in a very limited way in research, and has been brought in to facilitate the analysis, and bring in a further element of impartiality.

As a result of the role of the authors as facilitators and researchers, some interviewees may not have been fully open to us in their critiques. By triangulating results from interviews with the scoring ladders, and reviewing project documents, we aimed to obtain the most realistic analysis of the change process so far.

SWITCH APPROACH IN BELO HORIZONTE

This section describes the way the SWITCH project has been approached in Belo Horizonte. It starts by briefly capturing the origins of Belo Horizonte's involvement in SWITCH and the expectations of the two main parties, the University (UFMG) and the municipality, and the Belo Horizonte-specific objectives of SWITCH. This is followed by the intervention logic of the project, i.e. the way in which the different activities aim to achieve the objectives. Finally, an overview is given of the actual activities and inputs made to date.

Project origins and objectives

As mentioned in the introduction, since the mid 1990's a paradigm shift has been taking place in Belo Horizonte in its approach to water management, with more emphasis on both an environmental approach to urban drainage and democratisation of water management. Although the Municipality, as the lead authority on urban drainage, has been leading, a range of other stakeholders have been involved. The Universidade Federal de Minas Gerais (UFMG) has been working closely with the Municipality, carrying out research around this theme on different aspects (hydrology, technology, costs, etc). When the opportunity to participate in SWITCH presented itself, this was seen as a logical sequel to previous activities and complimentary to what had already been achieved.

The expectations of the two main parties, although different, were complimentary:
- The Municipality's interest lay in monitoring and research of drainage interventions, particularly to evaluate and validate such interventions in a real-life setting of a neighbourhood or catchment (as opposed to such evaluation under laboratory conditions). The expectation was that the results would serve as input for its current and future drainage programmes. In addition, it had an interest in strengthening participatory management models for urban drainage, and needed more research on governance and management to inform such models.
- The interest of UFMG lay in carrying out research on different aspects of innovative approaches to urban drainage. It also had an interest in participating in an international network of researchers and cities to be able to exchange experiences on such innovations.

With these two stakeholders and sets of interest, the two main objectives of SWITCH, i.e. research, and its use, were present.

Although there was a realization that addressing urban drainage issues would require the involvement of a range of stakeholders, this wasn't explicitly addressed in the original conception of the SWITCH project. This was partially due to the fact that already several platforms and mechanisms for stakeholder participation existed (see introductory section on governance) and that SWITCH could work through these in some form as well. However, after a kick-off workshop and several internal workshops, it was realised that, to achieve its objectives, SWITCH also needed to work in a more explicit way with a broader group of stakeholders at different levels. As a result, the main goal for SWITCH in Belo Horizonte was formulated as: "to improve development of, access to and use of information and knowledge on different aspects of urban drainage alternatives by all relevant stakeholders (authorities, researchers and community) so as to strengthen and democratize decision-making processes on urban water management". The specific objectives are:
1. To improve capacity to identify flooding risks and response measures through enhanced monitoring and use of modelling tools.

2. To introduce, test, adapt and showcase innovative urban drainage technologies which reduce flooding risks whilst contributing to an improved urban environment.
3. To assess and strengthen participatory management models for urban drainage within a broader IWRM institutional framework.

Project partners active in Belo Horizonte

The two main organizations carrying out SWITCH in Belo Horizonte are UFMG and the Municipality. Three different groups within UMFG participate: the School of Engineering, the Institute for Geosciences and the Economics Department. A range of entities from the Municipality have become involved as well, and these are further detailed in the following section on the learning alliance.

In addition, staff and students from the network of SWITCH partners have contributed to different parts of the work in Belo Horizonte. Researchers from Middlesex University (United Kingdom) and UNESCO-IHE (the Netherlands) have supported technological and hydrological research, while researchers from IRC International Water and Sanitation Centre (the Netherlands) and Greenwich University (in the UK) have supported governance research. Although not a formal SWITCH partner, a visiting professor from Cereve University Paris Est at UFMG, has also been supporting one of the demonstration projects and carrying out related research. Students from the Ecole Polytechnique Fédérale de Lausanne (Switzerland) have also carried out thesis research, particularly on modelling.

Intervention logic

In order to achieve the overall objective, the project follows an intervention logic, or theory of change, consisting of three components:
- integration and building linkages between different types of project activities
- building upon pre-existing initiatives, and linking with other projects and programmes
- working at different levels of scale

Each of these elements will be further detailed below:

Linkages between different types of activities

The first part of the intervention logic of the project consists of different types of inter-linked research, demonstration and learning activities;

Monitoring and research of urban drainage technologies in **demonstration** projects under real-life conditions, is the first part. The demonstration projects consist of the implementation of local drainage infrastructure such as infiltration trenches, constructed wetlands and rainwater harvesting infrastructure. These facilities are placed in schools, in parks and on UFMG's campus. Research focuses on the technological and hydrological aspects, as well as on the costs, of these drainage facilities.

Research at local scale level, is complemented by **modelling and research** on flood risks and mitigation measures at sub-catchment scale. Although demonstration activities take place at this level, no learning alliances were envisaged to be set-up around these. Taken together, these first two sets of activities will lead to new knowledge on urban drainage at real scale.

Learning alliances at community level act as platforms for **analysis, learning** and **capacity building** around the research and demonstration projects. Around the demonstration projects, local alliances would be established, consisting of community institutions (schools, health

centres), individual community members, and municipal officials and technicians. The demonstration activities are used for joint learning about the different aspects of drainage. Also specific capacity building events are organised for these learning alliances such as trainings and awareness raising activities. Particular emphasis is given to the committees involved in the participatory budgeting process, so as to make sure they can promote more sustainable drainage works within the participatory budget. The main expected outcomes of this component of SWITCH are strengthened capacity at community level to participate in decision-making on urban drainage, and to scale up within the community, as well as to neighbouring communities, via the local officials and technicians.

A **Learning alliance** at **institutional** level provides a platform to **scale up** results within Belo Horizonte institutions as well as at RMBH level. The main idea behind this alliance is to bring together the key institutional stakeholders on urban water management in Belo Horizonte and the wider metropolitan region (see Box 1 for a description of the main stakeholders). This alliance not only analyses new knowledge on urban drainage, but is also a subject of governance research, so as to help improve management and coordination. The main expected outcome of the institutional level alliance is strengthened institutional capacity to implement new approaches to urban drainage, and more democratic water governance, as well as the capacity to scale-up these approaches.

Box 1: key stakeholders in urban water management in Belo Horizonte
The main stakeholders around urban water management in Belo Horizonte are identified below. As will be discussed later on, not all of them are fully engaged yet with the institutional learning alliance.

Prefeitura de Belo Horizonte (PBH). The Municipality is arguably the most important user of research from SWITCH as the entity responsible for providing urban drainage services. In addition, they are the planning authority, and amongst other things responsible for the Participatory Budgeting process. Because of its sheer size, and different functions, a number of different entities and secretariats within the Municipal administration are participating in SWITCH. These include, for example:
- SUDECAP (Superintendent for the Development of the Capital): amongst its responsibilities are the implementation and maintenance of stormwater drainage infrastructure.
- SMAMA (Municipal Environmental Secretariat): responsible for implementing environmental policies, and control over environmental regulations
- Parks Foundation: this foundation is responsible for the development and maintenance of green areas and parks in the Municipality
- International Relations Secretariat: as SWITCH is an international project, this secretariat plays a role in facilitating whatever SWITCH needs in terms of relationship development, including also with neighbouring municipalities
- Participatory Budgeting (OP). This entity contains officials responsible for facilitating the participatory budgeting process, and providing capacity development support to communities.

Universidade Federal de Minas Gerais (UFMG). Within the University, three research groups are participating: the School of Engineering, the Institute of Geosciences, and the Economics Department. They are both project partners and learning alliance members.

COPASA. COPASA is the utility responsible for providing water and sanitation services in Belo Horizonte, as well as in most of the other municipalities in Minas Gerais. It is a mixed company with part of its shares owned by private investors and part by the State Government. COPASA has a service provision contract with PBH.

Projeto Manuelzão. This is arguably one of the biggest civil society organisations around water management in Belo Horizonte. It is an NGO aiming to raise awareness about environmental aspects of water management in the Velhas catchment and to educate communities and government representatives.

RMBH Council and other municipalities. SWITCH has the ambition to scale up knowledge on urban drainage not only within Belo Horizonte, but also to neighbouring municipalities. One of the key players in that is the RMBH Council, a platform which brings together all municipalities within the metropolitan region. Some individual municipalities have already expressed interest in the theme, particularly the Municipalities of Contagem and Betim.

Velhas river basin committee. Belo Horizonte is located in the catchment of the Velhas river (which itself is a tributary of the São Francisco river). As per Brazilian legislation, the Velhas has a river basin committee, made up of the main water stakeholders, including local authorities, water users and civil society groups. This acts as a deliberative body. A process is going on to establish a technical agency for the Velhas as well, which would become the executive branch of the committee. As an important water authority in the region, it is seen as a key body of stakeholders, so as to ensure that Belo Horizonte's actions contribute to, for example, water quality targets set by the committee. In addition, it is a body through which a wider audience of all water users in the region can be reached.

A final activity is the **documentation** of change process, to learn about how and why change is achieved. This is the process documentation that was referred to earlier.

The linkages between these activities are summarised in Figure 2, with different colours indicating different types of activities. The upper part of the figure shows the central position of the local demonstration activities, feeding into both the community level alliance, as well as into the technological research. These lead to outcomes in terms of new knowledge and local capacity to scale up. These in turn feed into the institutional alliance, which aims to build institutional capacity to scale up. Documentation is a cross-cutting activity.
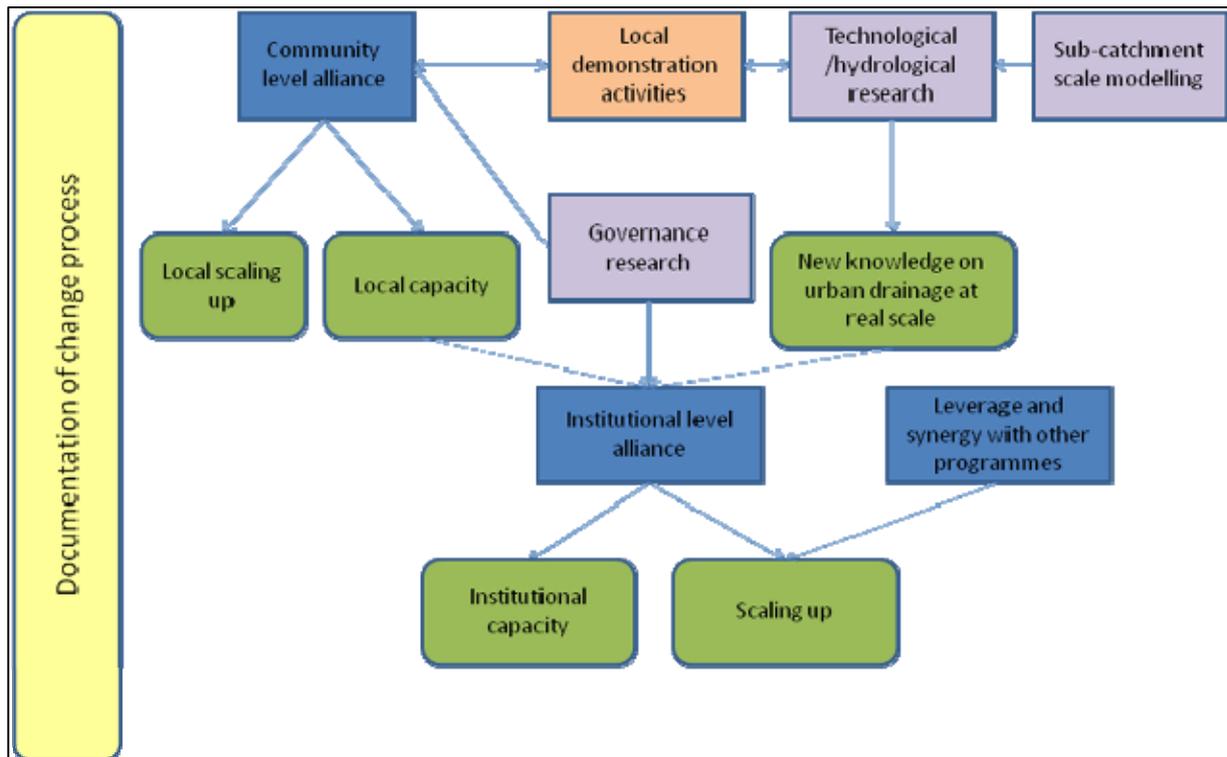
Figure 2: diagram of the SWITCH intervention logic in Belo Horizonte

Building upon other projects and initiatives

As mentioned earlier, Belo Horizonte already had initiatives and structures on urban water management when SWITCH started work in the city. A key component of the SWITCH approach from the onset was to build upon these, add value to them, and to create leverage in terms of scaling up. Various ways were considered from the outset, including:

1. Targeting and using existing planning mechanisms for scaling up. Existing planning mechanisms were considered to have higher potential for scaling up than the LAs, as these are already institutionalised. So, a specific effort was made to use those, and ensure that research results are fed into these mechanisms. A good example is the participatory budgeting. As communities can propose works into the OP, SWITCH would work with the local learning alliances on the formulation of works that can be included into the OP, and with officials of the participatory budgeting processes, on briefing them about key principles behind improved urban drainage. In this way, it is expected that communities will have the capacity to propose water-related works into the participatory budget, and that officials have the capacity to check their feasibility.

2. Including lessons learnt of past and ongoing programmes. Probably the most important past and ongoing programmes on urban drainage in Belo Horizonte are DRENURBS and PROPAM. These were the first programmes applying the new approaches to urban drainage, and serve as a basis for knowledge. SWITCH, therefore, would use past real-scale interventions from both programmes.

3. Using existing baseline information. As part of the Municipal Sanitation Plan (PMS), a range of surveys and baseline information collection exercises have been carried out. SWITCH would use this data, instead of collecting this information again.

4. Leveraging and synergy through links to other projects, such as PROSAB (a network of Brazilian cities working on sanitation) or the Global Change Committee (a municipal committee developing local policies to deal with climate change).
5. Learning from international best practices, through links with other SWITCH cities and other international networks.

By building upon these existing initiatives, SWITCH also needed to define its niche and complementary role vis-à-vis these. This has been defined mainly along the following lines:
- Evaluation and validation of drainage technologies; none of the technologies that are demonstrated or tested are entirely new to Belo Horizonte. For example, some of these had already been used in DRENURBS. The added value of SWITCH lies in the evaluation and validation of these, an activity which could not be carried out in a structured manner under these programmes.
- Critical analysis and research on governance arrangements. Although the various governance mechanisms had been set up, a critical analysis of these, including considerations for the development of governance arrangements for drainage, had not taken place. SWITCH was expected to bring in this element.
- Dissemination of research results and facilitating uptake through the learning alliances at local and institutional level, and other networks. Although existing channels and platforms were identified, the actual dissemination and facilitation of uptake, was seen as potential added value of SWITCH.

In the results section we will further elaborate how different stakeholders do see how the added value has come about, in a complementary role to the previously existing activities.

Working at different levels of scale

A final element of the intervention is the need to work at different levels of scale, as urban drainage has different implications at different spatial levels. SWITCH Belo Horizonte tries to address relevant issues at each scale level:
- Local level: this is the lowest level considered in SWITCH Belo Horizonte, and is the level below a sub-catchment. It may, for example, be a local infiltration trench or wetland and its surroundings. At this level, technology demonstration projects and local alliances are being established.
- Sub-catchment level: the Belo Horizonte municipal area has been sub-divided into 256 drainage areas, or sub-catchments. These hydrological units are used for planning in the Municipal Sanitation Plan (PMS) and SWITCH follows these units as well. At this level, flood risks are being analysed and interventions planned. Results of the analyses and projects at local level feed into the analysis at sub-catchment level.
- City level: this is the level of the entire municipality of Belo Horizonte. The focus of effort at this level is in the institutional sphere, and includes research on governance and the institutional learning alliance. Results of the modelling work at sub-catchment level are aggregated to this level.
- RMBH: this metropolitan level is only foreseen to be a level of scaling-up, by involving stakeholders from other municipalities in the institutional learning alliance activities for example.
- Velhas catchment level: Belo Horizonte is located within the catchment of the Velhas River. Although actions within Belo Horizonte will have an impact on the entire Velhas catchment, this is not an explicit unit of analysis. Rather, stakeholders from this level are considered as a target for scaling up actions.
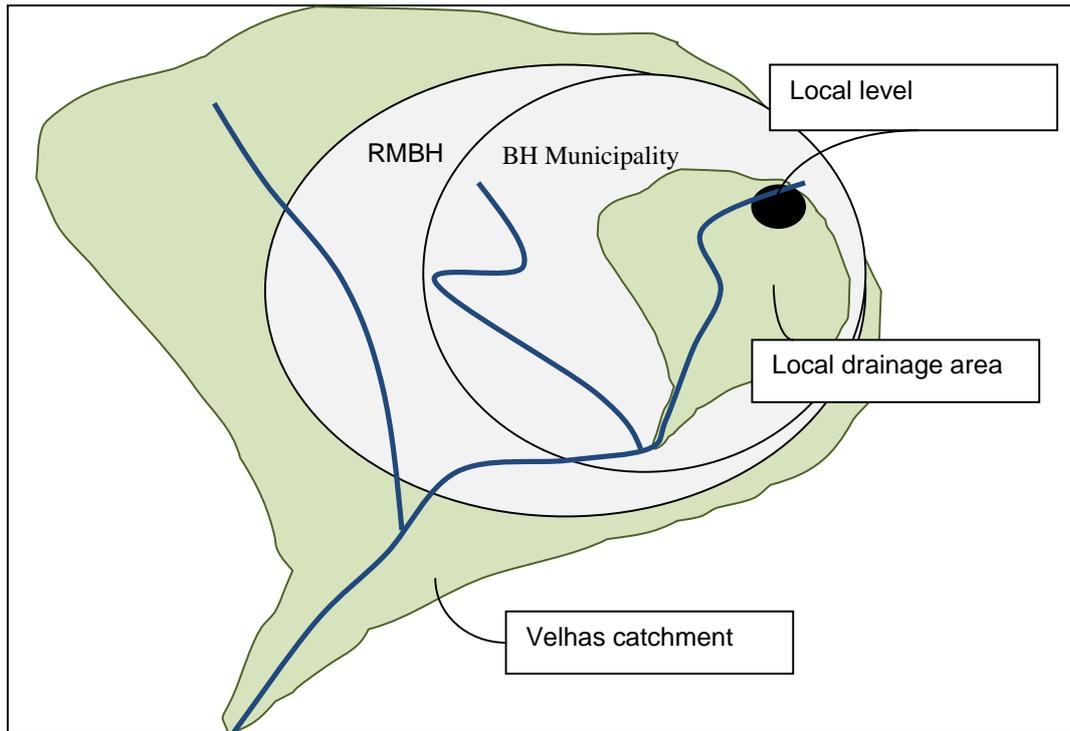
Figure 3: levels of scale at which SWITCH is working in Belo Horizonte

Activities and inputs

Having seen the theory of the approach the project would follow, this section summarises the main activities that have been carried out in the city, and the inputs they required. We indicate for each of the levels the types of activities undertaken and current status.

Local level

At the local level, a total of five demonstration and research activities have been selected, three of which also are in the process of establishing a learning alliance. Table 2 provides an overview of the demonstration, research and learning alliance activities at that level. Further technical details of the demonstration activities and discussion on functioning of the alliance are provided in the next section.

Table 2: overview of activities at local level

Location	Demonstration activities	Research activities	Learning alliance activities
Anne Frank School	Rainfall harvesting infrastructure in process of being constructed	Not started yet. To start with advent of rainy season.	Introductory meeting with the School community (2007) SWITCH participation in the environmental education seminar of the school
Lagoa do Nado park	Rainfall harvesting for school gardens and cleaning, and water reuse are planned; now at design stage	Not started yet	Introductory meeting with the Parks' Foundation and Lidia Angélica School as core of local alliance (2008) Awareness raising workshop, together with the Water Messengers

			project (2008) Work plan for learning alliance developed (2008)
UFMG campus	Infiltration trenches have been constructed	Not started yet. To start with advent of rainy season	No learning alliance planned here
Vila Guaratã	Infiltration wells functional	Perception studies have been carried out (2007) Hydrological research has been carried out (2007)	No learning alliance formed here
Vilarinho area and Pedro Guerra School	Constructed wetland. Design finished.	Perception studies have been carried out (2007)	Introductory meeting with school community (2007) Feed-back meeting of the research results (2007) Awareness raising event "a day in the catchment" (2007)

Sub-catchment level

In total three sub-catchments were selected for research activities (Table 3). At this level, no learning alliance had been planned.

Table 3: overview of activities at sub-catchment level

Location	Demonstration activities	Research activities
1o de Maio drainage area	Retrofitting of infiltration trenches has been carried out	Not started yet. To start with advent of rainy season
NS Piedade drainage area	Retrofitting of infiltration trenches has been carried out	Not started yet. To start with advent of rainy season
Agua Funda drainage area	Wetland	Not started yet, with advent of rain season

City level

At this level, no specific locations for demonstration and research can be identified. Table 4 provides an overview of generic activities at city scale, and even to the levels above that, i.e. RMBH and Velhas catchment.

Table 4: overview of activities at city level

Type of activities	Activities
Research (hydrological)	Establishment of rainfall and river flow monitoring stations Development of a flood atlas Start of PhD thesis: Assessment of flood damages adopting an agent based modelling approach (started in 2005 and incorporated to the SWITCH) Start of PhD thesis: Emergency planning under flash flow conditions in urban areas (2006) Start of MSc thesis: Assessment of flood risk perception by people living in flood prone areas (2007) Start of MSc thesis: Characterisation of wet weather diffuse pollution on an urban catchment in Belo Horizonte (started 2007)
Research (governance)	Institutional mapping (started 2007) Analysis of governance and urban environmental sanitation (2008) Start PhD thesis: Governance of water supply and sanitation in Belo Horizonte: an assessment of the relationship between the municipality and the service provider (2006) Start MSc thesis: The role of municipal councils in the construction of an integrated urban water policy in Belo Horizonte, Brazil (2007) Start MSc thesis: Using indicator in the assessment of public policies on urban waters in Belo Horizonte: case study of the DRENURBS programme (started in 2007)

Institutional level learning alliance	Introductory bilateral meetings with key stakeholders, such as SUDECAP, COPASA and OP: 2007
	Workshop to make linkages between SWITCH and the Global Change Committee (2007)
	First seminar on IUWM with institutional learning alliance (Sept 2007)
	International workshop on innovations in urban drainage (2007)
	Training of officials of SUDECAP and SMAMA (2008)
	SWITCH presentation on World Water Day (2008)
	Presentation about SWITCH to city councillors (2008)
	Second seminar with institutional learning alliance (April 2008)
	Start of visioning exercise with learning alliance (Aug 2008)
Documentation	Publication of 3 issues of the SWITCH Belo Horizonte newsletter
	Publication of Portuguese language leaflet
	Press releases for 3 local and State level newspapers and tv presentations.
	Article published in the newsletter of Projeto Manuelzao
	Two articles published in the official newspaper of the Municipality

Facilitation of SWITCH Belo Horizonte and its learning alliance

In addition to these activities, there has been a lot of effort put into the coordination and facilitation of the process. This role has been shared between UFMG and the Municipality. UFMG has the overall responsibility for coordinating the project. The Municipality is responsible for the facilitation of the learning alliance process, and the links with other stakeholders. A part-time facilitator has been appointed within the SUDECAP department of the Municipality. It is her responsibility to organise meetings, and ensure that documentation takes place, ensure linkages between the research, demonstration and learning alliance activities at local level. She is supported by a community mobilizer, particularly for the alliance activities at local level. Other staff within the Municipality also contribute to facilitation. For example, the International Relations Secretariat provides logistical support for larger events, and can play a useful role in inviting participants from outside the Municipality.

At the beginning of the process, facilitation mostly involved introducing the project to existing contacts through bilateral face-to-face meetings and information leaflets. There were parallel tracks at different scales with the local and institutional alliances. Now, more emphasis is being put into organising dedicated meetings for all the learning alliance members. For example, a series of workshops to develop a long term vision and strategy for IUWM are being carried out now. With the local learning alliances, communication happens on a frequent, often weekly, basis around the demonstration activities through emails, phone calls and face-to-face meetings.

In Belo Horizonte, the total SWITCH budget for both UFMG and the municipality is €1,772,509, of which the Municipality provides an in-kind contribution of €957,509. Up to and including 2007, a total of €28,000 was invested in Learning Alliance activities, most of which was spent on organising learning alliance meetings, training the learning alliance facilitator and publishing the SWITCH newsletter. In-kind contributions from both partners were provided in the form of meeting rooms and media equipment, voluntary work of PhD and MSc students as well as staff. A scholarship programme from UFMG, with the support of Federal and State level funding agencies, provides about 90% of scholarships for PhD and MSc students, who are involved in research related to the SWITCH project in Belo Horizonte.

RESULTS AND DISCUSSION

In the previous section, we have considered the logic behind the SWITCH approach to achieve integration, and the activities actually being carried out. This section presents the results of the project so far, in terms of progress in achieving better integration and change. We do so by first presenting the results per type of activity, analysing how these contribute to the overall objectives.

Demonstration activities form the heart of SWITCH at the local level

At the local level, demonstration activities are considered to form the heart of SWITCH, as these are the activities where innovations are evaluated, around which local learning alliances are being mobilized, where research is carried out, and where awareness raising and capacity building takes place. The types of demonstration technologies differ from case to case (see also previous section). But, in general these are local and small-scale technologies. Technologies were identified by the SWITCH team mostly, as possible responses to local needs. The box below illustrates the types of demonstration projects, and their origins at three secondary schools in Belo Horizonte.

Box 2: Learning about drainage at three schools

Three of the demonstration activities take place at secondary schools. The types of technologies that are demonstrated at these are different, as have been their trajectories of involvement in the project so far.

The **Pedro Guerra School** is located in the Vilarinho sub-catchment. In the past it used to be affected by local flooding, until major drainage works were undertaken. These were done in the traditional way, i.e. big concrete culverts. However, the old stream beds are still in a poor condition because of, amongst other reasons, diffuse pollution. In response, a constructed wetland was proposed by SWITCH to remove part of the pollution. In addition, this wetland would re-create a more natural and greener environment in the neighbourhood and would also create a recreation area. Pupils of the school were involved in carrying out a study on the perception of water management in the area which served as a basis for technology selection and design. It will now play a role in mobilizing the broader community and monitoring the implementation of the works.

The **Anne Frank School** was not selected by SWITCH to become a demonstration project. Rather, the school approached the project team as it was busy working on water-related and environmental education, and the school saw SWITCH as an opportunity to expand its work. The demonstration activity consists of a rainwater harvesting facility. Access to water was not an immediate priority for the school, as it is connected to the main water supply system. Rather, this technology is being demonstrated to allow the school to undertake experiments on water conservation and reuse for purposes of school gardens and cleaning the school grounds.

Finally, the **Lidia Angelica School** is located next to the Lagoa do Nado park. A number of streams flow through the park, some of which have caused floods in the past. In response to these floods, big gabion structures were built, but do not fit in at all with the green environment. SWITCH now wants to demonstrate alternative forms of drainage that are in better alignment with the park surroundings. The school will act as a key partner since it uses the park for recreation and science education.

Pictures of the demonstration activities can be found in Annex 2.

Establishing the demonstration activities has not been without difficulties. In the process of design and tendering for the works, long delays have occurred. The same has happened with the procurement of some of the monitoring equipment, for example around the Vilarinho wetland. The main reason for these delays lies in the procedures that need to be followed within the Municipality. These delays run the risk of reducing the interest of the learning alliance members. On the other hand, these issues also reflect the reality of municipal service delivery, with all its strengths and weaknesses and the SWITCH demonstration projects just follow that reality. It is still too early to assess the results of the demonstration projects and the effectiveness of the new technologies. However, we can identify the role of the demonstration projects in helping mobilizing learning alliances and facilitating research in the next sections.

The demonstrations taking place at sub-catchment scale are of a different nature. The focus is placed more on installing alternative infrastructure, such as infiltration trenches, and carrying out related monitoring and research, without a local learning alliance, or broader stakeholder involvement. Reasons for that will be discussed in further detail in the next section. However, some stakeholders have expressed a demand for demonstration activities, with corresponding alliances, at higher level of scale, for example in the form of a complex of drainage works (including infiltration trenches, installation of collector drains, development of surrounding parks, etc) which cover a certain urban sub-catchment, such as the typical set of interventions of the DRENURBS programme. The representative from COPASA, for example, sees more need for those kind of demonstration projects, as that is also the level at which they operate and can become part of an alliance, instead of around small-scale and localised technologies.

Local learning alliances mobilized around demonstration projects

Around the demonstration projects local learning alliances are being set up. These alliances typically have the following members:
- Schools - school communities (i.e. teachers, students and parents) have been identified as central to the establishment of local learning alliances and provide excellent locations for technologies to be demonstrated. School communities have the capacity to mobilize the broader community in their neighbourhoods. Secondly, as Municipal establishments, they represent the Municipality in the community, and they often have contacts with other technicians and municipal officials in their neighbourhood. By carrying out the demonstration activities at schools, it is also possible to involve pupils in the research, serving as part of their science curriculum for example.
- Broader group of community members.
- Officials and technicians of different municipal units with presence in the neighbourhood such as staff from health points, the participatory budgeting or of the Parks Foundation.
- Officials from the Regional Offices of the Municipality. Belo Horizonte is divided into 9 regions, and each region has its own office that acts as first point of entry to the Municipality for the community.
- Officials and engineers from the central level of the Municipality, such as SUDECAP and the Education Secretariat

Through this composition the attempt is to achieve local scaling-up in three ways through the alliances. Horizontal scaling-up takes place via the schools and the school community, students and teachers are able to share their knowledge and information with the broader community, to become aware of urban drainage issues, and take local actions. Institutional scaling-up occurs

where local officials, e.g. of the Parks Foundation, are able to scale-up new knowledge to other areas in their jurisdiction (see for example Box 3). Finally, where some members of the local alliances are also active in the institutional alliance, such as the Education Secretariat and staff from SUDECAP, they form the active link between both alliances, and can promote scaling up via the institutional alliance.

Although the local demonstration projects are only beginning, they have generated a lot of enthusiasm and expectations among the local alliances. Their expectations are a mix of local impacts and scaling up:
- Getting access to information and knowledge about local water management. Particularly, the schools want access to this in order to expand and improve educational material they use on environmental education.
- Being able to carry out science experiments around the SWITCH demonstration technologies. Again, this is particularly an expectation of the school community.
- To improve environmental and water conditions around the schools and community. This is the ultimate goal of the demonstration technologies around which the learning alliances are organised.

Box 3: Passionate about parks

Everyone knows him by his nickname of Guto. He is Sérgio Augusto Domingues, the Director of the Parks Department III at the Parks Foundation. He is responsible for development and maintenance of parks and green areas in his part of the city. Parks and green areas have become very important over the last year, as part of an attempt to improve the living environment in a city that has been plagued by crime and lack of public spaces in the past. Since the establishment of the Parks Foundation a couple of years ago, the number of public parks and green areas in the city has increased from 52 a 77. Guto is passionate about the parks in his area. As such, he is very enthusiastic about the demonstration and learning alliance at the Lagoa do Nao Park. SWITCH will work there on improving drainage conditions. It involves protecting springs that originate in the park, using more natural drainage channels instead of the current concrete and gabions, and reducing pollution flows into the park. This will offer a learning opportunity for the school community to participate in science experiments. But, Guto is not only there to improve the Lagoa do Nado Park, he also wants to learn to use similar technologies and approaches in other parks in his area of jurisdiction, particularly the ones developed around the DRENURBS programme, and in this way contribute to scaling up.

The degree and path of development of these local alliances has differed across the localities. All have seen a number of bilateral meetings in combination with an awareness raising or community mobilization event, around environmental education activities that the schools were organising. An example is an event organised in the Vilarinho catchment, called "*um dia na bacia*" (a day in the catchment). During this day, the school community together with a group of officials and the broader community visited the local drainage area, identifying good and bad practices around water management and organised competitions for the young people. A second day in the catchment is planned for September 2008. Around the Lagoa do Nado alliance, an awareness raising event was held, linked to the Water Messengers Project, at which Danielle Mitterand was present. At the Pedro Guerra School some more activities have taken place around the environmental perceptions study. This latter one is furthest developed as it has seen more activities so far, while the former two are still in the process of development (see also the scoring ladders in annex 1, for further details on their degree of establishment).

In terms of impacts so far, within the communities awareness has been raised about the importance of drainage and urban water management and some capacity has been built to identify and propose interventions in urban drainage. This is seen, for example, in the fact that the Lidia Angelica School has submitted a drainage project to the participatory budget to reduce local flooding around the school. It even has been shortlisted. The Pedro Guerra has supported the inclusion of the wetland mentioned earlier and surrounding green areas into the participatory budget. Maintaining this enthusiasm and interest is now a key challenge and above all will require rapid completion of the demonstration projects, and good accessible research around them.

As mentioned, alliances have not been set up around the demonstration projects at sub-catchment scale. One reason for this is to avoid confusion for the community. For example, in the 1° de Maio area, a community group was already established through the DRENURBS programme. Establishing another alliance was expected to create confusion. Upon seeing the enthusiasm and interest created by the local demonstration projects, and the demand expressed by agencies such as COPASA, the SWITCH team is now considering establishing alliances at this scale. It would need to consider how it can build upon the local groups set-up as part of DRENURBS, as well as with other agencies, and work with those under a learning alliance mode.

Developing new knowledge: from multi-disciplinary to inter-disciplinary research

A defining characteristic of most research in SWITCH is that it is carried out with close links to demonstration activities. The demonstration technologies are the subject of research in terms of their functioning and performance. In Belo Horizonte, this includes both academic research and tests by the schools. However, such "real-scale" research poses challenges for researchers, particularly as compared to laboratory experiments. It is more difficult to measure all control factors, and access to the sites with monitoring equipment is often difficult. The interviewees considered that there is an added value in such technological research at real scale. Particularly for the Municipality these demonstration activities are important to test some of the technologies and approaches it has already been using. Besides, it offers data on performance in a real setting, reflecting aspects of the realities of maintenance, costs, etc. The expected result of the research is not so much a series of technological innovations, but rather knowledge on validated use of technologies in their real settings in Belo Horizonte.

In the research around the demonstration projects, as well as around the modelling, UFMG researchers receive support from some of the international researchers (see section 3 on the details). Results from the research in Belo Horizonte feed back into the broader work packages within SWITCH on stormwater management. Researchers from both sides are satisfied with the level of support and coordination, particularly on the timely inputs from both sides.

Something similar can be said about governance-related research. This is not expected to generate a completely new governance model. Rather, it has focused on understanding the current governance arrangements, validating those, and indicating strengths and weaknesses. This has helped some of the researchers and Municipal staff realise that the actual governance arrangements are quite well developed in terms of participatory democracy as compared to other cities in Brazil and elsewhere in the world (see Box below).

Box 4: a watery perspective on urban planning provides a fresh look

Heloisa Costa is a professor at the Institute of Geosciences within the University. Trained as an architect, she is carrying out research on public policies around urban planning. Although she

had contact with researchers from the School of Engineering before the SWITCH project, she had never worked on a water-focused urban research project. Within SWITCH she is coordinating the governance-related research in the city. Even though most of the research is ongoing, SWITCH has already made some contributions to her work; most importantly it has brought a water perspective into theory of urban planning. Urban planners tend to plan the urban space from a land only perspective. Through SWITCH she has realised that water courses can also be ordering and integrating factors in urban planning. This insight will amplify some of the theoretical models used in urban planning research. SWITCH has also made more practical contributions to the university. An inter-disciplinary course on environmental management was already on the drawing board before SWITCH started. But cooperation between different research groups within the university in SWITCH has further forged these links and given an impetus to the development of the course, which will start in 2010.

However, the feed-back loop from governance-related research into institutional change processes is less clear as compared to the technological research. There are two main reasons. Firstly, governance research has been more analytical in its scope, i.e. analysing the current governance situation, without testing interventions in that same governance framework. Technological research does have a characteristic of intervention, and testing those interventions. Because of the analytical nature of governance research, it is difficult to link it explicitly to change processes. Secondly, governance research so far has been focused mainly at the city level and not at the local level. It has focused on understanding the main governance arrangements within Belo Horizonte, such as the already mentioned COMUSA and PMS, and the relation between the Municipality and COPASA. It has not gone as far as analysing governance arrangements in intervention processes. Now that the demonstration activities are starting, this is expected to change.

Because of these limitations, it has so far proved difficult to define strategies for institutionalising or scaling-up results of governance research. Some dissemination activities have been undertaken, such as presentations of the result of governance-related research to the institutional learning alliance, or supervising thesis students who are municipal officials themselves. However, the scope of these dissemination efforts could be broader.

At the same time, it is realised that the learning alliance is a form of institutional change and merits being researched and documented from an academic perspective. This has not happened so far, since the focus has been on adapting the learning alliance approach to the Belo Horizonte context and its establishment. It is now suggested to focus governance-related research in the second half of the project on the functioning of the learning alliance and their impacts.

In addition to stimulating research into use, SWITCH also promotes integration between different research areas aiming to address urban water management issues in an integrated manner. Research so far has studied urban drainage from different disciplinary perspectives, including engineering, hydrology, political sciences and economics. And, some interviewees would characterise this mainly as multi-disciplinary research, as opposed to inter-disciplinary research. That is, different groups study urban drainage from different disciplinary perspectives, but with limited integration of the results or spaces to study urban drainage from the outset in interdisciplinary teams. Initial ideas for the establishment of interdisciplinary spaces haven't materialised. Probably, one of the reasons for that is that contacts between the different research departments have mostly been on an individual basis, and not institutionalised. Various concrete proposals have been made by interviewees, such as organising monthly research seminars,

promoting interdisciplinary student theses, and developing a web-based platform where researchers and students from different disciplines can more easily get into contact with each other.

Institutional learning alliance: scaling up within the municipality, but not yet beyond

The institutional learning alliance cannot yet be as clearly identified and analysed as the local ones. The main reason is that it is a more diffuse group. The institutional alliance has now met some five times, often with participation of different officials. In addition, there have been bilateral meetings with other institutional players. The key stakeholders that have actively engaged with SWITCH either bilaterally or in the alliance include (see Box 1 for further explanation of the roles of these actors):

• Various entities and programmes under the Municipality. These include amongst others SUDECAP, SMAMA, the participatory budgeting secretariat, Education Secretariat, International Relations Secretariat, the Global Changes Committee, COMUSA and the DRENURBS programme. These all have contributed in a proactive manner to SWITCH and have engaged in analysing its research results which is elaborated later.

• Various departments within UFMG. They are not only participating as researchers but also as members of the learning alliance.

• RMBH and neighbouring municipalities. They have so far been passive recipients of information about SWITCH, but have already expressed interest in learning more and becoming actively involved.

Some other stakeholders that were identified as important but haven't engaged yet proactively in the project include COPASA, the Velhas river basin committee, and Projeto Manuelzão. Representatives of these organisations have participated in the seminars and they have been briefed bilaterally of the project and its work. But, they are not yet actively participating, either at local or institutional level. Another group of stakeholders which is considered missing from the alliance are consultants and contractors. Often, they have a big role in defining for example the technologies used in drainage works. However, as long as they are not familiar with the technologies or approaches SWITCH is promoting, they might continue using conventional ones. However, this is also a difficult and disperse group to engage in the alliance. The difficulties in mobilizing some of these other stakeholders have also been reflected in the scoring ladders (see Annex 1).

One of the main reasons for the difficulties in forming the institutional alliance may be that at institutional level there are no concrete activities around which they can engage, unlike the ones at local. At the time of the writing a new series of activities started with the institutional alliance, focused on the development of a long-term vision and strategies for urban water management in Belo Horizonte. It is expected that this visioning exercise will provide a concrete set of activities around which stakeholders are interested to come together, probably identifying a clearer role of at least a core group of stakeholders in working towards such a strategy.

At the same time, some of the interviewees expressed scepticism about the feasibility of an institutional alliance in Belo Horizonte, particularly doubting whether the learning alliance wouldn't cause duplication of effort with existing platforms such as COMUSA. Within COMUSA, the main players are already coming together to plan priorities in sanitation interventions. Although the focus and mandate of the learning alliance would be slightly different from COMUSA, there is a risk of it being seen as a duplication of effort. Interviewees recommended that some further thoughts are given to how the learning alliance may feed into the

COMUSA or otherwise support its activities. At the time of writing further discussions started to make sure that SWITCH would be a recurring point on COMUSA's agenda.

A third limitation to engaging stakeholders outside the Municipality lies in the mobilisation capacity of the facilitator. As an official of the Municipality, she cannot just invite others outside the Municipality to meetings or seminars as they fall outside her jurisdiction. It is considered easier if mobilisation of outside stakeholders would be done by UFMG as a Federal institution.

Finally, there was an expectation that alliances could be built with other cities in Brazil with similar characteristics. Unlike some of the other countries in which SWITCH is active, Brazil has a large number of cities similar in size and characteristics as Belo Horizonte, particularly State capitals such as Brasilia, Curitibá, Fortaleza, Porto Alegre and Salvador. Representatives of both municipalities and universities from these cities were not envisaged to be part of the institutional learning alliance, but that SWITCH would feed results into existing networks with them. So far this hasn't happened, amongst other reasons because of difficulties in aligning SWITCH's objectives, calendar and scope with those of the other networks.

Despite these limitations in forming a multi-stakeholder alliance, the Municipality can arguably be considered as the most important potential user of SWITCH's research. Mobilising the range of municipal entities with a role in water management, has already been an important attempt at integration in itself. Therefore, it is important to analyse the impacts in a separate way for some of these main units. Here, we can see a number of ways in which SWITCH's approach and results are being institutionalised:

- The use of more natural technologies is now being considered as conditional in projects to be approved by SMAMA.
- Strengthening of capacity of COMFORÇAS, the Commissions for Control of Participatory Budgeting Works. After the participatory budgeting secretariat became interested in SWITCH results, it has created the possibility to train COMFORÇAS in aspects of innovative urban drainage technologies. These may then be better addressed in proposals submitted to the participatory budget.
- DRENURBS works closely with SWITCH, as they are using similar approaches on technologies and intervention methodologies. For DRENURBS, SWITCH is the project that validates and provides learning on its approaches. There is thus a direct feed-back into DRENURBS' approach.
- Inputs into the Global Change Committee. This committee is drawing up strategy on Belo Horizonte's adaptation to global change. This will be presented this to the council to be developed into a municipal bye-law, although this work may be taken beyond the municipal elections (in October 2008). SWITCH has contributed to the works of this Committee by sharing principles of eco-efficiency in water management.

Although these are all considered important mechanisms for scaling-up elements of SWITCH's approach, it must also be said, that these cannot solely be attributed to SWITCH. Many of these changes had already started before SWITCH, for example through DRENURBS. SWITCH has found its niche in validating the approach and disseminating results among different municipal entities.

There are still big challenges in scaling up SWITCH's concepts within the Municipality, in particular the more participatory way of working. There is some openness to change approaches in technology, but less so to more participatory ways of working among municipal engineers, or

even outside contractors. The main reason is that many municipal engineers have not been trained in the importance and application of these approaches, which they may even see as a challenge to their authority.

Process facilitation and documentation

Alongside promoting changes, SWITCH project efforts have gone into facilitation and documentation of the change process. This section analyses some of the results and difficulties in this task.

Facilitation responsibilities have been centred within the Municipality. This is quite a distinct "host" for facilitation of learning alliances. In other cities in SWITCH, or even other projects that use an learning alliance approach, this role most often lies with a knowledge institute or Resource Centre (see Smits et al., 2007b) as these are seen to be more neutral by all stakeholders. The facilitation role has largely been taken up by one person, the learning alliance facilitator, based in the municipality. Her role in facilitation has been organising meetings and seminars, day-to-day communication with different entities within the Municipality and outside and coordinating alignment of the demonstration activities and local learning alliances. In the latter task she is supported by other facilitators, amongst others from the DRENURBS programme. In addition, the Municipality has assumed other facilitation roles. The International Relations Secretariat has played a role in mobilizing stakeholders from outside the Municipality, and in providing logistical support. SMAMA has played a role in presenting SWITCH's work to the Municipal Council.

The fact that the facilitation role lies with the Municipality has had a major advantage in institutionalising SWITCH's approach and its first results into the different entities of the Municipality. It is reckoned that it would have been difficult for an outside facilitator to mobilise those different units and ensuring that its results get institutionalised in such a broad range of sub-units. Besides, it would have been much more difficult to align and link SWITCH to implementation programmes such as DRENURBS. However, this municipal home to facilitation has also had some disadvantages. As mentioned earlier being placed in the Municipality, limits capacity to mobilise stakeholders from outside, since certain protocols and procedures need to be followed, and can take a long time. Besides, the Municipality has no formal jurisdiction to mobilize other municipalities, or State level agencies. It is considered that it may have been easier if the mobilisation were done by a State level entity.

Another important task in facilitation the process has been in documentation and information management. Although some activities have been undertaken (see overview of activities earlier one), this has been limited. One of the main perceived gaps has been in the establishment of a SWITCH Belo Horizonte website. There is some basic project information available on the general website, as well as a link on the PBH website. However, a more interactive and informative one for the project partners and stakeholders is not there. Some of the interviewees expressed a demand for it. It could for example facilitate a much better integration between the different researchers, and even be used as a project management tool. Although this tool has been discussed between project team members, there have been delays in establishing such a site partially because of slow procedures within the Municipality.

Another limitation is documentation of processes. The facilitator and others in the team have made a register of the activities that have taken place, such as events and meetings. But, analysis and synthesis of the process, and learning and adaptation based on such analysis has been

difficult. A main reason is that such kind of documentation is rarely done within public offices, such as a municipality, and skills and expertise to do so are lacking. Upon reflection, the SWITCH team considers that process documentation could better be shared between the Municipality and UFMG which has a tradition of analysis, synthesis and documentation.

Given the specific situation of the position of the facilitation responsibility in the Municipality, it is felt that more support could have been provided to the facilitation team from the international SWITCH network. Although the learning alliance facilitator has obtained some support through attending trainings on learning alliance facilitation, process documentation and monitoring of learning alliance, additional back-up support would have been useful in the application and adaptation of these broad concepts to the specific Belo Horizonte context. Learning alliances need to be seen as a broad methodology or framework which needs to be adapted and applied in the given context of a city like Belo Horizonte, with its pre-existing structures and mechanisms for multi-stakeholder dialogue and decision-making. In this adaptation, it would be useful to have a sparring partner, or peer, with whom to exchange ideas. Such a person would help thinking through how the local adaptation and contextualisation could take place, and act as a back-up to the facilitator and her team. Such a person could provide also feed-back to plans and ideas for the learning alliance, through distance-support and the occasional visit.

A second limitation in international support has been the language barrier. Although the facilitator speaks English, others in her team don't. This has meant that relatively a lot of time goes into translation of supporting documents from the international network. It has also limited the participation of other team members in trainings, or other interactions with international network members.

CONCLUSION AND RECOMMENDATIONS

SWITCH aims to contribute to a paradigm shift in urban water management towards a more integrated and participatory approach. In Belo Horizonte, it particularly aims to develop new knowledge on urban drainage and to improve access to and use of information that strengthens the capacities of city stakeholders in democratic decision-making on water management. SWITCH encounters a receptive environment in Belo Horizonte with high potential to achieve its objective. This positive enabling environment is created by a number of factors:
- A paradigm shift towards more integrated and environmental approaches to urban drainage had already started before SWITCH and some innovative technologies were already being tested and applied in municipal programmes.
- Belo Horizonte had made significant progress in democratizing its general decision-making mechanisms, as well as on water management specifically, such as participatory budget, COMUSA and participatory approaches at project level.
- A good working relation existed between individuals of the University and the Municipality. There was willingness and interest from the Municipality to use research results in the development of its programmes, and interest from the University to carry out applied research on real-scale developmental problems

The expectation of interviewees is for SWITCH to play a complimentary role to these initiatives, and to build upon them. Its expected niche and added value would lie in evaluating and validating technologies and intervention methodologies on urban drainage. In addition, its role would be in facilitating learning and sharing on these approaches amongst different stakeholders, so they gain capacity to participate in decision-making processes on urban water management.

This complementary role is reflected in the intervention logic of the project. In this, locally relevant mechanisms and institutional entry-points for institutionalising knowledge and scaling-up locally and beyond have been identified ranging from schools to participatory budgeting, the DRENURBS programme, different entities within the Municipality and the RMBH. Through a mix of demonstration, research, learning alliance and documentation activities, SWITCH tries to tap these entry points to scaling-up. Most of these activities are now in place though there is still room for improvement.

Demonstration activities play a crucial role in mobilizing local learning alliance. It is around such concrete demonstration activities that stakeholders are willing to come together and learn. So far, these alliances have shown high levels of enthusiasm and commitment. However, delays in design and construction can erode this rapidly. The demonstration activities at sub-catchment scale do not have yet any learning alliances linked to them, even though there is some demand for such demonstrations linked to a learning alliance at this level.

Part of the research is clearly linked to the learning alliances and demonstration activities, particularly at the local level. Results of this kind of research are already contributing to knowledge development at global level. Research at sub-catchment level, or governance-related research is not yet linked to learning alliance activities. For the latter type of research, this is also more difficult as it is less easily linked to intervention processes. Yet, the learning alliance approach, which in itself is a form of governance change, offers the possibility for linking research to its use in change processes.

Applying the concept of an institutional level learning alliance in Belo Horizonte has proved to be complicated, requiring local adaptation and contextualization of the learning alliance approach. Most of the efforts have gone into mobilising different units within the Municipality, and some of the elements of the new paradigms to urban drainage are being picked up and institutionalised within the OP, DRENURBS and SMAMA for example. The relative success in mobilising different units of the municipality and putting research into use in these units probably is due to the location of the facilitation role of SWITCH within the Municipality. At the same time, this may have limited the mobilisation of other stakeholders outside the Municipality. This has contributed to the fact that the institutional alliance is less robust. This is compounded by the fact that there are less clearly defined activities in which the institutional alliance can be involved than the local ones. It is expected that the series of visioning exercises can improve that situation.

One of the areas for improvement lies in documentation. Although some basic communication tools have been developed, more interactive ones such as a project website and platform are lacking. A second area for improvement is in the documentation and analysis of the change process which has taken so far. This proves to be a difficult task, for which skills are lacking in the facilitating team, and requiring further research support.

Some support has been given from the international network to the SWITCH city team in Belo Horizonte in facilitation the adaptation of the learning alliance approach in Belo Horizonte. Yet, this is considered to be limited particularly in view of the scale of the task and other factors such as the language barrier. Support to research activities is functioning satisfactorily, as the language barrier is less of an issue between UFMG and international network members.

In conclusion, Belo Horizonte offers SWITCH an interesting case study of a city where a paradigm shift on urban water management was already happening, both in terms of

technological innovation and democratization of its governance structure. SWITCH in Belo Horizonte has tried to develop its intervention logic in such a way that it could build upon existing initiatives and use them as entry points for scaling up. These links are indeed being put to use, both locally, as well as within the Municipality. Yet, more can be done to achieve the fullest possible impact, particularly in strengthening the institutional learning alliance and in the facilitation and documentation of the change process. Here, further support from the international network may be needed.

In response to these conclusions, the team has formulated a number of recommendations. We have tried to make these as practical as possible. Most of these activities wouldn't require a lot of additional resources. Where they do, it is indicated.

Demonstration
- Consider establishing learning alliances around the demonstration projects at sub-catchment scale. There is demand for learning and research on technologies and governance aspects at this slightly higher level of scale. Besides, they offer another entry point for scaling, for example through COPASA and DRENURBS. DRENURBS interventions could act as such demonstration projects, around which research and learning alliances can be established. This could have budget implications, as establishing additional alliances will require extra resources for facilitation. However, these could be very cost-effective investments, in view of the additional potential for scaling up.

Research
- Develop further spaces for achieving inter-disciplinarity among the researchers, for example by realising monthly research seminars in which the three research groups participate, developing inter-disciplinary thesis projects, and offering an interactive website, through which student and researchers from all groups can engage.
- Start governance research around the demonstration projects at local level. This will forge a closer link between governance research and the local learning alliances.
- Start governance research about the learning alliance approach itself. The learning alliance has been conceived to some extent mainly as a mechanism to bring research into use. Yet, as a new concept to encouraging institutional and governance change in Belo Horizonte, it also has the potential to be an interesting subject of research itself.
- Continue support to the research activities from the international network, as planned already.

The latter two recommendations would require a dedicated budget, which may come in addition to planned governance research, or could come from a re-allocation of governance research budgets.

Institutional learning alliance
- Further strategise on the future of the institutional learning alliance, particularly on the involvement of stakeholders beyond the Municipality. Here, consideration needs to be given to avoiding duplication of effort with other platforms such as RMBH and COMUSA, the purpose of the institutional learning alliance, and sharing of the responsibility in facilitating the alliance between UFMG and the Municipality. Probably, the visioning workshops that are currently taking place can play a role here as well.

Facilitation and documentation

- Improve some of the internal communication mechanisms, particularly through an interactive website, aimed both at those involved in the project and alliance members.
- Share the task of process documentation between UFMG and the Municipality. Whereas the Municipality can maintain its role in registration and basic documentation of all events, meetings and interactions, UFMG probably has more capacity in synthesising and writing process documentation documents.
- In further applying and adapting the learning alliance approach (particularly at institutional level) it is recommended that Belo Horizonte has a sparring partner from the international network with whom it can exchange ideas and jointly develop the approach. Its role would be to help thinking through the local adaptation of the learning alliance approach, and provide feed-back on the plans, ideas and activities of facilitating the alliance, through a combination of distant and on-site support. Such a partner could either come from a "global" partner or from one of the other cities. Resources would need to be made available.

By incorporating these recommendations a number of current shortcomings of the project can be overcome. We feel that these are all practical recommendations which can feasibly be addressed during the remainder of the project, in a cost-effective way. In that way, we expect that Belo Horizonte can indeed live up to its full potential, and act as a laboratory for IUWM, just as it has been a laboratory for urban planning from the times of chief engineer Aarão Reis and Oscar Niemeyer.

ACKNOWLEDGMENTS

REFERENCES

Annie E. Casey Foundation (2003). "*Topic Paper Process Documentation.*" Written for 'Making Connections A Neighbourhood Transformation Family Development Initiative". Baltimore, USA. http://www.aecf.org/initiatives/mc/llp/llp_reading/processdocumentation8.5x11.pdf

Butterworth, J.A. and M. Morris (2007) *Developing processes for delivering demand-led research in urban water management.* SWITCH Working Paper. http://www.switchurbanwater.eu/page/1789

Butterworth, J.A. and C. Dasilva (2008) *Learning Alliance Briefing Note 7: A framework for monitoring and evaluating project outcomes at city level.* SWITCH Project briefing note series

Nascimento, N.O, Heller, L, Baptista, M, Heller, P., Chernicharo, C, Knauer, S. and J.R. Champs (2007) *Long-term uncertainties and potential risks to urban waters in Belo Horizonte.* Paper presented at SWITCH Scientific Meeting, 9-10 Jan 2007, Birmingham, UK

Schouten, T. (2007) *Process documentation.* Learning alliance briefing note No.6. SWITCH Project, Delft, the Netherlands

Schouten, T. Mizyed, B. Al-Zoubi, R., Abu-Elseoud, M., and F.T. Abd-Alhadi (2007) *Inside Story: Process Documentation; Experiences from EMPOWERS.* INWRDAM, Amman, Jordan

Smits, S., Moriarty, P., and Sijbesma, C., (eds). (2007a) *Learning alliances: scaling up innovations in water, sanitation and hygiene*. Technical paper series; no. 47. Delft, The Netherlands, IRC International Water and Sanitation Centre. http://www.irc.nl/page/35887

Smits, S, García, M, Moriarty, P. And P. Laban (2007b) Building learning alliances – some initial findings. In: Smits, S., Moriarty, P., and Sijbesma, C., (eds). (2007a) *Learning alliances: scaling up innovations in water, sanitation and hygiene*. Technical paper series; no. 47. Delft, The Netherlands, IRC International Water and Sanitation Centre. http://www.irc.nl/page/35887

Smits, S.J, Nascimento, N.O., Dias, J., Nunes, T. and S. Knauer (2008) *Governance of urban environmental sanitation: a case from Belo Horizonte, Brazil*. SWITCH Working Paper

Wikipedia (2008) *Wikipedia on-line encyclopedia*. www.wikipedia.org

ANNEX 1: SCORING LADDERS FOR BELO HORIZONTE

These are the scoring ladders, filled out and analysed in August 2008. An earlier exercise was done in January 2008, but due to lack of clarity on some of the descriptions, these were considered incomplete.

Objective 1: We know who learning alliance members are, and facilitate communication between them effectively

Scenarios for objective 1	Score
This is no accessible record of learning alliance members, and their involvement in various events and activities	0
There is an out-of-date record of learning alliance members and their involvement in events and activities	25
There is an up-to-date record of LA members and their involvement, and some basic communication tools are systematically used (e.g. email, phone) between events	50 benchmark
There is an up-to-date record of LA members and their involvement, and archives are maintained through systematic use of advanced communication tools (e.g. a Google group).	75
Member information is accessible to all (e.g. online database), participation in all events and activities is systematically recorded and a combination of methods is used effectively (based on feedback received) to communicate between events.	100
Justification of score (Aug 2008)	**Score awarded**
There is a record of the LA members at local level, around the demonstration activities. Apart from communication with them through email and phone, there are regular face-to-face meetings with them. For the LA at institutional level, the record of members is only updated after events.	**50**

Objective 2: Regular, effective and innovative events capture and sustain interest of learning alliance members

Scenarios for objective 2	Score
Events (e.g. workshops, site visits, seminars) are not regular and only announced at the last minute.	0
Regular events are held at least every six months, but have limited impact in capturing the interest of learning alliance members.	25
Appropriate events are announced well in advance and use a mix of mainly standard methods to effectively engage interest of city stakeholders at least once every 3 months.	50 benchmark
Quarterly (or more frequent) events use effective and innovative facilitation methods (not just presentations and discussion).	75
Quarterly (or more frequent) innovative events result in high-quality reports (or other outputs) that capture content and ideas and are rapidly made available.	100
Justification of score (Aug 2008)	**Score awarded**
With the community alliance, there are frequent events, particularly field visits, meetings, presentations about SWITCH, mainly around the local-level demonstration activities. As these are only starting now, this is the first time more interactive methods are used.	**60**
The frequency with which the institutional level LA has met is 5 times per year. However, so far only presentations and discussions have been used. With the visioning process, which is starting now, also other methods are used.	**50**

Objective 3: Demonstration activities are undertaken within a framework for scaling-up

Scenarios for objective 3	Score
Demonstration activities are initiated without significant discussion in the learning alliance	0

Demonstration activities are decided after limited consultation with some members of the learning alliance	25
Demonstration activity plans are consistent and integrated within LA plans (city storylines) and are supported but without clear commitments to scaling-up	50 benchmark
Learning alliance members with potential to scale up demonstration activities pro-actively made suggestions and proposals that were addressed in demonstration plans.	75
Learning alliance members maintain a keen interest in demonstration activities at all stages and report back against their initial commitments to scale-up interventions.	100
Justification of score (Aug 2008)	**Score awarded**
The demonstration activities and sites were defined by the project team without involving the LA. Yet, the development of these is done with a number of local and institutional stakeholders. These are working with a clear vision to scaling up, within their mandates, such as through the Fundacao dos Parques, or the schools. Some institutions are members of both LAs, and are the prime movers in scaling-up, such as the Education Secretariat. However, some key organisations, are not involved around the demonstration, like COPASA or Projeto Manuelzao.	60

Objective 4: The SWITCH team and learning alliance understand why change is occurring in IUWM, not just what happens.

Scenarios for objective 4	Score
No process documentation is in place	0
Occasional ad-hoc process documentation is undertaken using some of available tools (including different media such as writing, photography, film etc) but with limited attention to detail or quality.	25
A few process documentation tools are used regularly following a process documentation plan but results are not widely shared.	50 benchmark
Several process documentation tools are used regularly and results are widely shared within the learning alliance	75
Effective process documentation is used for reflection and analysis that results in improved project implementation plans	100
Justification of score (Aug 2008)	**Score awarded**
Activities and events, such as meetings and field visits, are registered, using different media (reports, banners and photos). There hasn't been a compilation of these, nor a synthesis or analysis, which brings these together, and tries to analyse lessons learnt. Documentation is not shared in a structural manner with the LA. But, there is now a strategy to start the process documentation (captured in the LA work plan).	50

Belo Horizonte additional objective B1: A regular, quality flow of information between learning alliance members.

Scenarios for objective B1	Score
LA members do not respond to information requests from LA members.	0
Information is gained from LA members only on request of the facilitator.	25
LA members regularly and proactively share information with the LA facilitator, who then shares information with other LA members.	50 benchmark
Occasionally information is shared between LA members usually due to a specific event or need.	75
LA members regularly and pro-actively share information with each other using a variety of communication methods.	100
Justification of score (Aug 2008)	**Score awarded**
There is a regular flow of information between the facilitator and the LA members but there is no communication between them.	50

Belo Horizonte additional objective B2: Stakeholders are involved in priority setting in research.

Scenarios for objective B2	Score

Research priorities are set by researchers without any involvement of LA members, and are not even communicated to the LA members	0
Research priorities are set by researchers without any involvement of LA members but the research priorities are sometimes communicated to the LA members.	25
Research priorities are set by researchers without any involvement of LA members but the research priorities are always communicated to the LA members	50 benchmark
The LA members are consulted on research priorities.	75
Research priorities are set together by all the LA members and researchers using the LA platform.	100
Justification of score (Aug 2008)	**Score awarded**
Around all demonstration activities, local LA members have been informed about the research and demonstration activities. Institutional LA members have also been briefed about technological and governance research. There is room for specific research topics around each of the demonstration sites, in which the LA members can set priorities. This hasn't happened yet.	50

Belo Horizonte additional objective B3: Knowledge about sustainable urban drainage obtained by the different stakeholders at community and institutional level.

Scenarios for objective B3	Score
No communication, awareness raising and advocacy has been undertaken by SWITCH and its LA members	0
Communication, awareness raising and advocacy is being undertaken by LA members, but SWITCH results and concepts are not included	25
Communication, awareness raising and advocacy is being undertaken by LA members, and the main concepts and results from SWITCH are included	50 benchmark
Communication, awareness raising and advocacy is being undertaken by LA members, and SWITCH actively facilitates the inclusion of its main results and concepts	75
Communication, awareness raising and advocacy about water, including the main SWITCH concepts and results, is happening by LA members, and there is an active search for feed-back to improve and adjust messages for different stakeholder groups	100
Justification of score (Aug 2008)	**Score awarded**
A number of LA members and city stakeholders are carrying out awareness raising and advocacy activities around urban water management, such as Projeto Manuelzao and around the Participatory Budgeting. These contain many concepts and ideas that SWITCH also promotes, but so far SWITCH hasn't actively facilitated the inclusion of new concepts and results, nor are efforts undertaken to ask feed-back from stakeholder groups.	50

ANNEX 2: PHOTOGRAPHS

Photo 1: Oscar Niemeyer's legacy, the Pampulha Church on the shore of Pampula Lake

Photo 2: Edgar Garcia Maciel, headmaster at Pedro Guerra School indicating the map of the Vilarinho neighbourhood, one of the demonstration areas

Photo 3: existing gabion and concrete structures in the Lagoa do Nado Park

Photo 4: infiltration trench at the UFMG campus

Photo 5: Um dia no bacía (a day at the catchment), held in the Vilarinho, September 2007

Photo 6: training of community health workers at Venda Nova, May 2007

Photo 7: Danielle Mitterand visiting the Lidia Angélica school, at Lagoa do Nado park

Photo 8: installing gully with permeable bottom, at Vila Guaratã