Learning to work together on urban water management in the city of seven rivers: an assessment of the SWITCH project in Cali[1]

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I.   INTRODUCTION

Urban water management in Cali[2]

Cali is the third largest city in Colombia in terms of population with around 2 million inhabitants. It is located at the foothills of the Western Andean Cordillera.


Figure 1   Location of Cali in South America
Source: Wikipedia (2010).

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[1] Smits, S. et al., 2010. *Learning to work together on water management in the city of seven rivers: an assessment of the SWITCH project in Cali*. [online]. Available at: http://www.irc.nl/page/58311 [Accessed 7 December 2010].
[2] The water situation in Cali has been described in detail in various SWITCH documents. Unless referred to otherwise, the summary information presented here, draws on the most recent publication, Galvis et al. (2010).

Cali is known as the "city of seven rivers": six rivers stream from the Andean mountains through the City before ending up in the Cauca; the seventh marks the municipal boundary of Cali. Despite being so well-endowed with water resources, the city faces a number of serious water management challenges. Coverage of water supply services is nearly universal, at 97%. The Cauca is the main source of this water, directly supplying 77% of Cali's approximately two million inhabitants. The remainder is taken from intakes on the other rivers.
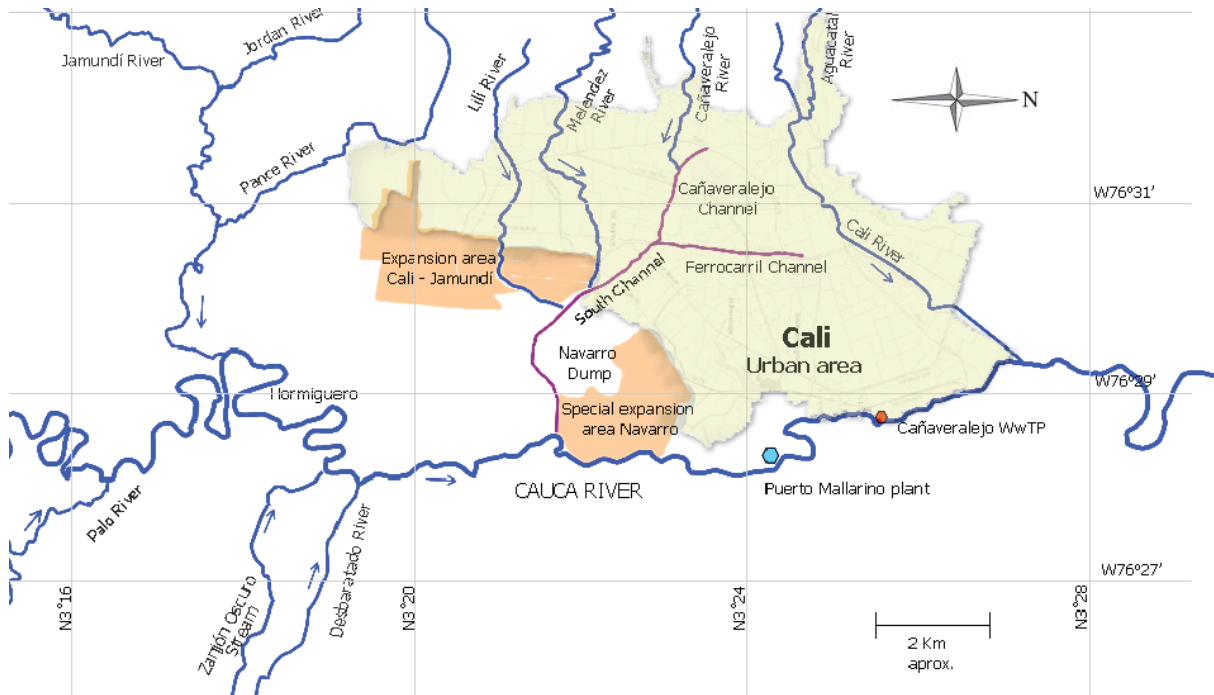
Figure 2   The seven rivers of Cali and its expansion areas
Source: Cinara/Univalle (2009).

All these rivers show a progressive deterioration in quality along their course. Manifold reasons include contamination with sediment due to deforestation in the upper catchment, and leachate from the now disused Navarro solid waste dump. Significantly, even though 95% of the population is connected to the sewerage system, only 56% of wastewater goes to the treatment plant. The deterioration in the quality of the rivers, particularly the Cauca, is now threatening the safe provision of water supply to the city's population. The situation is worst in the southern part of the city, where the South Drainage Canal discharges around 25% of the city's wastewater into the Cauca without treatment. This drainage outlet and the former Navarro disposal site are both located 5 km upstream of the main drinking water supply intake (and treatment plant) on the Cauca at Puerto Mallarino. Due to the increased river contamination, the drinking water plant has high operation costs and cannot function normally. The water supply company had to suspend the intake of raw water 37 times in 2007 because of high

contaminant concentrations in the river or high sediment caused by upstream erosion.

New urban expansion is currently planned in two areas adjacent to the city: the "Corredor Cali – Jamundí" where the construction of middle and higher income housing is projected; and the "Régimen Diferido de Navarro" (special expansion area) which is earmarked for low-income housing. These plans bring further water management challenges.

Both areas offer opportunities for local wastewater management and treatment, as they are far from the city's main wastewater treatment plant. Cali-Jamundi has a pleasant landscape which should allow for a wide variety of environmentally friendly water management options. The Navarro area is much less attractive as it is located on the former Cali city waste disposal site which implies a considerable health risk and is prone to flooding. Many, including the SWITCH team, consider that this area should not be considered for housing development.

Water governance

The problems summarised above are not new, although their severity is increasing. A study by Smits et al. (2008) examined the governance arrangements that exist in the city to address these problems and concluded that a high degree of fragmentation affects institutional roles in water and broader environmental management. This in itself does not need to be a problem, and may even reflect an appropriate separation of powers and functions. However, spaces for coordination and inter-institutional collaboration are limited and, as a result, there is little integration between the planning procedures and instruments of the different entities involved in water management in the city. Some of the underlying reasons for this lack of coordination include insufficient leadership to achieve a common vision across institutions, a divide between technical and political decision-making processes, and limited use of mechanisms to involve civil society groups. However, at the time of the study there was a growing recognition amongst interviewees of the need to work together across agencies to address the serious challenges. Some of the key stakeholders are listed and their roles briefly described in Box 1.

Box 1   Key stakeholders in urban water management in Cali

The main stakeholders in urban water management in Cali are identified below (based on Lobina et al., 2008).

Planning Department, Municipality of Cali is responsible for urban planning and aims at promoting the integrated sustainable development of the city. The Department is responsible for municipal development planning in relation to space, but also from the socioeconomic, environmental and administrative points of view. It does so in coordination with other municipal departments.

Regional Corporation of the Valle del Cauca, CVC has jurisdiction over the Department of the Cauca valley. This regional authority is responsible for the implementation of policies affecting natural resources, including awarding concessions, licences and permits for the use and exploitation of natural resources, environmental regulations on the use of water resources, and the definition of provisions and directives on river basin management.

Cali Municipal Enterprise, EMCALI is a 100% municipally owned multi-utility providing water, energy and telecommunications services to the city of Cali. Water services include water supply, sewerage and wastewater treatment.

Solid waste municipal company, EMSIRVA is currently being liquidated, but has been an important player in the course of the project. This used to be the agency responsible for solid waste collection, and the operation of the Navarro landfill, including management of its leachates. The company is being replaced by a new private enterprise, **GIRASOL**.

Administrative Department for the Management of the Environment, DAGMA is a municipal Department responsible for the development and implementation of environmental policies for the city of Cali.

Colombian Association of Sanitary and Environmental Engineers, ACODAL is a professional association for sanitary and environmental engineers. Among other things, it promotes knowledge management amongst its members and aims to actively engage its members in policy advocacy activities.

Regional Centre for Cleaner Production, CRPML is a research and advisory organisation, which promotes cleaner production mechanisms, particularly amongst small industries.

SWITCH in Cali

It is against this backdrop that the SWITCH (Sustainable Water Management Improves Tomorrow's Cities' Health) project was launched in Cali. SWITCH is a major research partnership funded by the EC (2006-2011), with a budget exceeding €20 million, undertaking innovation in the area of integrated urban water management (IUWM) in 12 cities across the globe. Its objectives are:

• To improve the **scientific basis** for integrated urban water management

• To **test and demonstrate** the feasibility and potential of **innovative technologies**

• To support **cross-institutional platforms** and better linkages between urban water stakeholders in a city, and between research providers and users, to support an integrated approach to urban water management, and to maximise the uptake and impacts of science

- To improve **decision-support processes** towards the realisation of IUWM through evidence-based and far-sighted strategic **plans** and better **policies**.

Rather than focusing solely on new research, the project is explicitly aiming to put research into use, through its impact on stakeholders and, through them, on urban plans and policies.

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

The SWITCH generic objectives and approaches were translated into city-specific objectives with a focused intervention logic to achieve the objectives, according to context and needs. In Cali, SWITCH started with the limited aim of undertaking research into natural methods for wastewater treatment. However, as explained later in this paper, in early 2008 Cali became a 'demonstration city' with a greater scope for work on the water management cycle and the adoption of the learning alliance approach.

This 2010 assessment and the structure of this paper

In order to review progress and test assumptions underlying the generic SWITCH approach, the project undertakes process documentation activities. To that effect, at regular intervals, a reflection has been made on the intervention logic and its effectiveness in each of the cities. In 2008, a first round of assessments was undertaken (see Lobina et al., 2008 for the Cali assessment), with a focus on making the intervention logic in each of the cities explicit, mapping the initial outcomes of the project, and making recommendations for successful implementation. These assessments were very well received, as a method for critical self-reflection on the assumptions underlying each of the cities' intervention logic and the expected impacts.

In 2010, towards the end of the project, this exercise was repeated but with different objectives and scope. Specifically the 2010 assessments aimed to:

- Identify lessons learned on the effectiveness of the intervention logic

- Define recommendations for actions in the final year of project with a focus on activities that could still be undertaken to achieve the project goals

- Identify mechanisms and make recommendations for scaling up and sustaining impact beyond the life-span of the project.

This paper presents the results of the 2010 city assessment of Cali. It first outlines the methodology used. This is followed by explanation of the SWITCH approach in Cali, highlighting the intervention logic, team composition and activities, inputs and resources. The next section presents and discusses the results obtained so far. Finally, conclusions and recommendations are made, addressed both to the SWITCH team in Cali, and the overall SWITCH management team. Please note that this assessment was completed in April 2010, when the first draft of this paper was written. This time perspective should be kept in mind, particularly when reading about the final year of the project, since these may have been projections at the time of writing. Some recommendations in this paper have been acted on during 2010.

II.   METHODOLOGY

Since SWITCH aims to change traditional patterns, attitudes, relationships, approaches and ways of thinking about urban water management, it needed to understand their context and background. In addition, it has needed to track what it is doing (inputs) to achieve changes (outcomes). The tool used for tracking was process documentation. Process documentation can help 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). It does this through a process of continuous documentation of what a project is doing and achieving. At a number of specific moments, this process of (self)-reflection should be brought together in a synthesis that facilitates looking back at lessons learnt and looking forward to define recommendations to adjust the project approach. This paper, and the previous Cali City Assessment (Lobina et al., 2008), each represent a synthesis of such moments of reflection.

The main methods used to carry out the current process documentation exercise included:

- Review of project documents. This was mainly a desk-top based activity in which the authors reviewed project documents and tried to (re)construct a description of the project intervention logic to make activities and inputs more explicit.

- Reflection meeting with the project team. The project team in Cali met to discuss and reconstruct the intervention logic and reflect on the main results and weaknesses of the project. In this meeting various tools were used, including a reflection on the set of overall SWITCH indicators of success (see Annex 2) and a time-line exercise, the results of which are described in the next section of this paper.

- Review of project team and LA composition using a "gender and disciplines" matrix (see Annex 1). One of the objectives of SWITCH is to bring different types of stakeholders together and assess water management problems in an inter-disciplinary way; this gender and disciplines matrix was completed to provide further insight into the types and background of members of the project team and of the LA.

- Interviews with project stakeholders. These provided the bulk of the data used for the process documentation. The interviews sought stakeholders' perspectives on their role in the project, and the main changes they have seen as a result. An attempt was made to include representatives from the different institutions represented on the LA, including researchers and students as well as stakeholders who are not part of the LA but have recently joined the initiative. Table 1 provides an overview of the interviewees.

- Analysis within the SWITCH team. The final step was the analysis of the results of the interviews, the matrix and review of project documents with the team. These discussions led to the formulation of conclusions and recommendations.

Type of organisation[3]	Interviewees
Project team Cinara/Univalle	Alberto Galvis, Diana Zambrano, Diana Paola Bernal, Melissa Herrera, Kim Andersson, Anny Yurieth Martinez, Luisa Fernanda Calderón, Maria Fernanda Jaramillo, Carlos Martínez and Ines Restrepo
MSc and PhD researchers	Alberto Galvis, Diana Zambrano, Diana Paola Bernal, Maria Fernanda Jaramillo, Luisa Fernanda Calderón and Edda Cifuentes (Cinara/Univalle) Andrea Gaviano (former intern from UNESCO-IHE at Cinara) Monica Sanz (SWITCH researcher from Universidad Nacional in Bogotá)
Advisors from Europe-based SWITCH consortium partners	Jan Teun Visscher (IRC) Diederik Rousseau (UNESCO-IHE)
Local and regional authorities	Gloria Pardo (Planning Department of Municipality of Cali) Amparo Duque and Andrés Zambrano (CVC)

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[3] Descriptions of the organisations for which interviewees work can be found in Box 1 above or in the description of the project team, below.

	Franci Restrepo and Diego Carvajal (DAGMA)
Utility company	Gloria Almario, Luis Hernando Villaquirán, Francisco Camacho y Jorge Enrique Ángel (EMCALI)
Construction and consulting companies	Carlos Mauricio Posso (Constructora Buena Vista construction company)
	María Teresa Alarcón y Esperanza Cruz (consultants)
	Douglas Laing (independent consultant)
	Luis Alfonso Hurtado (independent consultant)
NGOs and professional associations	Carmen Eugenia Sterling (ACODAL)
	Ana Dorly Jaramillo (CRPML)

Table 1   Interviewees

Limitations of the assessment

Because of the authors' roles as facilitators and researchers, some interviewees may not have been fully open in their responses and critique. However, by triangulating results from interviews with the review of project documents, the assessors aimed to obtain the most realistic analysis of the change process so far. Some of the authors' roles within the city made 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 had only been involved to a very limited extent in the research in Cali and was brought in to facilitate the analysis, and provide a further degree of impartiality.

SWITCH approach in Cali

This section describes the way that the SWITCH project was approached in Cali. It briefly outlines the project's origins, the efforts made to link this to the urban water challenges described above, and the initial steps in establishing the project. This is followed by a description of the intervention logic of the project, i.e. the way in which the different activities aim to achieve the overall objectives. Information is then provided on the project team, partners and stakeholders. Finally, an overview is given of the actual activities and inputs made to date.

Project origins

SWITCH in Cali builds on a number of experiences and activities between the Universidad del Valle (Univalle) and city stakeholders (as described in Box 1 above). This includes research by CINARA in partnership with IRC International Water and Sanitation Centre into drinking water treatment, partly conducted on the premises of EMCALI; the post-graduate training programme of Univalle, supported by IHE, several graduates of which are working with key stakeholders in Cali. Previous CINARA research also includes the Modelling of the Cauca River (PMC) project (1997-2007) with CVC which generated insight into the water

quality and main sources of pollution of the Cauca river. Through these projects, Univalle managed to establish close relationships with some of the key stakeholders in water management in Cali and along the Cauca river. Another important initiative in the period 2002-2004, was the organisation of a series of mesas de trabajo (round table meetings) with the main agencies, including EMCALI, CVC and DAGMA. During these meetings, stakeholders analysed water management problems in the city and developed extensive problem trees, partly using information generated by models from the PMC project.

In following-up the mesas de trabajo, various efforts were made by some stakeholders to formulate projects to address the problems that had been identified. However, these often remained limited in nature, looking into only one part of the water cycle, or working only with one of the stakeholders. In the early 2000s, Univalle and IHE developed a research proposal on eco-technologies for wastewater management.

When the project began, Cali was established as what was called "a case study city", with research in just two areas, and without a learning alliance. During the first year of the project, the Univalle team, supported by UNESCO-IHE and IRC, worked on a situation analysis of Cali and the development of a proposal to become a fully-fledged demonstration city within the project. Various meetings were held with an alliance of stakeholders. These activities resulted in the submission of an additional request for Cali to become what a fully fledged "demonstration city" with a learning alliance; the team was conscious that a paradigm shift would require a strong stakeholder process that could build on earlier experiences with stakeholder platforms. This proposal was approved in early 2008, marking for the project team and learning alliance members the real beginning of SWITCH, building on earlier projects and platforms. In the remainder of this paper, we will mainly focus on the intervention logic since early 2008.

Project team and partners

The lead partner for SWITCH in Cali is the Universidad del Valle (Univalle), through one of its research groups, Cinara, a research and development institute covering water supply, environmental sanitation and water resources conservation. The team consists of a senior staff academic Alberto Galvis as City Coordinator, supported by assistants Diana Paola Bernal and Diana Alexandra Zambrano, who together fulfil the role of facilitator. In addition, the team currently consists of some 10 other researchers working part-time on the project, who also support facilitation activities such as for learning alliance meetings. This team has gradually grown from the original core team of only 3-4 staff members. It also draws on other staff of Cinara. In addition, a staff member from a second research group at Univalle (EIDENAR) is doing his PhD within the context of SWITCH. EIDENAR has provided some specific inputs on technical issues but is not involved in the broader learning alliance process.

Univalle/Cinara has been supported by two other SWITCH consortium members from Europe: UNESCO-IHE and IRC, both long-standing partners of Univalle/Cinara. UNESCO-IHE has mainly provided support in the field of wastewater management technologies. In addition, it has also facilitated the internship of an Ecuadorian and Italian student in SWITCH Cali. IRC has provided support on project management and corresponding liaison with SWITCH management, and advisory inputs and support for both the learning alliance and governance work.

As can be seen from the gender and disciplines matrix (Annex 1), the Univalle/Cinara team is well-balanced in terms of gender, although the support team from UNESCO-IHE and IRC are all male. In terms of disciplines both the project team and supporting colleagues have been biased towards engineering. This reflects the main focus and starting point of the project in Cali, with governance and institutional issues a relatively small part of the project.

Intervention logic

In 2008, Lobina described the intervention logic for SWITCH in Cali. It has since further evolved, particularly in the development of additional methodological elements and phases. This section aims to make that intervention logic more explicit, particularly with respect to:

• The identification of problem areas

• Methodological elements

• Phasing and timing

Problem areas

As described in the introductory section, the water management situation and its challenges in Cali are quite complex and can appear overwhelming. In a process with the learning alliance in 2007, three "problem areas" were identified that SWITCH Cali would focus on. These were

• Water quality of the Cauca and its impact on the Cali water supply system

• The southern drainage system

• The feasibility of promoting a paradigm change in the development of future urbanisation zones in Cali, particularly the "Corredor Cali – Jamundí"

Although these three areas do not cover the entire city, each location requires work on different parts of the water cycle and this has encouraged the project to address various aspects of integrated urban water management. The areas are also characterised by different types of problems in terms or urgency and

complexity. The impact of water quality problems on drinking water is immediate and easily mobilises stakeholders; the situation in the southern drainage system is very complex and requires the involvement of multiple stakeholders; the expansion zones are being planned and therefore lend themselves to testing approaches for the future. All three problem areas are interrelated, but the learning alliance members decided to treat them as distinct topics, to make them more manageable and to give them more visibility.

An underlying problem in all three cases is governance, and particularly a lack of inter-institutional coordination and collaboration. During the initial assessment and in discussions in the learning alliance, this came out clearly. It was realised that this needs to be addressed in a cross-cutting way across all three problem areas, as a separate area of work. The proposed learning alliance was seen as one way of addressing this issue. But, a proposal was also prepared and submitted to SWITCH management to address governance in a more in-depth way through research. From 2009, research on governance issues also became a subject of work, albeit a minor one.

A long-term vision was defined for each of the three problem areas. These were then brought together into a vision for water management in Cali (Box 2) which now acts as the overall project vision to which SWITCH in Cali contributes. On an annual basis, short-term goals and activities have been defined to work towards this vision.

Box 2   Vision for Cali in 2040, as developed under SWITCH

"Cali is a city where all citizens can enjoy a clean and healthy environment, with vital eco-systems and offering extensive green areas in the urban area. The city's water resources are of good quality, maintain sufficient flow to preserve aquatic life, and satisfy a variety of human needs. There is a safe environment for healthy coexistence in an atmosphere of respect and peace, and an environmentally aware culture, where citizens have decent homes in areas with a low risk of natural disaster."

Methodological elements
To address the problem areas, SWITCH Cali has used a range of methods. These are summarised here and further discussed in the results section.

- **Research on alternative approaches to wastewater management:** This has focused particularly on aspects such as natural treatment methods for wastewater, auto-depuration of receiving water bodies, reuse of wastewater and methods for cleaner production and minimising waste. This research has been brought together in what is called a conceptual framework to outline the different types of alternatives for wastewater management and their potential feasibility (Cinara/Univalle, 2010). Some research has also been done on governance issues (Smits et al., 2008).

- **Inputs into planning processes:** The results of this research have acted as inputs into planning processes, in two-phases. First, a process of long-term strategic planning developed the vision with a 2040 horizon and identified broad strategies to achieve that vision for the three problem areas (Cinara, 2010). These strategies were then further elaborated as possible short, medium and long term actions. Neither this planning process nor the resulting document has any formal status in Cali's administration or among the institutions that participated in the process. For this reason, a set of current activities is focused on promoting the inclusion of the results of this work into formal planning spaces. The two-step approach was useful as it allowed participants to think through the long-term issues in the first phase without being dragged into the formal planning processes.

- **Learning alliance:** The above went hand-in-hand with the facilitation and capacity building of a learning alliance (alianza de aprendizaje). The aim of this platform was to bring together some of the key stakeholders in urban water management in Cali and to create the space for inter-institutional collaboration to:

  - Identify needs and priorities, as reflected for example in the three problem areas
  - Provide feed-back on research results
  - Generate ideas for the planning processes mentioned above
  - Take lessons from the planning processes back to the members' home organisations

  Facilitation and capacity building activities have been used to support this alliance, for example, through organisation of meetings, emails, field visits and dedicated training activities.

- **Reaching out to other stakeholders:** The learning alliance is formed around a core of senior technical staff from the main institutions. This core has tried to reach out to other stakeholders. They included, in first instance, decision makers from the same institutions, who as individuals are not formally part of the alliance but have been engaged with its work at various instances. A second group of 'other stakeholders' are the consulting and construction companies. The learning alliance has tried to establish partnerships with these consultants and construction companies to include demonstrations to test new technologies and approaches in planned urban development projects.

- **Formulation of public policies:** SWITCH has followed an approach perhaps best dubbed as 'strategic opportunism', i.e. when and where opportunities for consultation on new public policies emerged, SWITCH Cali, through the LA seized the chance and responded on the strategic issues. The clearest

example was around the CONPES (national policy document), as described in the next section.

- **Work with other projects:** In order to be able to respond to short-term demands from stakeholders, SWITCH has also worked closely with other projects of shorter duration and has even engaged in the development of some projects. This has mainly been a strategy for problems that can more easily be addressed in the short-term.

- **Using results in education:** The final element of the SWITCH intervention logic is to use SWITCH results in education. The objective of this part of the project is to train future engineers and other professionals in the new paradigm on integrated urban water management. Examples of how this is done are the inclusion of SWITCH results and topics into the curriculum of the university and in various short courses and seminar series.

- **Demonstration activities:** It is important to note that unlike other SWITCH cities, Cali doesn't have a specific budget or plan for demonstration activities, due to its late adoption as a full demonstration city. As a result, an effort is made to plan demonstration activities as part of other projects, such as, for example, the Sentinel Project to establish an early warning system. A second avenue is by promoting the inclusion of new technologies in expansion areas of the city.

The diagram below (Figure 3) illustrates the different elements of the intervention logic and how they have been linked. It shows how the project team has directly focused on education, research and the facilitation and capacity building of the LA. The outcomes of these activities have been used in the SWITCH initiated planning process, which in turn aims to feed into formal planning processes and public policy advocacy. In addition, the learning alliance core group has tried to scale up the use of findings and activities through outreach to other stakeholders and through other (short-term) projects.
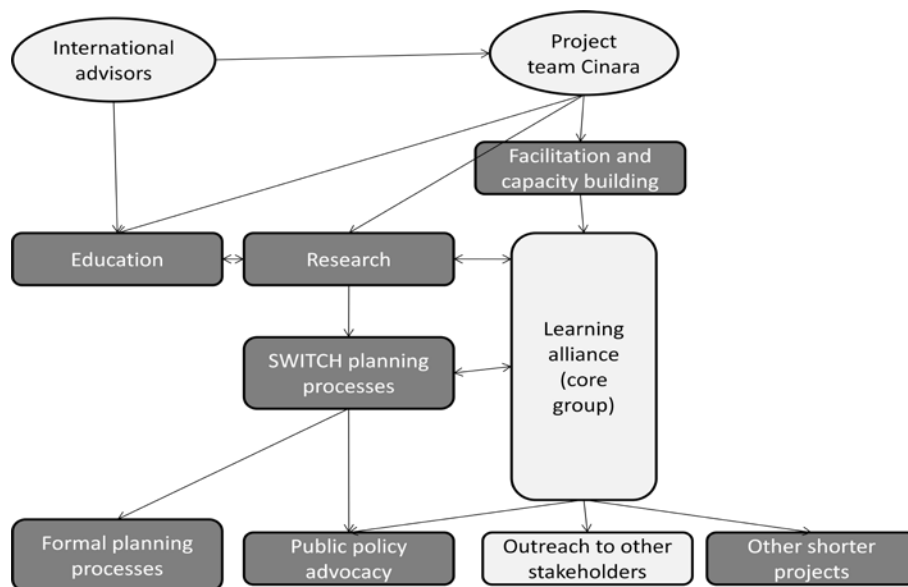
Figure 3   Methodological elements used by SWITCH Cali.

Phasing and timing

The phasing of the project reflected the need to create a common understanding of the problems and potential solutions under the umbrella of a long term vision. Activities were then identified that could fit into the existing plans of the various agencies. This resulted in the formulation of concrete project activities that where possible involved several stakeholders, and this in turn proved very useful as a way of enhancing inter-institutional collaboration. In parallel, members of the learning alliance participated in the development of the longer term plans of their own institutions, bringing in thinking that had emerged in the learning alliance.

Year	Phase
2006	Not yet a demonstration city. Even though SWITCH starts globally, there are delays in contractual and payment issues, and SWITCH cannot start in Cali.
2007	Preparing to become a demonstration city. A start is made with the situational assessment and stakeholder mobilization, as the basis for preparing a proposal to become a full demonstration city, as stakeholders demand.
2008	Formal start as demonstration city, with the establishment of the learning alliance, and the consolidation of its core group. Preparation for the planning processes, through review of literature.
2009	Consolidation of SWITCH Cali, with the formulation of the vision and strategic planning, the inclusion of the results of research in this, and the first seizing of opportunities for policy advocacy.
2010	Start of scaling up, by extending the LA to new groups of stakeholders, around specific themes and the active participation in formal planning procedures. In addition, 2010 will see the start of dissemination and engagement with decision-

	makers.

Table 2   Phases of SWITCH in Cali

This phasing was influenced by financial and contractual management issues, particularly at the start of the project. In the first year (2006), there was a long delay in receiving the first payment of funds. This meant Cali project staff, who could not pre-finance their own activities, could not attend some of the inception meetings. This, in turn, caused an overall delay of a year meaning that preparation activities started late. The unfortunate fact that Cali initially was only a case study city also impacted on the timing of activities, although this limitation was partly overcome by support for stakeholder meetings from IRC and other projects. Nevertheless, most of 2007 was dedicated to just two work packages and to elaborating a proposal for Cali to become a demonstration city with a full learning alliance.

Activities and inputs

The main activities that have been carried out in the city can be grouped under the main methodological elements outlined above. Table 3 presents a compilation of these activities drawn from the various activity reports provided by the Univalle/Cinara project team.

Table 4 (See page 17) provides a rough indication of how resources have been allocated to different budget and expenditure items. A number of observations can be made:

- Around 75-80% of the budget was allocated for research, with the remainder focused on facilitation, dissemination and planning activities. A similar ratio can be found in the actual expenditure. The team feels that this a right balance of activities, with around 20-25% of the budget spent on the stakeholder process.

- Unlike most other SWITCH cities, Cali didn't have a budget for physical demonstration activities. Currently, efforts are under way to include demonstration activities into existing plans for urban development through consulting and construction companies. These are still under development though and not yet reflected in budget items.

- At the start of the final year of the project, less than half of the budget had been spent. There are various reasons for that. The first one relates to the late start of SWITCH in Cali. A more important limitation has been the fact that often Univalle/Cinara has had to pre-finance activities while awaiting a new budget transfer. Within the university there are strict limitations to the extent to which pre-financing can happen. Cash flow has therefore become a

major limitation. Amongst other consequences, this limited the extent to which a full team could be established. As the remaining budget could not realistically be spent in the final year, the SWITCH management and Univalle/Cinara agreed to a partial reduction in the overall budget for the final year, to make it available for other consortium partners.

Year	Research	Facilitation of LA	Planning	Links with other projects	Dissemination and exchange activities
2007	• Study on concepts and policies on urban water management • Literature review on natural treatment technologies • Research seminar held in context of LatinoSan, with 3 research papers presented • Start of PhD thesis by Alberto Galvis • Internship of UNESCO-IHE student in Cali	• Individual meetings with city stakeholders • 3 LA workshops	• Cali diagnostic report • Proposal for Cali as demonstration city	• Co-organise learning alliance meetings with IWRM project (2006-2010) • Integrated Urban Wastewater System Data Network (2007-2008)	• 7 support visits from Europe-based partners • Participation in SWITCH scientific meeting • LatinoSan 2007
2008	• Study on governance • Development of conceptual framework on wastewater management • 1 research paper presented	• 15 bilateral meeting • 4 new members join LA • 4 LA meetings and workshops • Field visit with LAs • City Assessment	• Visioning and scenario building exercise • Review of existing planning documents and instruments	• IWRM project (2006-2010) • Start of the "Sentinel of the Quality of the Cauca River Water for the City of Cali" project	• Start SWITCH Cali website • Various outreach presentations • Dissemination through newspaper article and TV show • 6 support visits from Europe-based partners • Participation in SWITCH scientific meeting
2009	• Internship for UNESCO-IHE student • 2 research seminars in the context of AGUA2009, with 4 research papers presented • Development of proposal for further governance research • Finalisation of the conceptual framework for the decontamination and recuperation of water resources in the Municipality of Cali • 3 MSc and 1 BSc students	• Meetings to obtain further involvement of other groups within Cinara • Various bilateral meetings to discuss vision and scenarios • 3 LA meetings • Involvement of new stakeholders, including construction and consultant companies	• Bilateral meetings to finalise visioning and scenario building exercise • Start of engagement in the Cali Vision 2036 planning process	• IWRM project (2006-2010) • Start of the Reservoir Project • Start of the Implementation of Entrepreneurial Environmental Improvement Systems in Santiago de Cali project	• Inputs made to the CONPES policy document • Participation in SWITCH City Summit and scientific meeting with city stakeholders • Dissemination through newspaper article, radio items and participation in 3 regional and local seminars • Presentation to parliamentarians • from the Valle del Cauca • Visits from various EU-based advisors in context of AGUA 2009

Table 3   Main activities of SWITCH in Cali 2007-2009

Work package	Types of activities covered	Budget (€)	Spending up to Jan 2010 (€)	% of budget spent
1.1 Paradigm shift	Situational assessment, some workshops	56,400	20,820	36.9
5.3 Natural methods for wastewater treatment	Development of the 'master plan', visioning, situational assessment, MSc and PhD research	415,317	182,367	43.9
6.1 Governance	Input into CONPES policy document	10,000	2,962	29.6
6.2 Learning alliances	Facilitation of LA, workshops, visioning exercise	96,200	44,137	45.9
Total		**€ 577,917**	**€ 250,286**	**43.3**

Table 4   Budgets and resources used up to 31 January 2010

In addition to the resources of the project proper, university staff have dedicated time to the project, which is not captured in these figures. Finally, Cinara/Univalle has been able to mobilise funds from the other projects mentioned in Table 3. The estimated total volume of these projects is in between €80,000 and €100,000. Not only have these additional projects been able to support the uptake of SWITCH concepts, they have in some instances provided the cash-flow required for SWITCH to continue with activities, which as we have seen, has been a big problem.

III.   RESULTS AND DISCUSSION

This section presents the results obtained by SWITCH in Cali to date. It is structured according to the main elements of the intervention logic, presenting for each element, the main results and reflections on the lessons learnt.

Research: opening perspectives to new alternatives

The first objective of SWITCH is to contribute to the scientific basis for IUWM. Respondents considered that SWITCH has done this in two ways:

- **Creating a better understanding of and insight into the water cycle in Cali.** Particularly, the diagnostic report (Cinara, 2008) has been useful in compiling information on the water cycle in Cali, and thereby providing new insights. For example, its characterisation of the wastewater in the South Drainage Channel found that it contained heavy metals from small industries in the city. This

was, until then, unknown to some respondents. One of the underlying reasons for these new insights is that the diagnostic study has created a common source of information and knowledge on the water cycle. Many of the institutions have their own information sources and data sets, but most of these do not address the full water cycle, nor are they adequately shared with others. The SWITCH research has brought all of that together into a single document.

- **Contextualising existing knowledge, particularly around wastewater management options.** Natural wastewater treatment technologies, reuse, cleaner production, etc are well-known across the globe. However, through the SWITCH research, the feasibility of application of these technologies in Cali was assessed, thereby localising this existing scientific knowledge, thus extending the scientific basis for IUWM in Cali. Interviewees felt that SWITCH has opened up new perspectives on alternative approaches. While some interviewees knew about these options from books or theory, it was the feasibility analysis which gave them ideas about the possibilities and limitations of these options in Cali.

Despite the fact that SWITCH in Cali has been contributing to the science, there were, with a year to the end of the project, few references to this work in the scientific literature. Only in the final year were some of these results being published given the long timelines generally required to get research results into the science press.

On reflection, three aspects emerge which have contributed to the achievement of the research results and their subsequent appreciation.

Action research methodology
Action research was understood by interviewees as research done around concrete problems in the city, and as part of broader processes by institutions that were addressing them. Cinara/Univalle staff have done many similar types of research in past. This way of doing research is also much appreciated by the research team (see Box 3) for the various benefits it brings, compared to more classical research approaches.

Box 3   Technology 'platanizado'

For a group of researchers from Cinara/Univalle, an action-research methodology gives her research more purpose and efficiency. First of all, action-research is a way of contextualising technologies from elsewhere to the Cali environment. Or, as one researcher says, it allows technology brought from outside to become platanizado – a term used in Cali to refer to someone from outside, who picks up the local vernacular. In addition, by working with stakeholders around concrete problems, efficiency can also be

gained in research. For example, it was much easier to obtain data and information from institutions, once they knew the purpose for which it would be used.

Credibility and reputation of Cinara/Univalle

An important factor that has enabled the research to be done and appreciated is the strong technical reputation and credibility of Cinara/Univalle. It is perceived as having an objective and unbiased position and this is particularly important for such a project. For example, in compiling the information base from different sources, Cinara/Univalle developed a trusted resource that was used as a reference by stakeholders. A similar factor played a role in contextualising existing information on wastewater treatment methods. Interviewees trust that the university provided an overview of options with their strengths and weaknesses from a neutral perspective, and was not trying to promote one or the other technology.

Demand-driven?

A third factor, and an important assumption of SWITCH in general, is that research would be demand-driven, responding to stakeholders' research needs. On reflection, "demand-driven research" is probably too heavy a term in this respect; rather, it was about bringing together research demands and the capacity to respond. Interviewees felt that a good balance between demand and response was obtained:

- The main research topic in the original proposal already came from an extensive process with stakeholders in the mesas de trabajo prior to proposal development. This meant that the original proposal for Cali already responded to an important area of local research need.

- Two additional topics (learning alliances and governance) were identified by stakeholders, turned into proposals by the project team, and subsequently approved by SWITCH management. These even became separate work packages for SWITCH Cali.

- Another research need that arose was on the costs of wastewater treatment and other technologies. This topic is currently being addressed within the existing work package on technologies. The SWITCH researchers who are involved feel there is sufficient flexibility within the broad formulation of the work package to address such a theme.

- The original proposal foresaw some case study research in two other towns in Colombia: Buga and Cartagena. It was later decided not to carry out this research but to focus capacity and efforts on Cali where the most pressing needs were seen.

Despite these examples of flexibility, it has not always been easy to balance research needs and the project team's capacity to respond to requests. For example, one of the two PhD theses developed as part of SWITCH Cali (dealing with emission of greenhouse gases from wastewater treatment plants) was predefined before the LA started and is being developed in relative isolation from the LA process. This is a very specific theme which only in future may become of interest to the LA. Likewise, certain research demands that come from the stakeholders cannot be addressed within the scope of SWITCH, and separate projects are being developed to respond to them.

It must be noted that research needs are not always explicitly articulated by stakeholders. According to the researchers, it is also their own task to distil new research needs from the stakeholder process. Yet, the process would benefit from having the research agenda made more explicit.

Planning processes

SWITCH Cali has produced two documents dealing with planning:

- One on visioning, scenarios and strategy development (Cinara, 2010). This provides a long-term planning framework based on important trends in the city and region.

- The 'master plan', which is a conceptual framework for decontamination and recuperation of water resources in the Municipality of Cali (Cinara/Univalle, 2010), highlighting alternatives for wastewater management in the context of long-term planning.

These planning processes involved participants in the SWITCH learning alliance, but do not have an official or formal status in the city administration, even though LA members participated. Yet, these processes have led to some important achievements:

- **Creation of a better environment for inter-institutional collaboration:** As mentioned in the introduction, this is a big limitation to water governance in Cali. Yet, the fact that SWITCH planning has been an unofficial and to some extent neutral platform, has created a 'safe' environment in which institutions could learn how to work together. The planning also focused on the overall water problems, rather than on single parts of the water cycle, thereby emphasising the necessity for stakeholders to collaborate.

- **Instilling a long-term perspective:** Interviewees reflected on this, stating that most institutions tend to plan only for the short and medium-term, often limited to the duration of an administration. Some also expressed scepticism when SWITCH invited them to think about a vision for 2040. Yet, some stakeholders said they now recognise that the long-term is a valid additional

time-frame since some water problems cannot easily be addressed in the short-term. Besides, certain investments have long life-spans and it is important to consider them.

- **Creating an umbrella framework under which to identify new projects and initiatives.** At the same time as working on long-term issues, stakeholders also see the need to develop short- and medium-term projects and initiatives to address immediate problems. The planning process has created the long-term vision and strategies, which provide the umbrella, which makes it easier to work together on these short-term needs.

- **Generating transparency about alternative options.** Interviewees valued the transparency created through the master plan about wastewater treatment options and their advantages and disadvantages. Often, groups tend to push one technology or option, but through the planning, a more open basis has been created for more transparent and informed decision-making.

At the moment, the results of this planning process of the learning alliance are being used as an input into formal planning processes. The three main ones are:

- The development of the municipality's long term vision (Cali Visión 2036). This is a visioning exercise, started in 2009, similar to the one undertaken by SWITCH, but looking into other areas, such as housing, health and education. This vision will have a formal status. SWITCH participated in a first phase of the vision development. Cinara/Univalle has been asked to facilitate a second step in this process and this puts them in a position to also contribute the long-term ideas and plans developed under SWITCH.

- The critical review of the national document (CONPES) on the Cauca river (see Box 6 below) which sets out the main activities and investments to improve its quality. An e-based discussion platform is now established to make further suggestions for practical improvements, trying to shift the emphasis from end-of-pipe solutions to more integrated solutions.

- The municipal "urban development plan" (POT). This plan defines the directions for urban development of the municipality over the next 10 years. It has a formal status as municipal public policy. In the development of the POT, the municipality organises a consultative process, in which both neighbourhood representatives and institutions can participate. Both Cinara/Univalle and other LA members are actively participating in various fora, to bring forward the results of the SWITCH planning process.

These formal planning processes both started in 2009, and at the time this paper was written was still too early to see any results in terms of uptake of SWITCH ideas and concepts in the formal planning documents.

On reflection

The approach of developing a vision and ideas for action and the establishment of concrete projects that (partly) matched the vision but which could be included in the ongoing programmes of the different SWITCH partners has worked out quite well. The planning process led by SWITCH has created a safe environment, in which a vision, strategies, alternatives and ideas could be developed, outside the direct pressure of public planning processes and the institutional responsibilities and politics that these bring. In the context of a lack of institutional collaboration or joint planning, this appears to actually have been desirable and necessary. Several of the leading technical staff in the agencies have become very acquainted with the SWITCH ideas and are now in a better position to help include these in ongoing formal planning processes.

Learning alliance: expanding from a core group of peers

An alliance of peers established

A big part of the effort of SWITCH in Cali has gone into the establishment of a learning alliance. At the moment, this can be characterised as an "alliance of peers". Annex 1 provides an overview of the composition of the alliance, in terms of institutional background, gender and discipline. This shows the following:

• Most of the relevant institutions in the city are represented in the alliance. These are mainly local and regional government agencies, the utility, some NGOs, and consultants.

• The individuals participating on behalf of their organisations are mainly professional and technical staff at senior positions in their organisation, with different levels of decision-making.

• The LA is relatively-well balanced in terms of gender, particularly in the core of the most active members. However, the LA is highly biased towards the engineering disciplines. This reflects the composition of the main relevant institutions, where engineering continues to be predominant.

The alliance has seen fluctuations in participation of some of the members on the list in Annex 1, particularly the participation of municipal authorities through the municipal environmental department (DAGMA) and the planning department. Intermittent participation is partly due to staff changes. However, over time, a core group of about ten people has formed representing the utility, the regional environmental authority, the CRPML and some independent consultants.

Expanding the alliance

Currently, effort is being put into extending the alliance to involve new stakeholders, particularly consultants and contractors. These are very heavily involved in the city's expansion areas in the development of both housing and

green areas. Some of them are keen to apply SWITCH concepts in this context (Box 4).

Box 4   Constructors' interest in joining the alliance

Constructora Buena Vista is one of the big developers and contractors in Cali, involved in developing the expansion area in the South. He thinks the SWITCH concepts may be of interest to his company for various reasons. First of all, "green" sells; there is an increased interest for houses that are "green". Secondly, applying SWITCH concepts may reduce the costs of housing development. For example, if water saving devices can be applied in houses, the diameters of sewerage pipes can be reduced as well, which in turn will reduce costs. His company will now do some feasibility studies for housing using these concepts. If it turns out to be feasible, even physical implementation may start. However, he also foresees some limitations. For example, some of the municipal norms, e.g. on diameters of sewerage pipes, are quite strict. The alliance will therefore be important as a space for identifying limitations in municipal norms and standards, which may hamper the application of SWITCH concepts and related innovations in new housing development.

An explicit decision was made to focus the alliance around senior technical staff, and not on policy-makers such as councillors. It was felt that it would require different methodologies other than a LA to engage with these groups. Besides, priority was given to first establish a working alliance with technical peers to do some of the technical "homework" before engaging with these other stakeholders. Engagements with policy makers have therefore been ad hoc. For example, a briefing was organised for parliamentarians from the Valle del Cauca department on the status of the CONPES (national policy document) for the Cauca River. Engagement with civil society has also been limited to representatives of professional associations, such as ACODAL or independent professionals. No explicit effort has gone into engagement with community groups, such as resident associations. Again, it was felt that their engagement would require other methodologies than a learning alliance. However, the second phase of the Cali Visión 2036 process includes stakeholder consultation about the vision and action ideas, and there will be opportunity to engage these groups.

Opinion among interviewees is mixed on whether SWITCH should have engaged with these stakeholders from the outset. Some have argued in favour of the phased approach as it was adopted, consolidating a core group of technical staff and then expanding to other stakeholders. This at least seems to fit well for the contractors and consultants as it is doubtful that they would have participated actively from the onset. As the opportunity increased to implement some of the options proposed by SWITCH in the expansion area, their active involvement became more relevant and was probably seen to be in their direct interest.

However, there was common agreement among all interviewees that in the final year of the project, the time had come to start an engagement with new groups of stakeholders, particularly:

- Community leaders: to stimulate demand from the bottom-up, and help in holding policy makers to account for decisions on IUWM. The feeling was that these should include formal community representatives, as well as opinion leaders in the community.

- Local and regional politicians.

- Decision-makers in the entities that were already members of the LA.

On the exact strategy to be followed to engage with these stakeholders, opinions were again divided. All interviewees agreed that probably it would not work to have them as full LA members, suggesting instead various activities such as awareness raising, briefing sessions, training sessions and identifying champions. The development of the POT was seen to provide a specific opportunity for further community engagement.

These activities may also have needed further methodological development. For example, the participation of community groups in urban water management needs to follow different methods than would be used in the participation of rural groups. The SWITCH team recognised that it did not have all the experience required for that, and hence would require further methodological support. Also, it was recommended that not all these activities were undertaken by the SWITCH project team itself; other LA members could also play a role. For example, technical staff could organise briefing sessions for decision-makers within their own institutions. The fact that there was such a divergence in ideas about this, showed a continuing need to develop and update a concerted strategy with the LA.

Start of uptake of SWITCH concepts by individuals

Through the combination of activities described above, some uptake of SWITCH concepts by individuals involved in the project can be seen:

- Interviewees stated that they had a better knowledge and, above all, a more positive attitude towards some of the technologies and approaches discussed as part of SWITCH. This mainly refers to those options that are less controversial such as water-saving devices in houses, or approaches for cleaner production principles to reduce contamination. Many interviewees saw these as simple and feasible option to implement at scale. However, they tended to be less enthusiastic over more controversial or complex changes in technology, such as moving towards natural treatment methods for wastewater management. At the time of the 2010 assessment, the main

achievement was a better understanding of such technologies, although some respondents also showed a more positive attitude towards them.

- Some individuals have even become "ambassadors" in their own organisations, promoting ideas picked up through SWITCH.

- The first manifestations of the uptake of SWITCH concepts in concrete actions include, for example, the planning department of the EMCALI utility, which is making adjustments to the terms of reference for consultants working in the southern expansion zone so that they can include alternative technologies in housing development. However, municipal norms and standards still appear to pose limitations, as can be seen in Box 2 above.

Despite these examples of uptake of the SWITCH concepts, interviewees also recognised that the institutionalisation of alternative technologies, approaches and thinking would take a long time. In particular, taking these lessons to the decision-making level would require a lot of further work. This reinforces the point made above on the need to develop a strategy to engage decision-makers.

Inter-institutional collaboration

Whereas some change was seen in the uptake and use of SWITCH concepts by individuals, this was at a much earlier stage of development for inter-institutional collaboration. The fact that a learning alliance exists was seen as an important result in itself by some. Against a background of complex problems of inter-institutional collaboration, there was some scepticism about the relevance of an LA, or its potential in addressing these problems (see Box 5). However, the LA has, according to the interviewees, contributed to developing personal relations and empathy, which in turn have allowed members to be more (self)-critical. It also helped to make members realise that all institutions and all individuals face the same problems and the value of working together to address them. A lot of credit is given by interviewees to the City Coordinator (Alberto Galvis) and the other members of the team. Having worked for many years with the stakeholders involved, Galvis personally, as with Cinara/Univalle more broadly, has developed strong credibility, which has also given stakeholders confidence in the process.

Box 5   From scepticism to appreciation for the importance of a learning alliance

One of the key members of the learning alliance felt unsure about the whole learning alliance process. *"What are we trying to achieve? Where are we going? As an engineer I like to think in straight lines. Only after a year, I saw that we were defining the goal along the way and that this was a way of bringing all institutions together. "* This learning alliance member adds, *"Institutions used to be quite jealous of each other. But, in the alliance, we learned to know each other, and even befriend each other. In such an environment, it is easier to be critical of oneself and of each other, without hurting each other. "*

Another team member also felt sceptical initially about the learning alliance. *"As an engineer, one thinks that all problems can be solved through technology; and social scientists think that talking does the trick. But when I attended the first learning alliance meeting, I realised that the problem is not technology only, but the fact that institutions were not working together. Now, I realise that the truth lies somewhere in the middle: both technological options and talking are needed."*

An appreciation of the need to work together is reflected to a limited extent in concrete inter-institutional collaboration. Examples include:

- **Starting to share data and information.** Institutions tend to keep their own data sets. Some interviewees mentioned that through improved personal relations, it was easier to access data or information from other agencies.

- **Formulation of joint follow-up projects.** Whereas in the past, many projects would be done by one single institution, SWITCH stimulated the formulation of some joint projects. For example, DAGMA and CRPML undertook a small project to map small industries in Cali, based on the realisation that some industrial waste was ending up in the city's drainage channels. This project tried to map these polluting industries, identify their production processes and the waste generated, and promote cleaner production mechanisms specific to each type of industry. Such kinds of collaborative projects would not have happened so easily before SWITCH.

- **Talking with a common voice.** This was shown most clearly when the CONPES national policy document was developed, and the alliance made inputs into this (see Box 6). The fact that an alliance existed and had developed relationships and a common understanding, allowed for the voicing of common concerns by the institutions.

Despite these achievements, members still feel that more needs to be done to address institutional collaboration. Above all, these relationships need to move from being individual to being truly institutional.

Institutionalising the alliance?

This need to address institutional collaboration raised also the question of whether and how the alliance itself could be institutionalised and sustained. In view of the significant appreciation for the alliance as a space to learn to work together, there was unanimity among interviewees on the need to institutionalise it somehow. However, there was a divergence in views on how this could be done. Suggestions from interviewees included:

- Establishing the alliance as an advisory body to the steering committee which will oversee the implementation of the CONPES

- Establishing the alliance as a municipal water platform, either independent of the Municipality or as a body recognised by the Municipal Council

- Leaving the alliance as an informal platform, facilitated by Cinara/Univalle

- Building the alliance around "catchment councils" a newly proposed body as part of the recently published national water policy

Without going into the advantages and disadvantages of each option, these findings showed the need to discuss the institutionalisation of the alliance as a space for inter-institutional collaboration on water management, perhaps as part of alliance meetings planned for the final year.

Inputs into public policies

As mentioned above, an explicit decision was taken to engage with politicians or public policy based on an approach of 'strategic opportunism', making inputs into such policies where and when the most relevant and strategic opportunities presented themselves, and then plan for these in a concerted way. Above all, the engagement with the CONPES national policy stands out as a concrete result of this approach.

Box 6   Alliance members make a joint input into national policy development

For a long time, there had been talk that a CONPES (national policy document) would need to be developed for the recuperation of the upper Cauca River, since it is one of the most important rivers in the country. Despite the talk, nothing happened. Then in May 2009, President Álvaro Uribe visited Cali. During his visit, the situation of the Cauca River was high on the agenda. There and then, the President stated that the CONPES document had to be developed with urgency. The responsible National Planning Department (DNP) and Ministry of Environment, Housing and Territorial Development (MAVDT) started to elaborate it rapidly. They also undertook some consultations with the main relevant institutions separately. However, local institutions feared that this process could lead to fragmented inputs. They also felt that these national agencies might not have a full grasp of the situation, and the work already developed by SWITCH and other initiatives. ACODAL, the professional association of sanitary and environmental engineers, and SWITCH agreed to try to make a joint input by LA members into the CONPES development. Two LA workshops were dedicated to this, and various inputs were made, which were recognised by DNP. Nevertheless, the first draft of the CONPES was not to the full satisfaction of the LA members, as it focused mainly on "end-of-the-pipe" solutions, and not on waste reduction. Besides, it was heavily biased towards domestic wastewater only, not to other sources of pollution. Some LA members drew up a long letter, providing further inputs. Despite some pending concerns, the final document better reflects some of the ideas developed by SWITCH. Several of those involved in the process felt that

without SWITCH it would have been much more difficult to make a concerted input so rapidly into the CONPES.

On reflection, it is felt that this approach has paid off so far. Opportunities for engagement with public policies development cannot be easily planned. The learning alliance has shown itself to be well prepared when such opportunities have arisen. However, in line with the earlier comments made on expanding the alliance and engaging with policy makers, there is a need for a more structured engagement with public policy processes. This refers in the first instance to the follow-up to the POT and Visión Cali 2036, as important planning and local policy documents. In addition, as mentioned earlier, there is a need for a strategy to reach out to decision-makers and to community leaders.

Inclusion of SWITCH results in education and capacity building activities and documentation and dissemination

An important result of SWITCH so far, has been the inclusion of its results in a wide range of education and capacity building activities, ranging from the inclusion of subjects into the regular MSc programme of Univalle to dedicated seminars and short courses, such as the three international seminars organised in the context of LatinoSan 2007 and Agua 2009 and diploma courses. In this way, some of the LA members have received further capacity building, not least because some of them follow the MSc course at Univalle. In addition, a broader group of students and researchers have obtained access to the knowledge and ideas developed under SWITCH, through the BSc and MSc curricula.

Documentation of the project results is well-advanced. Research reports have been developed from the diagnostic study (Cinara, 2008) and the governance research (Smits et al., 2008), and the planning processes (Cinara/Univalle, 2010). Various conference papers have been written and the team meticulously documents all learning alliance meetings and workshops, as described in annual reports to the SWITCH management. However, a commonly heard complaint by stakeholders and the research team is that some of the most relevant documents produced under SWITCH are in English, since this is the main language of the project. This limits the dissemination of these written results to the city stakeholders, since many do not easily read English reports. The team recognises this limitation and plans to make versions of key documents in both Spanish and English.

International support, collaboration and exchange

A final component of the intervention logic is the international support, collaboration and exchange. The collaboration between UNESCO-IHE, IRC and Cinara/Univalle was considered valuable by all parties. Because the three had a long-standing history of collaboration, mutual expectations were mostly clear and

there was an understood way of working together. The involvement of these international partners was also valued by other interviewees. Somehow, this international support also gave credibility to proposed new alternatives. One area where the collaboration between Cinara/Univalle and the SWITCH management could have been stronger though was on financial management, particularly around the lack of liquidity. With hindsight, a much earlier solution should have been identified between Univalle and the SWITCH management.

The exchange with other cities and partners in the project has remained below expectations. Interviewees expressed their interest in learning in particular from neighbouring countries which have similar situations, such as Brazil or Peru. However, such exchanges remained limited to SWITCH scientific meetings The meeting held in 2009 offered opportunities to work together with other Latin American countries and it is suggested that another meeting is held with time to meet partners from the region.

IV.   CONCLUSIONS AND RECOMMENDATIONS

Conclusions

SWITCH has aimed to contribute to a paradigm shift in urban water management towards a more integrated and participatory approach. It has aimed to do this through a combination of demand-driven research and engagement with stakeholders, brought together within learning alliances. Each of the cities in SWITCH has built its own intervention logic and methodology, although using some common elements. The objective of this paper has been to assess the intervention logic of SWITCH in Cali, Colombia, and to define recommendations for the future, so that the processes set in motion could be sustained and scaled up where relevant. It draws its conclusions on the basis of interviews with stakeholders from the city, as well as meetings with project staff involved in SWITCH Cali.

Cali presents a range of water management problems. Chief among them is the pollution of the seven rivers that flow through the city, particularly the Cauca. There are many sources of pollution, including domestic wastewater, diffuse pollution from run-off, waste from small industries and leachate from the former waste dump. The situation not only affects water quality of the rivers per se; it also has an impact on the city's water supply. The intake of the main water supply has had to be closed many times because of excessive loads of pollutants. The expansion of the city presents a challenge as it could contribute to further contamination. At the same time, it presents an opportunity to develop alternative approaches to water management that are more sustainable. Underlying the water management problems are governance issues and weaknesses, particularly the short-term planning frameworks and the lack of

coordination and collaboration between the different agencies involved in water management.

SWITCH in Cali has provided a response to this situation. The initial entry point for SWITCH was on natural approaches to wastewater management. However, from the onset it was also recognised that addressing wastewater management issues should be accompanied by an intensive stakeholder engagement process. The uptake and development of the learning alliance approach in Cali therefore reflects an important response by the project to the city's demands. Putting a learning alliance in place has made it possible to further define the scope of the project, focusing on three problem areas. The intervention logic has been built over time, using the main methodological elements provided by SWITCH, such as research, learning alliances, strategic planning processes and public policy advocacy. This process helped the team to define concrete activities together with SWITCH partners that fitted in agency plans but also responded to opportunities that arose, such as the CONPES. This approach may in fact be commended in many situations, as it requires more time to adjust the longer term plans of organisations. It is essential to work with concrete activities that can show change but be flexible enough to embed these in existing plans. With only a year left in the SWITCH project, results need to be disseminated (through the website and other means) and additional projects need to be developed. Furthermore a strategy needs to be developed to consolidate the learning alliance and include new stakeholders.

The project in Cali has experienced serious delays, mainly related to project management problems. The lack of liquidity has, at times, caused the project come to a standstill, and as a result budgets have been underspent. These delays affected the speed and rhythm of the stakeholder process. Furthermore, the project team remained very small for a long time. Only in the final year has the project team grown, bringing in further expertise. Despite the delays, the team has been more or less on time with the delivery of products. This was made possible by combining SWITCH with other projects and activities as a way of overcoming cash-flow problems. It has been important at times to draw on international support, which is highly appreciated, but the exchange of experiences with other cities in the consortium has remained very limited.

Even though the duration for which the project has effectively been running in Cali is limited - three years, and only two with a learning alliance – some important results have been obtained, which contribute to the four overall objectives of SWITCH.

1. SWITCH Cali has contributed to the scientific basis for IUWM, both by creating a better understanding of the water cycle in Cali and its underlying processes, as well as by contextualising the feasibility of alternative technologies from elsewhere. Both of these contributions are highly valued by stakeholders. Important gaps have been identified in the scientific basis for IUWM within

Cali, specifically on the costs of wastewater management options and methods for improved stakeholder participation in decision-making in urban settings. Following the assessment, proposals were being developed to address these gaps. A gap was also identified in the sharing of insights with all stakeholders, not least because some of the most important reports are written only in English.

2. No explicit activities related to the physical testing and demonstrating of the feasibility and potential of innovative technologies were foreseen to fall within the scope of SWITCH Cali, due to the fact that Cali only became a full demonstration city at a later stage in the project. However, through research on contextualising alternative technologies, both for wastewater management and in-house water devices, a critical analysis was obtained of the feasibility of these options in the local context. These have generated interest from developers, contractors and authorities alike, leading to the exploration of opportunities to arrange physical pilot demonstration activities.

3. A learning alliance has been established, as a cross-institutional platform, which has a core of senior technical staff from the city's main institutions. Individual members have shown signs of adopting the new concepts, ideas and technologies mentioned above. However, this uptake remains largely limited to individuals. Although some act as ambassadors and try to share learning with their colleagues, the institutionalisation of knowledge remains at an early stage. There has been some engagement with the highest levels of decision makers in member organisations, even though these individuals are not active members of the alliance. Findings have not yet reached the level of political decision makers. However, the learning alliance has provided an area of confidence where stakeholders have started to coordinate and collaborate. This was supported methodologically by the strategic planning processes that SWITCH started. There have been some first signs of strengthened inter-institutional collaboration outside the direct space of the learning alliance, but these are limited and incipient. The learning alliance is highly valued by interviewees and there is a demand for it to become institutionalised.

4. As far as contributing to decision-making through plans and polices, SWITCH Cali has followed an opportunity-based approach, with important results. The SWITCH strategic planning processes have provided opportunities for stakeholders to learn to collaborate and the results are now feeding into official municipal planning processes. In addition, the learning alliance has made a concerted input to the CONPES, a national public policy document on the management of the Upper Cauca. Yet, it is also recognised that advocacy towards policy makers, politicians and community representatives has been limited, and that it is time to reach out to these groups in a more concerted way.

In conclusion, there is a high degree of appreciation for the project, both in terms of the quality of its products and in terms of methodology and process followed. There is an explicit demand from all the interviewees that the processes set in motion – learning alliance platform, planning processes and research – should continue after the project itself ends.

Recommendations

In response to these conclusions, the authors propose some overall recommendations, as well as specific recommendations relating to the four general objectives. Finally, some recommendations are made for SWITCH management.

General recommendations

As SWITCH moves towards a finish, it is important to develop an exit strategy, which recognises the need to continue with various processes set in motion, which should continue after the life-time of the project. This should contain amongst others:

- A dissemination strategy

- A strategy for the continuity of the learning alliance, possibly even for its institutionalisation

- Future "work agenda", including possible follow-up project ideas, research agenda and initiatives, that fit under the SWITCH umbrella

Recommendations for objective 1: scientific basis for IUWM

- It is recommended to complement existing research with studies on costs and governance as emerging research issues. If it is not possible to address these fully within the remaining project scope, these should be added to the future research agenda.

- A strategy for dissemination of research results needs to be developed, detailing, amongst other things, target audiences, channels, allies (including LA members) and versioning.

- Steps are required to strengthen the interdisciplinary research agenda and explore further opportunities for funding research projects and initiatives financed by LA members or from other sources.

Recommendations for objective 2: demonstration of alternative technologies

- It is recommended to continue efforts to make concrete arrangements for piloting the demonstration of alternative technology options in the southern expansion zone, thereby defining roles both for contractors and developers and authorities. This should be accompanied by a process of studying and documentation of the demonstration activities.

- It is recommended to use the opportunities provided by the POT, Cali Visión 2036 and CONPES to identify possible future physical demonstration projects.

- Further effort should be made to ensure that an exchange of experiences on alternative technologies (and methodologies) is realised with the other SWITCH cities in Latin America: Belo Horizonte and Lima. This could take the form of a dedicated exchange visit between the three cities, or as an activity within the scope of the final SWITCH Scientific Meeting.

Recommendations for objective 3: support to the cross-institutional platform

- An important recommendation is to develop and implement a strategy for LA members to share the lessons learned from SWITCH within their home organisations. The SWITCH project team may need to support these kinds of events together with other LA members.

- There is a clear need to write a strategy for the continuation of the alliance as a space for inter-institutional collaboration. This needs to be developed in the first semester of 2010, so it can start to be implemented in the second semester. It needs to draw upon the ideas provided by the interviewees provided for this study, but also needs further thought and deliberation in the alliance.

- It is recommended to reach out to stakeholder groups that so far have not been engaged in the alliance. This can to a certain extent be done through the current formal processes that are ongoing such as Visión Cali 2036, the detailing of the CONPES and the establishment of the POT. Other strategies may also be needed. It is suggested that these are further elaborated with inputs from the current group of LA members.

Recommendations for objective 4: strengthen decision-making through plans and policies

- The main recommendation is to make best use of the space for participation that has been seized by SWITCH in the previous years, i.e. the POT, Visión Cali 2036 and around the CONPES. Full efforts need to be made for active participation in these consultative processes. Where new opportunities for influencing public policies arise, these need to be considered.

- A second recommendation is closely linked to the recommendation for objective 3: to further define a strategy document for advocacy towards public policy makers. This should draw on the various alternatives and ideas provided by stakeholders, and could include elements such as awareness raising of policy makers, engagement with community leaders (to create a demand from bottom-up), using the capacity for advocacy of LA members and engagement with national level stakeholders.

Recommendations for SWITCH management

- It is important to clarify which documents need to be published in English and/or in Spanish to help the team in its dissemination strategy.

- It is recommended that the SWITCH management team facilitates further exchange of experiences between Cali and other cities. It is recommended that this is a targeted exchange, for example, focused on the Latin American cities, if the budget allows.

It is hoped and expected that by considering these recommendations, it will be possible to capitalise further on the results obtained in the SWITCH project, and that longer-term processes of paradigm shift can be put in motion.

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Annex 1. Gender and discipline matrix

Project team Univalle/Cinara

No.	Gender	Role in SWITCH	Profession	Academic training
1	M	City Coordinator / Cinara Univalle Staff	Sanitary Eng.	MSc and PhD Student
2	F	City Facilitator	Sanitary Eng.	Undergraduate and MSc student
3	F	City Facilitator	Sanitary Eng.	Undergraduate and PhD student
4	F	Cinara project team	Sanitary Eng.	Undergraduate
5	M	Cinara project team	Sanitary Eng.	MSc
6	F	Cinara project team	Sanitary Eng.	Undergraduate and MSc student
7	M	Cinara project team	Economist	MSc
8	M	Cinara project team	Environmental Eng.	MSc
9	F	Cinara project team	Sanitary Eng.	Undergraduate
10	F	Cinara project team	Sanitary Eng.	MSc
11	F	Cinara project team	Sanitary Eng.	Undergraduate
12	M	Cinara project team	Journalist	Undergraduate
13	F	Cinara project team	Economist	Undergraduate
14	M	Eidenar/Univalle Staff	Sanitary Eng.	MSc and PhD Student
15	F	Cinara/Univalle Staff	Sanitary Eng.	PhD
16	M	Cinara/Univalle Staff	Economist	PhD

Other Univalle/Cinara staff with limited involvement in SWITCH

No.	Gender	Role	Profession	Academic training
1	F	Cinara staff	Economist	Undergraduate
2	M	Cinara staff	Sociologist	Specialisation
3	M	Cinara/Univalle Staff	Sanitary Eng.	MSc
4	F	Cinara/Univalle Staff	Sociologist	MSc
5	F	Cinara staff	Social Worker	Specialisation

Students and interns involved in SWITCH

No.	Gender	Role	Profession	Academic training
1	M	PhD Student	Sanitary Eng.	MSc and PhD student
2	M	Internship in 2009	Environmental Eng.	MSc
3	F	Internship in 2007	Civil Eng.	MSc
4	F	PhD Student	Sanitary Eng.	Undergraduate and PhD student
5	F	MSc student	Sanitary Eng.	Undergraduate and MSc

				student
6	F	MSc student	Topographic Eng. with specialization in GIS	Undergraduate and MSc student
7	F	MSc student	Agricultural Eng.	Undergraduate and MSc student
8	M	Undergrad Student	Bachelor student	Undergraduate

LA members

No.	Gender	Role in SWITCH	Profession	Academic training
1	M	Utility	Sanitary Eng.	Undergraduate
2	F	Environmental authority	Sanitary Eng.	Undergraduate with specialization,
3	F	Research centre	Biologist	MSc
4	F	NGO	Economist	MSc
5	F	Professional association	Sanitary Eng.	MSc
6	M	Independent professional	Biologist	PhD
7	M	University professor	Hydraulic Eng.	MSc
8	M	Utility	Sanitary Eng.	Undergraduate
9	M	Utility	Sanitary Eng.	Undergraduate
10	F	Utility	Sanitary Eng.	Undergraduate with specialisation
11	F	Municipality	Sanitary Eng.	Undergraduate
12	M	Consultant	Sanitary Eng.	Undergraduate
13	M	Professional association	Sanitary Eng.	Undergraduate
14	M	Environmental authority	Civil Eng.	Undergraduate with specialisation
15	M	Municipality	Civil Eng.	Undergraduate
16	M	Consultant	Sanitary Eng.	Undergraduate
17	M	Utility	Sanitary Eng.	MSc
18	M	Constructor	Industrial Eng	MSc
19	M	NGO	Civil Eng.	MSc
20	M	Independent professional	Sanitary Eng.	Undergraduate with specialisation
21	M	Independent professional	Sanitary Eng.	Undergraduate
22	M	Utility	Sanitary Eng.	MSc
23	F	Environmental authority	Civil Eng.	MSc
24	M	University professor	Sanitary Eng.	PhD
25	M	Professional association	Civil Eng.	MSc
26	F	NGO	Technician in soil and water conservation	Undergraduate

27	M	Regional authority	Sanitary Eng.	Undergraduate
28	M	Regional authority	Business Administrator	Undergraduate
29	F	University professor	Statistician and Mathematician	MSc and PhD student
30	M	Regional authority	Sanitary Eng.	Undergraduate
31	M	NGO	Philosophy and linguistics	Undergraduate
32	F	Environmental authority	Chemical Eng.	Undergraduate

Stakeholders who recently became involved with SWITCH but who are not yet in the LA

No.	Gender	Role in SWITCH	Profession	Academic training
1	M	Constructor	Civil Eng.	Specialisation
2	M	Utility	Civil Eng	Undergraduate
3	F	Consultant	Architect	Specialisation
4	F	Consultant	Architect	Specialisation
5	F	Professional association	Sanitary Eng.	MSc
6	M	Independent professional	Biologist	PhD

Staff of European SWITCH consortium members, working in SWITCH Cali

No.	Gender	Role in SWITCH	Profession	Academic training
1	M	Coordinator WP 5.3	Civil Eng.	PhD
2	M	Coordinator WP 1.1	Civil Eng.	PhD
3	M	Coordinator WP 6.2	Geographer	PhD
4	M	Advisor WP 5.3	Civil Eng.	PhD, Professor
5	M	Advisor WP 6.2	Civil Eng.	PhD
6	M	Advisor WP 6.1 and 6.2	Irrigation Eng.	MSc
7	M	Supervisor PhD candidate	Microbiologist	PhD, Professor
8	M	Advisor WP 6.2	Sociologist	PhD

Annex 2. SWITCH indicators of success

1. **Newly developed innovations are demonstrated at semi-full scale and towards the end of the project the first signs of replication should be identifiable.**

   The physical demonstration of innovations within SWITCH Cali was never foreseen nor budgeted for, as Cali only became a demonstration city after the second year. However, the first signs of interest by city stakeholders to start physical demonstration have been identified. Some contractors and consultants are interested in studying the feasibility of including innovative technologies into the design of the expansion area of the city. The utility, EMCALI, is changing the terms of reference for contractors to provide more space for the inclusion of such options.

2. **The [sustainability] indicators should be operational, meaning that they are used in practice by learning alliances in demonstration cities, to facilitate discussions on and planning for improved sustainability of the urban water system.**

   The sustainability indicators being developed by SWITCH are not being used in an explicit way by the learning alliance.

3. **The SWITCH approach contributes to policies, in that it is referred to in policy documents or used in policy implementation.**

   SWITCH Cali has been engaging in three official policy development efforts: the urban development plan of the city (POT), Cali Visión 2036 (the long-term planning document for the city) and the CONPES (the national policy for the upper Cauca river). The former two processes are ongoing and SWITCH is actively participating in these, putting forward findings from the research and the SWITCH strategic planning process. The latter document was completed in 2009, and includes specific contributions from the learning alliance members, referring to concepts and ideas developed by SWITCH Cali.

4. **Wide recognition of SWITCH approach and products in scientific and sector reports.**

   Most of the SWITCH Cali reports have only recently been published. It is not yet clear to what extent these are referred to in other scientific publications. Within the city there is reference to the work of SWITCH, though not, to our knowledge, in the form of formal references.