Chapter 6
Climate Change Adaptation: Fomenting Reuse of Treated Wastewater for Agriculture and Water Protection in Bolivia — Triangular Cooperation Mexico - Bolivia - Germany

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Abstract
In August 2011 the German Federal Ministry for Economic Cooperation and Development (BMZ) approved a triangular cooperation project between Mexico, Bolivia, and Germany. Funds derive from BMZ's Regional Fund for Triangular Cooperation in Latin America and the Caribbean, which focuses on the "Support for improved wastewater treatment and reuse and protection of water bodies through a climate change adaptation approach." Mexico and Bolivia are both promoting the importance of water at the international level as both countries recognize the necessity to establish Climate Change adaptation measures in the sector. Within the triangular cooperation, Bolivia is highly interested to learn from Mexico as a regional leader in the water sector, in order to strengthen its institutional and technical capacities in the country. On the other side, Mexico is promoting its presence as a dual co-operation actor, offering technical advice to beneficiary countries in the LAC-region. Germany in contrast offers leadership of this initiative, applying its longstanding experience and expertise in the water sector in both countries.

1. Introduction

Triangular cooperation as an innovative form of cooperation complements North-South and South-South cooperation schemes. It has been seen in recent years that there are many opportunities for the development and implementation of triangular cooperation projects together with the partners in the south. Therefore it continues to gain importance in the context of international cooperation development.

Within the German development policy, triangular cooperation is defined as a "cooperation project that is jointly planned, financed and implemented by an established DAC donor, an emerging economy and a beneficiary country" (BMZ, 2013).

To support the implementation of triangular cooperation projects between Germany and Latin American emerging countries, the German Federal Ministry for Economic Cooperation and Development (BMZ) set up the Regional Fund for Triangular Cooperation in Latin America countries (LAC). This fund is the first and so far only regional fund for triangular cooperation by the German government. Twice a year BMZ revises and approves submitted project proposals and also promotes and funds regional dialogues, exchanges of lessons learnt, and measures for building human capacity.

Triangular cooperation in this context means implementing joint development activities in beneficiary countries in the LAC region, in which each of the partners provides a specific contribution. It includes Germany as a 'traditional' donor, a Latin-American emerging country, and a third beneficiary country. The objective of the project should be consistent with the development agenda of the beneficiary country and comply with the development guidelines of both Germany and the emerging country.

The projects are technical cooperation (TC) measures, planned and implemented jointly with the beneficiary country and consisting of consulting, training, and to a lesser extent financial grants or subsidies. It has been shown that these triangular cooperation projects have been mostly successful when the topics addressed by the project corresponded with the needs of the beneficiary country (Langendorf and Mueller, 2011).

The following paper sheds light on the triangular cooperation project between Bolivia, Mexico, and Germany and explains the benefits for each partner within the triangular cooperation scheme. The project is developed within the water and wastewater sector and acts within a very sensitive context, where social and socio-cultural aspects have a high priority.

2. About the Project

The following chapter will give an overview of the beginnings of the initiative, the importance of the project for the partners, the institutions involved, each partner's specific and mutual interests, and their technical and financial responsibilities.

2.1 The origin of the project

In 2009, the Mexican National Water Commission (Conagua) received a delegation from the Bolivian Ministry for Water and Environment (MMAyA) and a representative from GIZ Bolivia, to explore the possibilities for cooperation within a triangular mechanism (Conagua, 2009). This first approach led to the participation of three representatives of the Mexican National Water Commission at the workshop *"Strategies and instruments for the multiple use of water towards climate change adaptation,"* which was held in 2010 in Bolivia (EPB, MMAyA, GIZ, 2011). Among the Mexican delegation sent by Conagua was the former International Affairs Manager, who used the opportunity to move toward the establishment of a formal triangular cooperation.

Finally, in 2011 Mexico together with Bolivia submitted the application via the German embassies in both countries to BMZ. When Mexico received the formal project approval, Conagua together with the Mexican Agency for International Development Cooperation (AMEXCID) started to organize the triangular cooperation kick-off seminar, "Support for improved wastewater treatment and reuse and protection of water bodies through a climate change adaptation approach," which was held in Mexico City in November 2011. From the points of view of Conagua and AMEXCID the seminar was very productive in that it enabled them to more precisely understand the key concerns of the Bolivian partner related to the project. This provided the bases to define and formulate a concrete working plan (GIZ, 2012).

2.2 Project topic and its importance for the partners

The Bolivian Ministry for Environment and Water is focused on the improvement and fomentation of wastewater treatment, and water reuse on departmental and municipal levels. At the end of 2008, only 50% of the Bolivian population had access to wastewater disposal facilities, a very low figure compared to general Latin American standards. If criteria such as the treatment of wastewater are also taken into account, those figures drop to an estimated 20%. The National Plan

for Basic Sanitation 2008—2015 (EPB y MMAyA, 2009) defined strategic objectives to improve this situation, which focus on (a) a policy of integrated water use management, (b) the efficient use of services within a climate change adaptation approach, and (c) the reuse of residual waters. The "Strategic Institutional Plan 2009—2013" (EMAGUA, 2009) established the mechanisms for necessary investment to improve the water, sanitation, and treatment sectors. The need to strengthen technical and institutional capacities and the framework of the legal sector, and for technical assistance and training in the water and waste water sector prevailed.

Mexico, in contrast, has a well-developed water sector and is considered to be a regional leader in Latin America. Mexico has a long history of institutional development in the water sector, as well as in water legislation. In 1992, Mexico established the National Waters Law (LAN, 1992), which was modified in 2004. The reform defined watersheds as the central water planning and management unit. Beyond this, Mexico is a country with a great hydraulic tradition, with the world's sixth largest area under irrigation, and the 19th highest per capita storage capacity in dams. A good overview on the historical development of Mexican water sector and its achievements is given by Conagua (2011). Mexico has also emerged as a global climate change leader, and considers the water sector a key area through which to address climate change, particularly with respect to vulnerability and adaptation issues (World Bank, 2013).

For those reasons, it is evident that Bolivia will be able to greatly benefit from Mexico's experience in the water sector. Thanks to Mexico's technological prominence and legal expertise, Bolivia is well assisted in its attempt to develop institutional and professional capacities by means of knowledge and technology transfer.

Germany has had a roughly 40-year development cooperation partnership in Bolivia in the water sector, in which the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) as the implementing agency has accumulated a lot of experience and established a broad sector network in Bolivia (GIZ, 2013a, GIZ, 2013b).

In Mexico, Germany has supported the National Water Commission since 1997 through the CIM-Program, which offers technical advisors in

the fields of integrated watershed management, groundwater monitoring, irrigation, and decentralized small water treatment systems. Hence, in both countries German experts are equipped with in-depth knowledge of the sectors and enjoy a well-established network of partners on the ground.

2.3 Institutions involved

Within the triangular cooperation GIZ is acting mainly as a technical and institutional facilitator, providing networks and instruments, and supporting communication and coordination. Furthermore it promotes a common understanding of cooperation in LAC and documents the experience of triangular cooperation in the field under a variety of cooperation settings.

The main actors within the initiative in Mexico are AMEXCID and the National Water Commission. The AMEXCID, a decentralized body of the Mexican Secretariat of Foreign Affairs (SRE), was created on September 28, 2011, and provided with specific powers to deal with matters relating to international development cooperation. The AMEXCID also assumes a donor's role within regional development co-operation. The National Water Commission provides partial financing of the activities, technical and logistical assistance, and experience and knowledge of Mexican water sector institutions.

The Office for International Cooperation of the National Water Commission assigned a responsible person to facilitate the internal administrative management of the technical areas, as well as the communications with AMEXCID and the Bolivian Ministry for Environment and Water in Bolivia. Besides the Mexican Agency for International Development Cooperation and the National Water Commission in Mexico, a broad array of actors on federal, state, and municipal levels, and the investigations center are participating in the project. Due to Conagua's position as the main water institution in Mexico at the national and regional levels, it is able to mobilize the participation of state authorities, district entities, and municipal water operators.

The Bolivian Ministry for Environment and Water is the principal actor in Bolivia within the initiative, In particular, the Deputy Ministry for Potable Water and Basic Sanitation (VMAPSB) and the Deputy Ministry

for Water Resources and Irrigation (VRHR) assume the responsibilities to develop, promote, and coordinate the project in Bolivia. At the beginning of the project, they integrated the "comisión mixta" (mixed task) in coordination with GIZ as an appropriate institutional arrangement on the technical level to develop and manage the inter-sector approach of this project. For the coordination of the overall project activities, the Minister appointed the General Director of the Planning Unit of the MMAyA. Broad participation on the Bolivian side was thus attained thanks to the multi-level design of the project.

2.4 Partners' specific and mutual interests in triangular cooperation

Germany's (BMZ / GIZ) interest and strategic objective is to complement the already existing Bolivian water and irrigation programmes, which did not consider the specific focus on water reuse. Germany is also interested in supporting Mexico in its new role as a donor country and promoting a mutual understanding of cooperation in Latin America. Both Germany and Mexico are interested in developing new forms of visible cooperation in water management and water technology.

The project presents a good opportunity for GIZ to efficiently develop a triangular cooperation, as Mexico is eager to emerge as a dual co-operation actor and strengthen the capacities of developing countries. Mexican institutions also provide a large experience on this topic. Triangular cooperation, considered an innovative alternative for cooperation between three nations ready to improve the efficiency of aid for development, allows Mexico to introduce itself as an emerging strategic partner in the direct execution of projects derived from the necessities of the recipient third country. There is especially a mutual interest with Bolivia in cooperative projects in the water sector, because both countries recognize the strategic importance of water conservation and climate change adaptation measures in the sector. Bolivia and Mexico promote the water theme at international level (Semarnat, 2010; Herron, C.A., 2012). This mutual interest provided the opportunity for the two countries to develop triangular cooperation (GIZ, 2012).

The common objective of all three partners on the sector level was to provide efficient technical assistance and key elements of capacity development to improve the treatment and reuse of domestic wastewater in Bolivia in order to protect scarce water resources. The

Bolivian Ministry for Environment and Water and the lower federal and departmental water institutions and authorities, such as the Executive Entity for Environment and Water (EMAGUA) and the National Service for the Sustainability of Basic Sanitation Services (SENASBA), have provided advice on the legal framework and regulations on water quality, tariff systems, and subsidies and incentives. There was also a broad agreement to develop processes and benefits on the local and regional levels, which led to strong support of selected urban and rural municipalities on the technical aspects of selecting, implementing, and rehabilitating waste water treatment plants and reuse systems. So far there have been activities and technical visits in the municipalities of Cochabamba, Sacaba, Tarija, La Paz, Aiquile and Comarapa.

Beyond meeting these technical objectives, the project also focused on cultural and organizational issues. Social and socio-cultural aspects have a high priority within water topics, and are often considered more important than the technical aspects of the issue. Most of water and wastewater projects at the department and municipal levels provoke conflicts between users and the local authorities, or between different user groups, and the establishment of wastewater treatment plants (WTP) is often highly conflictive. Due to negative experiences in the past with such projects (a lot of existing WTPs do not work well and have negative effects), the population and the users oppose these projects. Therefore, Bolivian partners requested Mexican experts with a broad experience on social conflict management within water and wastewater projects.

2.5 Technical and financial responsibilities

The technical and financial responsibilities of each partner are defined in the "Record of Discussions" (Registro de Discusiones). Mexico strongly fostered the ratification of the paper to have a clear framework for each partner's contribution within project activities.

Sign of the Record of Discussions by the representatives of AMEXCID, Conagua and GIZ-Mexico.

Mexico provides experts and technical expertise, as well as financial support for coordination, organization and mobilization of experts. Furthermore it offers the integration of an

institutional and expert network for capacity building activities. Total countable value of the Mexican contribution equals an amount of about 300000 Euro.

Germany offers financial support for mobilising experts and participants from all parties, as well as logistic support in Bolivia. Additionally it offers a technical network on the national and sub national level for capacity building activities and the provision of experts where appropriate or demanded (technical and methodological). This means that Germany could provide in exceptional cases the participation of German experts on specific thematic issues when it is explicitly desired by the partners. Furthermore Germany supports project coordination. In Mexico, where Germany does not have any specific water programme within bilateral cooperation, GIZ contracted a former CIM-expert who is well familiar with the Mexican water sector and who serves as a liaison between GIZ and Conagua, as well as with the Bolivian partners. The total economic contribution of Germany is about 300000 Euros.

Bolivia secured the participation of technicians and authorities in the different project activity and is responsible for their organization in the country. The countable value for Bolivian contribution equals an amount of about 75000 Euro.

3. Progress and Achievements

This section first presents the project activities during 2012, the results of the mid-term evaluation, and the working plan and activities for 2013, which incorporated the findings and recommendations of the evaluation results. By tracing these activities, this section aims to illustrate the learning process among multi-stakeholders taking place in this initiative.

3.1 Progress and achievements in 2012

In March 2012 Bolivia, Mexico, and Germany together accorded the working program for 2012. The program included four main activities, consisting of two missions to provide technical advice by Conagua experts in Bolivia, and two seminars including technical tours in Mexico, addressed to officials from governmental institutions, municipal authorities, and water operator organizations. During the 2012

activities, the Mexican National Water Commission sent six high-level national experts to Bolivia to provide technical advice. Another 24 Mexican experts participated in the seminars and technical tours. Conagua also organized the participation of five Local Water Directions of the Federal States of Queretaro, Guanajuato, Puebla, Tlaxcala, and Mexico, as well as of seven State and Municipal Water Operators. Additionally two high level officials from the Bolivian Ministry of Environment and Water were invited to participate at the "*IV Coloquio Jurídico Internacional del Agua*" (4th International Colloquium on Water Legal Framework), which was organized by Conagua (Baumann et.al., 2013).

Table 1. Main activities realized in 2012

Activity	Country	Subject
Technical mission	Bolivia	Advice on the design of wastewater treatment plants, and irrigation systems for treated wastewater reuse in agriculture.
Course	Bolivia	Integrated water management and adaptation measures on climate change in the water sector.
Seminar and technical tours	Mexico	Potential for treated wastewater reuse in agriculture irrigation systems.
Seminar and technical tours	Mexico	Water policy planning and legal water framework

The activities completed in 2012 gave Conagua a detailed knowledge of the Bolivian water sector and the status quo of wastewater treatment and water reuse, as well as of the institutional framework in Bolivia. Furthermore, Bolivia developed a clear idea of Mexican technological and administrative progress, and institutional, organizational, and administrative advances in the water sector, especially in the field of wastewater treatment and reuse.

Technical visit to the Tula Irrigation District, Mexico, guided by Conaguas's officer in chief

The 2012 activities developed in both countries strengthen the inter-institutional relationship, especially between the Mexican National Water Commission and the Bolivian Ministry for Environment and Water, and are a key element for the successful and efficient execution of the ongoing cooperation project.

It should be pointed out that five Municipalities in Bolivia received technical advice by Mexican experts for the improvement and rehabilitation of existing wastewater treatment plants. In the municipality of Comarapa the recommendations of the Mexican experts were successfully implemented and led to the rehabilitation of the municipal water treatment plant.

Rehabilitated wastewater treatment ponds in the Municipality of Comarapa, Bolivia

3.2 Mid-term evaluation

In March 2013 a midterm evaluation workshop took place in La Paz, Bolivia. The goal of this workshop was to learn about the existing communication and coordination structure, and the impact of the activities completed in 2012.

The workshop aimed to:

- ➢ Evaluate project development and activities completed in 2012;
- ➢ Determine whether the project was providing what originally had been proposed (appropriateness), whether the activities were orientated to reach the project goals (effectiveness), and to what extent the project contributed to the solution of the problem in Bolivia (relevance);
- ➢ Analyze the project's level of achievement according to the indicators that were established for each goal in the application;
- ➢ Evaluate project management, communication, and coordination mechanisms;
- ➢ Evaluate the level of involvement of the different actors and their compliance with the commitment they took on;
- ➢ Plan and agree on activities for 2013.

The workshop was directed to responsible persons from the three partners and representatives from different beneficiary institutions at

the national, departmental and municipal levels in Bolivia. Thirty two high level public servants and water sector experts attended the workshop. From Mexico, representatives from Aconcagua, the AMEXCID, and the Mexican Embassy in Bolivia participated. From Germany, GIZ experts of the PROAGRO and PROAPAC programs attended. The Bolivian Viceminister for Water Resources and Irrigation, the Viceminister for Potable Water and Basic Sanitation participated, along with directors from the National Service for Basic Sanitation (SENASBA), EMAGUA, and the Authorities for Inquiry and Social Control for Potable Water Basic Sanitation (AAPS, regulatory entity).

(1) Usefulness of activities

The first step was the evaluation of the usefulness of the four main activities completed in 2012. Therefore the participants were requested to identify concrete and specific examples of implementation of the knowledge obtained by training and technical advice. The main conclusions were:

- The direct advice by Mexican experts from Conagua, which focused on the "Support on the design of waste water treatment plants, and irrigation systems for treated wastewater reuse in agriculture" achieved the most direct results, leading to the implementation of concrete measures for the rehabilitation of existing wastewater treatment plants in three municipalities.
- The visit of Bolivian authorities and experts to Mexico to obtain support for the development of a legal and regulatory framework in the field of water quality, attends a seminar on water policy planning, was considered useful and improved the draft of a new water law which is currently being discussed in Bolivia.
- The seminar titled "*Integrated wa2ter management and adaptation measures to climate change in the water sector*" was of minor usefulness. The course was not linked to concrete activities in Bolivia, and most of the knowledge could not be applied. There was a discrepancy between the very broad focus of the course and the more specific needs of the more technical participants. Finally, there were no follow up and no multiplying of knowledge, as had been previously agreed.
- The seminar about the "*Potential for treated wastewater reuse in agriculture irrigation systems*" and the technical tours in Mexico were useful for understanding new wastewater treatment technologies and the opportunities to increase agriculture yields by water reuse.

Furthermore, the participants learned about new financing and investment models for wastewater treatment plants, as well as different strategies for the multiple reuse of treated wastewater at municipal and district levels. Despite this information, participants stressed that the acquired knowledge has not been anchored at the institutional level in Bolivia, but the activity has impacted personal motivation and increased awareness about the theme.

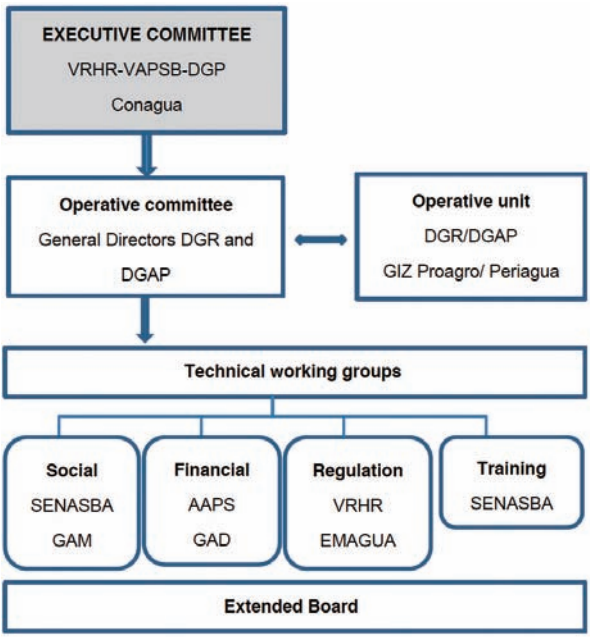
In general, the can be considered broadly on track according to the expected output and results. The number of participants at seminars, workshops, on technical tours was greater than expected. The activities which were completed in 2012 are also considered highly appropriate and relevant, taking into account the high policy priority placed on the subject of wastewater treatment and reuse. Therefore, it is expected that the project could contribute significantly to the ongoing governmental initiatives to improve wastewater treatment and reuse in Bolivia.

On the other hand, the capacities built and the knowledge generated has been less than expected or desired. There are mainly two reasons for this low performance: Firstly, the persons and technicians who participated in the different activities were not well selected in all cases; secondly, the Bolivian institutions (beneficiaries) did not take enough advantage of the learning or apply it systematically. The efficiency of the measures in many cases had been good, but could be better in the future.

(2) Adjustments to project management structures

An important recommendation based on the findings of the mid-term evaluation was to strengthen the project management and coordination structure. The following figure shows how the management structure was improved to ensure successful project development and implementation of activities in the future.

Figure 1. Organization structure for project management and execution
(See Table 2 for abbreviations in this diagram)



Source: GIZ, 2013

Executive committee: The executive committee establishes the agreements about project strategy and ensures the financing of the activities. It meets once a year and includes the Deputy Minister for Water Resources and Irrigation (VRHR), the Deputy Minister for Potable Water and Basic Sanitation (VAPSB), and the General Director for Planning (DGP) from Bolivia, the International Cooperation Manager from Conagua, the Deputy Director for Trilateral Cooperation from AMEXCID, and two representatives from GIZ.

Operative committee: The operative committee monitors the project and keeps track of the activities. It increases the responsibilities of the institutions and helps to resolve operational problems. The operative committee is composed of the General Directors for Irrigation and Potable Water, and representatives of Conagua, AMEXCID, and GIZ. The committee members meet whenever is necessary to solve operational problems.

Operative unit: The operative unit works continuously to coordinate concrete activities. It guarantees the integration of the Terms of Reference for each activity in coordination with the Operative Committee.

Working groups: Working groups are responsible for the execution of the activities and the selection of the participants at workshops and seminars. There are four working groups, organized according to the main thematic topics: Social, Financial, Regulation, and Training. Each working group shall be composed of representatives of the institutions and authorities that are involved in a specific topic.

Extended board: The extended board integrates members of all parties and involved institutions, and is responsible for final evaluations and participatory planning.

Table 2. Bolivian institutions and their mandates

Institution	Mandate
DGR, Directorate-General for Irrigation DGAP, Directorate-General for Potable Water	Planning sector management, development of policies, guidelines and norms, evaluation of projects
SENASBA, National Service for the Sustainability of Basic Sanitation Services	Technical assistance to Water Operators and institutional strengthening
EMAGUA, Executive Entity for Environment and Water	Planning, execution, and administration of infrastructure projects
AAPS: Authority for Inquiry and Social Control of Potable Water and Basic Sanitation	Regulation, control, and inspection, and setting of tariff structure
GAD: Autonomous Departmental Government	Departmental administration
GAM: Autonomous Municipal Government	Municipal administration

3.3 Working plan and activities 2013: Building on the mid-term evaluation results

The results of the mid-term evaluation led to both a prioritization of thematic measures and a definition of the type of activities for 2013.

Taking these into account, four main activities were agreed upon to ensure the efficiency of the overall project. Considering the importance and higher efficiency of "in the field" measures in Bolivia, two technical visits and workshops were planned. It was also considered important to implement intensive measures in Mexico, like one month internships for technicians at selected water operators (Table 3).

Table 3. Working program and main activities in 2013

Activity	Country	Subject/Topic
Course/workshop	Bolivia	Design, operation, and maintenance of wastewater treatment plants
Course/workshop	Bolivia	Regulations of water quality for reuse
Practical training/ internship	Mexico	Design, operation, and maintenance of wastewater treatment plants
Advisory	Mexico	Advisory on the topic of tariff-systems, incentives, and subsidies

In addition to these programs, Conagua requested a technical visit to Germany to take advantage of German technological leadership in the water and wastewater sector. Therefore, GIZ organized a one week study trip to Germany under the topic of *"Innovative technologies for wastewater and sludge treatment, constructed wetlands and water reuse in agriculture."* The program of study for the trip established according to the requirements expressed by Mexican and Bolivian counterparts. This complementary activity was only addressed to high level decision makers from Conagua, the Bolivian Ministry for Environment and Water, and the Directors of Departmental and Municipal Water Operators from both countries.

The study trip to Germany was undertaken in July 2013 and was very successful for several reasons: Firstly, it became a powerful motivation for the Mexican partners to remain engaged in the project and continue their commitment to support future activities; secondly, it fomented the personal and institutional relationship and confidence between Mexican and Bolivian partners; and thirdly, it strengthened the mutual understanding of triangular cooperation. In other words, the trip provided an excellent opportunity to firm up the partnership for further cooperation in this initiative.

4. Conclusion

At governmental levels the topic of this project is a high priority in the field of environmental and climate change policy in Bolivia and Mexico. This mutual concern fosters the interest in the project at both sides, guarantees political support, and foments positive synergy effects.

Mexico as the emerging donor country has a clear development edge over Bolivia in the water sector and the Mexican institutions possess high levels of professionalism, and operational and management capacities. Therefore, the interest and the expectations of Bolivia to take advantage of the cooperation are very high — a key element for a successful development of the project. Germany's longstanding experience in bilateral cooperation in both partner countries has proved to be of great advantage, and allows Germany to act as a project facilitator in a very efficient way.

The water and wastewater sector exists within a very sensitive context, where social and socio-cultural aspects have a high priority. Mexico and Bolivia's linguistic similarities and the common understanding of cultural idiosyncrasies are thereby advantages, increasing the project's efficiency within the context of triangular cooperation.

The mid-term evaluation allowed an assessment of the efficiency of current measures and activities, the level of identification and project adoption by the partners, and the detection of deficiencies in the management and communication structures. This led to necessary adjustments at the right time to guarantee a successful development of the next phase of the project.

Though this project is ongoing, it has already started to record good progresses in Bolivia, including the rehabilitation of existing wastewater treatment plants in three municipalities and the improvement of the draft of a new water law currently under government discussion. To further improve its effectiveness, the project continues to evolve. Section 3-2 and 3-3 above illustrate the project's adaptations in scope and design based on the recommendations of the mid-term evaluation, including focus of the activities and implementation structure. This case study thus provides a useful good practice of how a TrC can connect the partner organizations in Mexico, Bolivia, and Germany to improve wastewater treatment and reuse in

Bolivia. It further demonstrates how partners in a TrC initiative can continuously learn and adapt to better respond to the complex and changing development needs by systematically incorporating joint evaluation exercises in its activities.

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