
Starting at the top: preventing pollution from tanneries and cleaning up the Rio Bogotá

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I. INTRODUCTION

The Rio Bogotá (Bogota River) descends 370 km through the plain of Bogotá from an altitude of 3400 m above sea level in Villapinzón before it discharges into the Magdalena River at 280 m above sea level (Bravo et al., 1999). The upper river is relatively small and shallow with a limited gradient until, halfway along its route; it passes Bogotá, not only Colombia's Capital City but also an important industrial centre with eight million people. Then the river descends more fiercely. As it arrives at Bogotá, the river has an average flow of 12m³/s, but it then receives at least 15m³/s of mainly untreated wastewater from domestic and industrial activities³ (EPAM, 1993). The Rio Bogotá is perhaps one of the most polluted rivers in the world. In the city area, it was found to have a maximum total chemical oxygen demand (COD) of 475 mg/l (maximum soluble COD is 128 mg/l) with a dissolved oxygen (DO) level of 0.05 mg/l (UNIANDES, 2002). In everyday language the Rio Bogotá is a dead river as it lacks sufficient oxygen to sustain life.

The annual cost of water pollution over the whole country has been estimated at more than 1% of Colombia's Gross Domestic Product (GDP) (Sánchez-Triana, 2007). However, only in 2010, has the Ministry of the Environment formulated a policy on Integrated Water Management (MAVDT, 2010). Only 5% of the environmental authorities' budgets have traditionally dealt with pollution issues other than investment in conventional wastewater treatment plants (Sánchez-Triana, 2007).

The biggest polluter is the city of Bogota and the wastewater it generates. Sewage treatment plants were found to have permanent financial, administrative, technical, operational and maintenance failures (Court Order, 2004). Today, considerable attention is focused on cleaning up the river, but these are expensive "end of pipe" efforts that do not prevent pollution in the first place but seek to

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³ The 15 m³/s figure is from 1993. However, this flow has probably not increased dramatically since then despite significant growth in the city size. Since the year 2003, water consumption in Bogota has dropped from 160l/cap/day to around 120l/cap/day (oral communication from the water Utility of Bogota, 2011) which suggests that wastewater from domestic sources has also declined per household

clear up the mess afterwards. In 2009, Colombia's President Álvaro Uribe announced a US\$ 1.1 billion plan for restoring the Bogotá river basin by 2030, including a US\$ 330 million primary wastewater treatment plant to serve the city. In December 2010 The World Bank Board approved a US\$ 250 million loan for the Rio Bogotá Environmental Recuperation and Flood Control Project, focused on the river basin between Cota and Soacha.

In the early years of this century, there had been little progress on cleaning up the river and it seemed that focusing on cleaning up the upper catchment before the river reaches Bogota could provide hope and encouragement for recovery of the river further downstream. This after all accounted for perhaps 5-10% of the total pollution load and some noxious chemicals. The Tibitoc water treatment plants with a capacity of 4m³/s supplies the northern part of the city, and there is an important zone of horticultural cultivation. Both the treatment plant and the farmers face operational difficulties because of high contamination levels in water abstracted from the river.

Colombia has a vast number of micro and small sized enterprises (MSEs)⁴. They employ 81% of the nation's workforce, representing 99.4% of the total number of businesses (DNP, 2007).MSEs in the industrial sector impact heavily the environment.

One of the biggest sources of pollution in the upper catchment of the Rio Bogotá is from tanneries, mainly small-scale and family businesses which have been dumping their industrial discharges into the river without treatment for decades. The owners of these micro-tanneries are of indigenous background, with limited access to training or to technical, legal or financial support. Operating largely in the informal sector, this community has been overlooked by pro-poor policies and governmental support, and has instead been stigmatised as private-sector polluters. However, tanners were increasingly living below the poverty line (El Tiempo, 2004a).

The use of regulatory, market and persuasive policies often bypasses such enterprises, reflecting uncertainties in the policy, scientific and methodological approaches to MSEs. Frequently the only approach adopted is legal action.

Strategies for controlling pollution are ill equipped to deal with such businesses. Cleaner production projects, designed to minimise waste and emissions out of industrial processes through prevention strategies, are rarely implemented. Instead "end-of-pipe" clean up approaches are promoted but these entail high investments, and are often unaffordable for MSEs (Cloquell-Ballester et al., 2008; Montalvo and Kemp, 2008; Blackman et al., 2007; Altham, 2007). As the viability of MSEs is threatened by pollution controls, social unrest results and MSEs are, unsurprisingly, in frequent conflict with authorities.

How can small-scale businesses best be supported to clean up their act without losing their vital benefits to the families they support and the wider economy? This question prompted a PhD student to combine her research with a highly practical

⁴ MSEs are micro enterprises (1-9 employees) and small enterprises (10-49) employees

intervention, and so started a process that was later supported by SWITCH. It has demonstrated that a trust-building multi-stakeholder approach focused on detoxifying relationships can ultimately also start to detoxify the river.

Conflict over micro-tanneries on the upper Rio Bogotá

Near the source of the Rio Bogotá, lies a community of about 150 tanners of indigenous background. The small-scale tanning industry offers 700 direct jobs and represents the main commercial and industrial activity in the area. These small family-run industries have existed for decades and spread themselves along a 7km stretch of the river to the south of Villapinzón, a small town with a population of 8000 people about an hour by road from Bogota. One third (51) of these micro-tanneries are within 30m of the river bank, a zone that since 1977 has been considered “for preservation and protection use only” (INDERENA, 1977).

Until 1984 the tanners used natural tanning agents. Then the regional authorities began to promote synthetic tanning agents, with little or no oversight or support. Chemical product salesmen and representatives of companies providing “end-of-pipe” technologies became the only technical advisors to these businesses. Today, tanning entails two basic processes that impact upon the environment: removing the hair from the hide (“unhairing”) with sodium sulphate, and the tanning process itself using chromium sulfate.

The effluents from these micro-tanneries are discharged into the Rio Bogotá with disastrous consequences for water quality. On leaving Villapinzón, the river had a COD of 102mg/l in 2004 and high levels of chromium sulphate ($\text{Cr}_2(\text{SO}_4)_3$) that at 0.3mg/l were three times the safe limit for agricultural and domestic use. Discharges of chromium sulphate from the micro-tanneries were found to be between five and nine times higher than what is allowed by Decree 1594 on industrial discharges. According to Regional Authority (CAR), these loads made it impossible to meet the water quality standards set for the year 2020 for this part of the river.

In the late 1990s, the Regional Environmental Authority (CAR) started to impose sanctions on the tanners because of their harmful use of synthetic tanning products. They took the view that they had tried to solve the environmental pollution from this community around Villapinzón for more than 20 years without effective results. CAR pointed out that it had invested in 67 technical options that were still on its shelves and it had run out of patience. However, of these 67, all but one had been “end-of-pipe” solutions and only one was about cleaner production, which seeks to prevent or mitigate the extent of pollution in the first place.

In 2003, several “acciones populares” (public interest claims) regarding pollution of the Rio Bogotá were brought together at the regional judicial court under one big court order encompassing the whole Bogota River.

By 2004, the tanners were considered to be solely to blame for the pollution. It was also clear from judicial proceedings, newspaper articles, and statements from tanners, CAR officials, and the Public Prosecutor, that land issues lay at the heart of the conflict. Their small-scale tanning industry had not been formally recognised and the tanners on the river bank were considered invaders without property rights (El Tiempo 2004c). Realising that no environmental rehabilitation project was being implemented, in February 2005 the Regional Environmental Authority (CAR) took decisive action and closed 58 tanneries (El Tiempo, 2004b; 2005).

By this time, chemical salesmen, and local lawyers had made a living out of the conflict without offering real solutions. Indeed some lawyers had manipulated them to the point where they could not present legal defences because the legal terms had expired.

There were also divisions between the small tanners who want to hold onto land they claimed that their fathers had owned and a larger tanner who would have been happy to move to an industrial park elsewhere. Meetings tended to end in rows and acrimony.

In summary, the tanneries were facing restrictive regulation, big fines, closures, and even, in some cases, being forced to relocate away from the riverbank. As these mainly farm-based and household-level enterprises have limited capacities and resources, they had few options beyond the riverbank.

Tanners were trained in polluting practices. *“The medium sized tanner was always represented by renowned lawyers, whereas the small tanners only had only occasional legal support. When small tanners spoke up in court this often turned out into aggressive claims against the CAR and the government leading to clashes with the judge.*

“I learned talking to the tanners that they learned the job from their fathers and still remembered that after scraping the hairs of the hide they soaked them in a mixture of water and smoked animal brains. In 1984 this form of natural tanning was replaced by synthetic tanning when tanners got training from the CAR (which at that time was only a Regional Authority but not yet concerned with the environment) who taught them the use of synthetic tanning agents (chemicals) and then left them to themselves for more than 10 years. They even got a diploma from the training.”

Interview with Monica Sanz

II. SWITCH ACTION RESEARCH

In 2003, a PhD student at UNESCO-IHE read about the conflict and began to think how the concept of cleaner production could be applied. Monica Sanz met with the Magistrate who was overseeing the court orders against the tanners and he took an interest in her ideas for conflict resolution and for cleaner production. In December 2003, she organised a video conference between UNESCO-IHE in Delft and the main actors involved on the recovery of the Bogota River.

The small tanners in Villapinzón asked her to help them resolve their conflict. She helped them to present their property documents to the Public Prosecutor and together they identified a number of issues, from which the tanners started to realise that they would have a better chance to overcome their problems if they were united.

Sanz adopted a six step process inspired by negotiation theory (Table 1) and started to work closely with the tanners. She also obtained the support from the Cleaner Production Centre (CRPML) in Cali to find cleaner production solutions for the tanneries.

	STEP	AIMING AT
1	Preparation	Initial definition of the problem based on (situation analysis, identification of interest and actors (possible allies), nature of relationships) whilst also exploring the Best Alternatives for a Negotiated Agreement (BATNAs)
2	Building relationship	Sharing information and building trust
3	Redefinition of the problem	Internal Visioning - Initial consensus building strategy
4	Establishing common grounds first internally and then among all actors	Empowering communities for better win-win situations – Identifying realistic and accurate options for improvement
5	Agreements	Establishing commitment
6	Implementation and Follow-up	Implementing solutions - Monitoring the process and providing feedback (dynamic process)

Table 1 A six step process to negotiation

In August 2004, the court ruled that the small tanneries needed to include CP as a strategy for pollution prevention and that the CAR needed to provide support. To her surprise, the Magistrate designated Monica Sanz to supervise the court order once it was enforced (Court Order, 2004).

Although there was no learning alliance involved in this process, the parallels can be seen. It was a learning process with multiple stakeholders addressing a real life problem. The process involved visioning, trust building and a process of redefining problems before seeking solutions. It also required facilitation. The first three steps took a period of some three months during which time Sanz worked separately with the different actors in small groups, to better understand the problem, and particularly with the tanners.

Initially, the CAR considered that the cause of the problem was that the tanners had rejected any solution offered to them. The (then) tanners’ leader considered that the problem was that they did not have the money to implement end-of-pipe solutions and that the authorities never listened to them.

By the end of step 3 some consensus was beginning to emerge about a number of issues including the fact that solutions proposed in the past had not taken into

account the interests of the small tanners. The CAR started to realise that their relationship with the tanners was interdependent and long term and that the property rights of the tanners on the river bank needed to be respected. These three steps allowed a clear problem definition and strategy to be established. The strategy aimed at strengthening the tanners' association, legalising the tanners and helping them to sort out the legal barriers, solving the interrelated land issues, implementing appropriate cleaner production options, and implementing a business plan for competitiveness.

The first 3 steps already brought about change. The small tanners chose a new leader and their association ACURTIR, now supported by 120 tanners, became stronger. They agreed on cleaner production as the preferred technical option and this was also supported by the Magistrate responsible for the court order on the Bogota River. The tanners started to participate at the national leather committees at the Ministry, and the authorities began to respect the property rights of the tanners from the river bank. Reliable information on the situation of the tanneries now circulated between the national comptroller, the authority and the local actors themselves. Individuals were eager to participate in pilot schemes with cleaner production. Despite some negative voices that sought to promote discord, trust was built with the researcher who was playing the role of a change agent.

During the next steps stakeholders were brought together in larger groups. Methods for working in larger groups included "open space technology" (OST) where participants were assisted to create and manage their own agenda of parallel working sessions to discuss different topics and identify how to proceed and work together. A senator who participated in the first OST decided to support the conflict resolution process and opened channels with the Office of the Presidency, the President himself and the Chamber of Commerce. It took more than one meeting to reach solutions as CAR stated that it needed to get proof of the tanners' will to change before supporting a cleaner production project. CAR only gradually accepted this technical option, partly because they did not think it suitable for highly polluting industries and because they had no legal control.

Box 1 Tanners had a vision for today and tomorrow

In 2004, as part of the initial focus on defining problems and building trust the riverside tanners were invited to describe their vision of how things would be in 2009 and in 2020. They foresaw that in 2009 they would be still tanners, but using cleaner production methods and, working with CAR, would have resolved land ownership issues, and be providing a better product with new markets. Many of these objectives were largely achieved, more or less to this timetable. For 2020 their vision was more ambitious, but still realistic. They believed that they would be exporting their products through their association and that they would have their own technical support centre for leather.

The negotiation processes produced changes in the power relationships. The large tanner in the process lost power in relation to the small tanners. Meanwhile the

small tanners replaced their leader and they supported another candidate for mayor in 2007 who then won the elections.

In contrast to the rapid progress made during the first three steps, reaching a final agreement (step 5) took a further 2.5 years during which time five large meetings were held.

Once the tanners started to show their willingness to change, notably by visiting a tannery in El Cerrito (Cali) that was implementing cleaner production and choosing technological options, resources began to be mobilised. Prompted by the Senator who had joined the OST and by the Magistrate, the Bogotá Chamber of Commerce offered financial support for the necessary legalisation process. The tanners responded by approving this process and providing 15% of the finance themselves. In 2006, when the SWITCH project was launched globally, it was agreed that SWITCH would give financial, administrative and technical support to the conflict resolution work with the Bogota tanners and authorities. SWITCH worked with a Colombian institution that came to be the Universidad Nacional at the Institute of Environmental Studies, known by the acronym UNAL.

From 2007, the Colombian Institute for Science and Technology (COLCIENCIAS) and the regional authority, CAR, co-financed the SWITCH project in Bogota. The NGO AVINA also contributed with resources for a pilot industry. The prestigious lawyers, Gómez Pinzón, supported the process through their Social Community Work programme. The Office of the Governorship, the Public Prosecutor and the Ministry of the Environment spent time helping to resolve the tanners' land problems and they put pressure on the environmental authority's board of directors to reach an agreement. CEINNOVA, the Technical Development Centre for the Colombian leather industry - provided training.

Box 2 Training provided on and off site

50 tanners participated in ten training sessions provided by the leather industry Technical Development Centre in Colombia CEINNOVA, including both theoretical and practical issues: best available technologies (BAT) good operational practices (GOP) process control, industrial safety, solid waste management, cost control, marketing and association building. Educational material was designed and 30 site visits were made to provide other tanneries with instruction about cleaner production. In addition, 7 training sessions were carried out for operational staff in the 12 pilot tanneries.

Initially, the Chamber of Commerce handled the resources needed for the legalisation. Once the SWITCH project started, the financial resources were administered by UNAL. However, the process continued to be facilitated and led by Monica Sanz working with the tanners.

During step 6 (implementation), SWITCH-UNAL helped to initiate a pilot project for cleaner production in six small tanneries, and CAR joined in co-financing another six. These 12 improved their operations, reduced their negative impact on the

environment and served as a learning experience and example for improved unhairing and better control of pollution.

It can be argued that by the time SWITCH became involved in the process the biggest hurdle had already been cleared out of the way - the parties were talking to each other and were actively involved in trying to resolve the problems. However, SWITCH brought new finance, institutional resources and commitment to the work that the tanners had begun with Monica Sanz, with the support of some key people in the political system and key organisations.

The aims of the SWITCH intervention did not change the overall direction of this work to put an end to the social exclusion of tanners and to find effective alternatives to the mostly technology-driven end-of-pipe focus in dealing with the pollution of these micro-enterprises. The strategy was based on internal strengthening of the target communities, and on building strategic alliances to address the different issues at stake. The approach was based on understanding the context and the specific needs of the MSEs through detailed research. A systematic process continued to boost the negotiating power of MSEs, focus on multi-level and multi-disciplinary interventions and to support marginalised communities to learn to solve their own problems (see Box 2).

Box 3: Systematic Approach for Social Inclusion (SASI)

SASI (Systematic Approach for Social Inclusion) is a methodology based on an integrated theoretical and methodological framework⁵ inspired by the theories of negotiation, conflict resolution and managed learning (action research), as illustrated in figure 1). These approaches were selected for their suitability in handling the complex situation of the MSEs in Villapinzón. Together, they implied working with big groups implementing a process that is planned, problem solving based on trial and error, and a process that was both systematic and at the same time, highly participative and respecting of the interests of the MSEs.

Participants were assisted to create and manage their own agenda of parallel working sessions to identify how to proceed and work together. They also used Appreciative Inquiries (AI) an approach that asks questions and envisions future positive relationships and a system's capacity for collaboration and change

The parallels between SASI and the learning alliance approaches found in other SWITCH cities are apparent. In this case the process focused on a specific social conflict with related power issues and technical objectives. The most notable parallel is that the technical issues can only be addressed within a social context and that resolving different interests and agendas is never just a technical question.

⁵ Origins of the theories of negotiation, conflict resolution and managed learning can be found in Thompson, 2009; Holman *et al.*, 2007; Raiffa *et al.*, 2002; Ravetz, 1999; Schein, 1996; Lewin, 1946

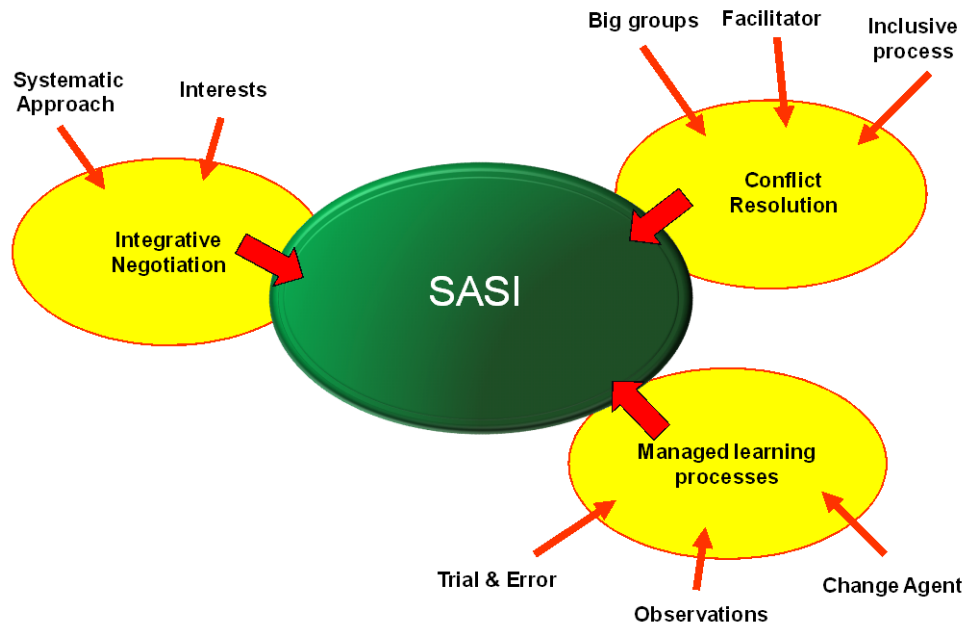


Figure 1 Key elements of the SASI Systematic Approach for Social Inclusion

During managed learning, the researcher plays the role of a change agent who (a) engages in the process and differentiates when she or he needs to be a helper, a facilitator or a mediator, (b) recognises the importance and uniqueness of the context, (c) facilitates an open learning process based on trial and error and the special characteristics and culture of a given community, and on mutual learning, instead of adopting pre-set models, and (d) is mainly motivated towards empowering vulnerable communities to solve their own problems (Lewin, 1946; Schein, 1996).

Despite the progress being made, closure orders were still in force and did in fact take place. During a two year period when many small tanneries were shut down, it was of course even more difficult to carry on with the cleaner production environmental plans supported by the Chamber of Commerce. However, the SWITCH project was a strong supporting factor. Activities supported by SWITCH involved:

- Research on sustainable discharge limits from tanneries through learning about the long-term effects of pollution.
- Determining the best cleaner production options for the micro-tanneries.
- Implementing cleaner production options in six tanneries initially, and then with six more with support from the environmental authority.

- Supporting training on the best available technologies (BAT) but also on the good operational practices (GOP) and elaborating training material.
- Monitoring the progress and impacts of implementation.
- Developing demonstrations on solid waste management and use derived from residues from the tanning process.

Throughout this process the tanners were actively involved in developing innovative control processes.

III. OUTCOMES

The dispute between the authorities and the tanners in the upper reaches of the Bogota River was at first seen to be about unacceptable pollution of the river. On closer inspection it was clear that it was also about land rights and to some extent, the social exclusion of a community from the decision making processes. Efforts to prevent the tanners from polluting the river had been largely coercive and had failed to engage effectively with their interests. Intermediaries acting “on behalf” of the tanners had not always acted in their best interests. The only solutions on offer were about treatment plants.

A first step to overcome some of the conflicts was to establish the tanners association, ACURTIR. This began to represent the interests of the smaller tanners, which were not the same as the large scale tanners. The tanners sought help from several sources, the Mayor, a sympathetic official in environmental authority, a sympathetic Senator and the ombudsman (Procuradía). Thanks to the efforts of the Senator, even the President of the country took an interest in what was happening.

The process that followed the initial intervention by the PhD student was one of gradual engagement. Supported by some key champions, the tanners and the authorities began to communicate better and to work towards more positive ways of dealing with the problems.

Out of 80 tannery businesses in the area, around 50 attended training sessions, 30 tanners adopted cleaner production methods and 12 involved themselves in detailed research.

SWITCH and the University of Colombia became involved at a relatively late stage, once the actors were on speaking terms, but they were able to step up research focused on understanding production processes and the effectiveness of cleaner production processes in reducing pollution, but also the governance, legal and conflict issues associated with the problem.

The outcome so far is by no means perfect. There was pollution before and there is still some pollution now, but those tanners who have adopted cleaner production methods have dramatically reduced their impact on the river water and their rights as landholders and as an industry have been established. The technical efforts have produced positive results.

- 30 tanneries that did not have planning conflicts implementing cleaner production options along with physicochemical treatment.
- Pollution levels from two tanneries have been measured since 2004. Since starting cleaner production, these have shown reductions in pollution loads by one third to two thirds in Chromium and from 60-72% in BOD5.
- These industries have adapted their unhairing processes, and are recovering hairs from the first wash to make compost rather than discharging them into the river. They bought a land plot to use as a common compost site. Fats are also recycled and used rather than thrown away, and they use fewer chemical inputs.
- Water used for washing skins is collected and recycled. The amount of water being used has been reduced substantially. Between 2004 and 2009, 30 legalized tanners saved 70% on water consumption and reduced their discharge into the river.
- 50 tanneries within 30 meters of the river bank have had their property rights recognised and are waiting to be relocated by the Governor.
- 20 tanneries have been bought by the construction company that works on the highway passing through Villapinzón. 50 industries that had faced great planning uncertainty still have to adopt the technical improvements.
- In 2010, in a unique judgement, a local judge agreed that tanners could work on a project for environmental recovery to “work off” their fines, instead of paying them in cash.
- Industrial use has been established for tanners’ lands, allowing them for the first time to invest in their own futures with confidence.
- The tanners’ association ACURTIR has emerged stronger, and is developing an environmental section for members to help each other and a commercial/business department to improve marketing.

The problems that have not yet been successfully addressed are those related to economic viability, although business training is now offered to the tanners and access to loans from the Ministry of Commerce is being explored. Not all members of ACURTIR are paying their affiliation fees.

Even with cleaner production there is still pollution. The next step would be collecting the wastewater centrally and developing a treatment plant with secondary treatment in addition to the primary treatment at business level.

There is also still a problem with the institutional culture of the Regional Environmental Authority (CAR) where, despite progress with the tanners, the general approach continues to be one of non-participation.

Detailed outcomes

In practical terms the strategy set jointly with the stakeholders aimed at

strengthening the tanners' association, legalising the tanners and helping them to sort out legal barriers. It also involved solving interrelated land issues, implementing appropriate cleaner production options, and implementing a business plan for competitiveness. The strategy is presented in Table 2 together with the progress achieved to the end of 2010.

<i>Issue</i>	<i>Aim</i>	<i>Progress</i>
1. United tanners willing to change	More empowered tanners with better negotiating power and able to improve the outcomes of the negotiations	<p>The micro-tanner association has become stronger: They participate now at the national committees at the Ministry. They are supporting the change process by consensus. They have travelled to the Cerrito Tanneries in the Valle del Cauca in order to learn about cleaner production. A positive and new leader is responsible for the association. There is consensus on the tanners' problems among all the direct stakeholders.</p> <p>Cleaner production is acknowledged as the right technical pathway to follow among tanners. The solutions built by the tanners were supported by the Presidency of Colombia, the National Comptroller, the Governor and the Ministry.</p> <p>The tanners are being broadcasted positively on the media. The newspapers show a different perspective on their conflict.</p> <p>Their association (ACURTIR), with 120 partners has established principles based on conflict resolution as their organizational framework.</p> <p>The tanners have learned to deal with high decision makers such as the National comptroller.</p>
2. Process of Legalization	The environmental authority CAR, control authorities (Public Prosecutor and National Comptroller) and the Magistrate in charge of the court order on the Bogotá river willing to engage in constructive discussions with tanners.	<p>Out of the total of 150 micro-tanneries, 86 were legalized in 2005 once they presented their PMA (standing for Planes de Manejo Ambiental in Spanish) or environmental plans based on cleaner production and CAR accepted them. The tanners supported 15% of the costs of this process. The Magistrate ruled that Cleaner Production should be implemented in the area. A strategic alliance was established after the first big group OST with a senator who was sensitive to the</p>

		<p>Bogota River's problem. Support given from the Chamber of Commerce to finance the elaboration of the PMAs thanks to the senator's support. Pressure on CAR from the Office of the Presidency afterwards to allow the CP implementation, thanks to the senator's support.</p> <p>February 2010 For the first time in Colombia, a local judge allows the possibility of conducting a project for environmental recovery as a substitute for fines — in other words working constructively instead of paying fines.</p>
3. Inter-related issues	Reaching sustainable solutions by integrating land and environmental issues, for example by coordinating policies on land use and policies on the quality of the river water in the same area.	<p>Control authorities and political stakeholders such as the President of the Senate in Colombia are supervising the process in order to solve the land conflicts. The Office of the Governorship influences CAR's directive board to work by integration. The mayor gives priority to the land issues of the tanners. The properties on the river bank will be purchased by the Governorship.</p> <p>The river bank policy was set in 2009. Tanners beyond 30m from the river bank are allowed to work.</p> <p>Industrial use was established in December 2010 for the tanners' lands. They can now invest without uncertainty in their industries that are formally in an industrial area.</p>
4. CP PROJECT SWITCH	A technical solution for MSEs in accordance with the requirements from the law that supports prevention, and is consistent with the interests of the tanners.	<p>SWITCH-UNAL started in 2006</p> <p>Colciencias (Colombian Institute for Science and Technology) co-finances activities from 2007</p> <p>The Authority CAR itself co-finances the tanners' training in CP relying on support from academia.</p> <p>The tanners are trained in CP and environmental matters leading to innovations in unhairing processes originating from tanners themselves</p> <p>Between 2004 and 2009, reductions in pollution loads were achieved of 32-68% in Chromium and 60-72% in BOD₅, when discharges to the river were measured in two</p>

		<p>of the twelve pilot tanneries. Savings in water use from 24-68% were recorded.</p> <p>Tanners are doing solid valuation (composting) from the grease and hair residues. They bought a land plot for this common purpose.</p> <p>A decision making tool was created for tanneries. The tool is based on sustainability indicators. (see SWITCH deliverable 4.2.4)</p>
5. Business Development program	More efficient production processes and better marketing	<p>Colciencias - UNAL also concentrates the efforts on the competitive issues.</p> <p>The Colombian Technical Development Centre for Leather gives training on how to achieve better quality products.</p> <p>The tanners are trained on business matters by the faculty of Business Administration from UNAL.</p> <p>Access to loans from the Ministry of Commerce is being worked out by the change agent.</p>

Table 2 SWITCH Intervention strategy and progress up to year 2010

IV. CONCLUSIONS

Six years of multi-issue, multi-level and multi-stakeholder negotiation has succeeded in reducing the environmental impact from the tanneries in a way that does not threaten the viability of the micro industries and that meet the interests of the regional authority. A sustainable solution was worked out for both the environment and the tanners. All the tanners in the area are following the trend towards adopting preventative technical strategies.

Within the scope of this study, the following conclusions can be drawn:

- Technical solutions could only be implemented once the impending social challenges were faced and consensus had been built with stakeholders. Integrating land issues and environmental issues proved to be a priority.
- The authorities and communities came to see that they are interdependent and that they needed to build long-term relationships between them were essential in terms of building consensus and establishing a commitment for change processes.
- A social inclusion process is a shared responsibility by all the stakeholders involved, even if this process originates from a conflict. Indeed, Conflict can be viewed as an opportunity for positive change, instead of being seen as an

obstacle because people are more amenable to change when they are going through a crisis (the tanners were facing a crisis and were eager to change)

- By establishing strategic alliances (as with politicians), the micro-tanners' negotiating power was boosted and their interests were respected. The role of champions was very important in this case since it opened up lines all the way to the Presidency and this focused everyone on trying to reach a solution.
- Environmental regulators have been shifted towards a more preventative approach rather than relying only on punitive methods.
- The researcher's role started by wanting to input ideas of cleaner production, but quickly became the role of a change agent. This was a demanding and complex task that implied commitment to the process on a long term basis. She had no position of power and could only work by agreement. Her role as a change agent was successful in that she was independent and offered holistic approaches to problem and stayed with the process over a number of years.
- Finance is an issue for micro industries. Along with the interrelated land issues, access to credits for MSEs was the most difficult task.

SASI, the methodology adopted in this case, contains elements that may have implications for cities around the world that are tackling issues of environmental pollution along with the sustainability of marginalised communities. SASI is based on a pragmatic and selected mix of methods that is anchored on universal principles and theories. It could maybe be adapted to the specificities of each context in similar situations. The parallels between this methodology and a learning alliance approach have already been drawn. They key principles are the involvement of all key stakeholders in a platform where their rights and concerns are all respect. The process is facilitated and the person who coordinates and facilities the process must be trusted by all sides. Those involved in the discussions are responsible for re-defining the problem and reaching common ground on the methods to try for resolution. Learning and action research go hand in hand.

Some outstanding issues are still being addressed. These include access to credit, and how to mobilise funds for co-financing the more expensive solutions. Work on dealing with all outstanding fines also needs to be completed. There is a national Comite de Veeduria under the National Comptroller that could play the monitoring role in ensuring that commitments are followed up.

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ACRONYMS

ACURTIR	Tanners' association for Villapinzón and Choconta
AI	Appreciative Inquiries
AVINA	NGO specialising in sustainable development
BAT	Best available technologies
BATNAs	Best Alternatives for a Negotiated Agreement
CAR	Regional Environmental Authority
CEINNOVA	Colombia Leather industry Technical Development Centre
COD	Chemical oxygen demand
COLCIENCIAS	Colombian Institute for Science and Technology
CRPML	Cleaner Production Centre
DO	Dissolved oxygen
GDP	Gross Domestic Product
MSEs	Micro and small sized enterprises
GOP	Good operational practices
OST	Open space technology
PMA	Environmental management plans
SASI	Systematic Approach for Social Inclusion
UNAL	National University of Colombia
UNESCO-IHE	Institute for Water Education, Delft, the Netherlands
UNIANDES	University of the Andes
SWITCH	Sustainable Water Management Improves Tomorrow's Cities' Health