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Evidence and lessons from Latin America

What are the success factors behind Latin America's use of economic instruments to improve water quality and generate new revenue for abatement?

# ECONOMIC INSTRUMENTS FOR WATER POLLUTION MANAGEMENT IN LATIN AMERICA

## SUMMARY

Economic instruments can contribute to sustainable development goals by improving water pollution management practices. This Brief looks at three types of economic instrument implemented in Latin America: water taxes to finance pollution remediation in Colombia; sewage tariffs for pollution abatement in Brazil; and the establishment of a framework to charge for pollution in Mexico. All three measures have increased economic efficiency by reducing pollution costs and, as such, policymakers in countries across Sub-Saharan Africa and South Asia facing similar challenges may benefit from learning about these Latin American experiences. The Brief analyses the implementation of these tools and the enabling conditions relevant to refining water management through market mechanisms in developing country contexts.

## WATER MANAGEMENT AND THE GREEN ECONOMY AGENDA

Decades of agricultural run-off and unregulated industrialisation are having negative impacts on water resources in Latin America. According to the World Water Council, up to 60% of Latin America's water comes from aquifers that are facing increasing levels of pollution from over-mining and intensive agricultural practices. Threats to the health of many major lakes and river basins are also increasing.[1] Water pollution poses threats to development in the region in various ways; by increasing the costs of water purification for drinking; increasing the incidence of waterborne illnesses; and negatively affecting fish populations. Costs associated with clean-up and the exploitation of new water sources are high. Command and control practices have so far proved insufficient in managing degradation and ensuring future supplies.

## KEY LESSONS LEARNED

Strong relationships between governmental agencies, polluters and local communities can result in actionable policies and achievable targets.

Accurate, transparent and agreed rates reinforce polluter commitment.

Adequate monitoring is essential for redressing pollution and enforcing payments.

Strong national legislation is paramount, yet requires a reliable system to measure, evaluate and report changes.

[1] Comisión Nacional de Agua. No date. *Water Problems in Latin America*. World Water Council 4th World Water Forum, online publication.

As part of a new green economy agenda,[2] many countries are adopting policies that attempt to reflect the full costs of water use, including the costs of adverse impacts on the environment. Latin America, in particular, has made much progress towards improving water resources for both productive and domestic use through green economy policy tools.

### *Moving Beyond Subsidies*

Governments in Latin America have a long history of subsidising economic activities with adverse environmental impacts. In Brazil, policies favouring cattle and agricultural business prompted large-scale land clearing subsidies; across the region chemical fertilisers and pesticide subsidies promote chemical use precisely in the more commercially orientated agricultural areas where the environmental damage may already outweigh any increases in productivity they bring. Thus subsidies have often distorted longer-term economic objectives by not accounting for the cost of adverse environmental impacts, and by prompting industries to choose heavier polluting practices to generate enhanced revenue streams.

In recognition of the inefficiency of such policies, Latin American governments have been seeking new means to ensure the sustainability of their water resources. In recent years, a variety of economic instruments have been adopted to allow for more flexibility in addressing agricultural users and industries that differ widely in size, material outputs, and cost structure. In Latin America, governments have been developing new policy tools that combine incentives and regulatory measures. Across the region, a number of innovative market-based instruments exist, which assign financial equivalents for pollution costs. These mechanisms produce new sources of revenue to manage pollution and promote behavioural change. Context specific taxes, charges, standards and permits have been successfully developed in order to respond to local environmental, institutional and operational specificities. These policies provide instruments for evaluating and accounting for costs/benefits of preventing or mediating natural capital loss resulting from pollution (Box 1).

Taxes rates are developed according to pollution quantities and content, as measured by a series of indicators relating to biological content (see below); permits define a total limit for the amount of pollutants that can be delivered to a water body over a period of time that will not shut-down the natural health and functions of that system.[3] Such evaluation is dependent upon capacity for data collection and consistent monitoring, requiring technological and skilled labour resources on the ground.

New fiscal policies in Latin America operate through clear communication of national and regional water quality objectives, and the policy mechanisms through which to achieve these. In this model, firms can, through independent internal evaluation of the costs of not complying and subsequent choice of action, become new agents of responsible change.

#### Box 1: Aligning Private and Social Costs Through Market-based Policies

Market-based policies encourage behaviour through market signals, rather than through explicit directives regarding pollution control levels or methods.[4] Many market-based instruments function by implementing a penalty, either in the form of a tax or a permit per unit of pollution; polluters can choose to pay or to reduce emissions to avoid paying the penalty.

Other policies subsidise pollution abatement or combine taxes and subsidies for diverse levels of pollution. In this case, polluters with disparate costs according to source, quality, and quantity have flexibility to choose the least costly abatement method. They may reduce pollution by recycling, installing new equipment, using labour-intensive methods, or reducing production or consumption. Taxes can be bundled with other mechanisms such as charges for use in order to cover the expense of protecting and renewing the resource and/or tax incentives for environmental investment.

[2] Learn more about the the green economy in Latin America in the ELLA Guide: Pursuing a Green Economy: Growth Alongside Sustainability in Latin America.
[3] For a more detailed description of water quality evaluation methodologies, see Koteen, J., Alexander, S. J., Loomis, J. B. 2002. *Evaluating Benefits and Costs of Changes in Water Quality*. U.S. Department of Agriculture, Forest Service, Portland, OR.
[4] Stavins, R. N. 2000. *Market-Based Environmental Policies*. Harvard University, Cambridge, MA.

## MARKET-BASED INSTRUMENTS: LATIN AMERICA'S EXPERIENCE

It is widely recognised that it is economically efficient for society to tax 'negative' activities such as pollution.[5] There can be multiple benefits: taxes can diminish harm to the environment, generate additional revenue for environmental management, and offer lower operational costs.

This following section will review the operational context of some effective market-based policies such as taxing pollution in Colombia; raising revenue and abatement through sewage tariffs in Brazil; and establishing official standards for monitoring and assigning costs for damages to water supplies in Mexico.

### *Colombia: Restoring Rivers Through Pollution Taxation and Reduction Targets*

In Latin America, as in other parts of the world, water taxes have been levied on direct and indirect sources that release pollutants into water bodies through human or service-related activities. The current Colombian water tax mechanism has been acclaimed as a 'state of the art' example in terms of design and implementation of water taxes.[6] It is particularly notable for its clean production agreements with polluting firms, capacity for tax collection, and the creation of a fund to support further environmental stewardship.

Faecal coliform levels in Colombia's rivers are some of the highest in the world, with 97% of sewage being released, untreated, into its rivers.[7] The agricultural sector emits approximately 4,000 tonnes of biochemical oxygen demand (BOD) per day into Colombian freshwater supplies, followed by the livestock sector, households, and industry that contribute 500 tonnes of total suspended solids (TSS) per day.[8] At such a rate, these pollutant loads cannot be assimilated by water bodies, posing serious threats to the health of the ecosystems and human life that depend on them both immediately and longer-term.

In response, the Ministry of Environment implemented a strong institutional and regulatory process involving pollution taxes, clean production agreements between firms and the government, and environmental investment funds. These regulatory controls use price signals to control the quantity of pollutants and create obligatory investment to protect water resources. The taxes serve as a resource to water authorities. The pollution taxes are defined according to pollution reduction targets and include taxes on the property itself (15-25%), royalties from extraction of non-renewable resources, and a compulsory 1% of income for additional investment in watershed maintenance.

These new incentive-based regulations give businesses flexibility in meeting water-pollution standards: in effect, companies must pay for the right to contaminate rivers. If they elect to cut their emissions they may do so at their own pace, and according to their own choice of technique and technology. However, they may also choose to continue operations without reducing pollution and face steadily increasing taxes. In Brazil, municipal authorities that left waste untreated became subject to charges, and this provoked investment in new, more effective cleaning technologies to lower future costs. Most polluters find that within two or three years, it is in their economic self-interest to reduce pollution levels.[9]

The taxes are enacted through the National Environment System (*Sistema Nacional Ambiental* - SINA) encompassing the Ministry of the Environment, 33 regional autonomous resource management corporations responsible for sustainable development for the entire country, four environmental agencies in the large urban centres, five research institutes to provide technical and scientific support, and entities at the departmental, municipal and

[5] Dourojeanni, A. 2001. Water Management at the River Basin Level: Challenges in Latin America. In: *Recursos Naturales e Infraestructura No 29*. ECLAC, Santiago; Huber, R. M., Ruitenbreek, J., Serôa da Motta, R. 1998. *Market Based Instruments for Environmental Policymaking in Latin America and the Caribbean. Lessons from Eleven Countries*. World Bank, Washington, DC.
[6] Kraemer, A. R., Pielen, B., Leipprand, A. 2003. *Economic Instruments for Water Management*, Inter-American Development Bank (IDB), Washington, DC.
[7] Ibid.
[8] BOD is the measurement of the amount of dissolved oxygen needed by aerobic biological molecules in a body of water to breakdown organic material present in a given water sample at certain temperature over a specific time period. It is a measurement of the organic compounds in a water body whereby excessive growth results in an oxygen deficit, ultimately shutting down life in an eco-system. It is also known as BOD5 depending on the test mechanism. See Ministry of the Environment. 1998. *La Experiencia Colombiana en Esquemas de Pagos por Servicios Ambientales (Colombian Experience with Payment for Environmental Services)*. Office of Economic Analysis, Bogotá.
[9] Ambrus, S. 2000. *Colombia Tries a New Way to Fight Water Pollution... and it Works*. EcoAmericas, Bogota.

district levels. SINA is thus made of multiple operational entities functioning at many levels. SINA is responsible for identifying the parties responsible for specific releases into the water for each section of the watershed. Each authority must also establish a monitoring programme to make semi-annual measurements of releases into the watershed and compare them with agreed reduction targets.

Preliminary data indicates that the Colombian plan is generating significant successes. For instance, after two years of implementation in the Río Claro – Cocorná Sur watershed, TSS pollution fell by 84.95%, and BOD5 pollution dropped 40-42%.[10] In another watershed, the Río Negro, one of the most polluted rivers in Colombia, the introduction of water taxes promoted reductions of TSS by 33.81% and BOD5 by 33.56% in the first year.[11] By the end of 2000, organic waste dropped by 36% and suspended solids had declined by 52% in the region's seven principal watersheds.[12] These changes are largely due to the institutional capacity to measure pollution initially and then changes over time, as well as the ability to collect taxes.

Another significant result of the Colombian system is that tax on pollutants introduced to water bodies by specific industries is up to 79% more cost effective than the previous system of fines and shutdowns,[13] measured in terms of the administrative cost to return a kilogram unit of water to a healthy BOD level. This tariff is an example of an economic policy implementation that has motivated environmentally favourable behaviour and promoted more accurate valuation of natural resources in pursuit of their more efficient allocation and use.

***Brazil: Revenue and Abatement Through Sewage Tariffs***

Brazil's water resources, though plentiful, are under increasing strain from heavy pollution from sewage, leaking landfills, and industrial waste. However, only 35% of wastewater is treated.[14] Brazil is the first country to use tariffs levied in the form of an industrial sewage charge based on pollutant content to tackle this problem. Rates are calculated to recover the budgetary needs of state agencies responsible for classifying and monitoring water bodies and abatement. The tariffs are designed for flexibility at state level, allowing regulators and polluters the opportunity to negotiate the size and timing of penalties. In the past twenty years, these tariffs have become an integral component of national water regulation in Brazil.

While the federal government controls the regulatory process, standard setting and budgetary allocations, the states are responsible for water pollution control, and the municipalities are authorised to administer solid waste management. This decentralised model has provided state governments the autonomy to tailor environmental standards and economic instruments according to local social and economic priorities.[15]

In Rio de Janeiro and Sao Paulo, effluent charges or tariffs have been successfully used to finance the work of each state's environmental agency tasked with pollution abatement, financing administrative costs, monitoring enforcement, and educational campaigns. In Rio de Janeiro, the local environmental protection agency *Fundacão de Saneamento Ambiental* (FEEMA) is responsible for tax collection. FEEMA determines effluent charges based on budgetary specifics and submits these rates for approval by the state government. The charge is levied on all polluters based on volume and effluent concentration, including BOD and heavy metals. For example, effluent charges on pharmaceutical, food processing, and dairy industries have contributed to reductions in water use and subsequent wastewater production by 62%, 49% and 42% respectively over a six year period in Rio de Janeiro.[16]

In the case of effluent charges in Brazil, two key elements behind the success of this system can be identified: strong government leadership for legislating, monitoring and enforcing the tax; and regionally tailored implementation involving the establishment of a cost-effective tax base and rate.[17]

[10] Kraemer *et al.* 2003, see above n6.
[11] Ibid.
[12] Ambrus. 2000, see above n9.
[13] Kraemer *et al.* 2003, see above n6.
[14] Brazilian Institute for Geography and Statistics (IBGE). 2000. *Pesquia Nacional de Saneamento Básico (National Survey of Basic Sanitation)*. IBGE, Rio de Janeiro.
[15] For more information on this scheme, visit the World Bank *Blue Water Green Cities* website.
[16] Kuylenstierna, J., Najlis, P. 1998. The Comprehensive Assessment of the Freshwater Resources of the World: Policy Options for an Integrated Sustainable Water Future. In: *Water International* 23(1) 17-20.
[17] Freitas, M.D. 1994. Policy Instruments for Water Management in Brazil. In: *Applying Economic Instruments to Environmental Policies in OECD and Dynamic Non-Member Economies.* Organisation for Economic Co-operation and Development, Paris.

***Official Mexican Standards Establish Pollution Reduction Targets through Fiscal Incentive***

In Mexico, toxic and hazardous substances are introduced to surface water bodies as a result of agricultural run-off and industrial activity. Mexico's pollution charge is an economic instrument based on the 'polluter pays' principle which directly links taxation to regulation through specific guidelines and pricing schemes. The Federal Water Charges Law in Mexico establishes water pollution charges for all discharges to national waters that exceed the applicable standard. Thirty three official water standards (NOMs) for wastewater discharge establish limits for pollutant emissions in each industrial sector.[18]

Pollution charges are levied according to wastewater rights: a specified amount is paid for the right for each cubic meter. The charges are incurred by all firms that exceed established standards, based on volume of flow, discharges of conventional pollutants,[19] the costs of pollution abatement, and regional water scarcity. The tax base thus has three components: the excess of chemical oxygen demand (COD) emissions above the standard, the excess of suspended solids emissions above the standard, and a volume component. The volume component is applied whenever the organisation is in violation of any of the pollutants for which it is subject to a standard, even when that organisation is in compliance with COD and suspended solids. For each of these three components, charges depend on the zone in which the firm is located. A simplified approach based on volume alone is used for discharges below 3,000 cubic meters and there is no charge for discharge that meets the concentration standards.[20] Also, those that do not comply but have a plan to control emissions can obtain an exemption for up to two years.

To monitor and control the water quality of surface water, Mexico has set up a National Monitoring Network with 1,510 test sites. The Ministries of Water and Surface Health classify water into five different quality categories using BOD and COD, as well as dilution capacity, assimilation capacity, and previous use. Specific thresholds for toxic substances are identified with predetermined limits depending on the industry. Sugarcane, petroleum, plastics and synthetics industries, for example, must comply with different and industry-specific standards.[21]

Mexico also has a national laboratories network composed of 13 laboratories located in major water basin administrative centres and 15 laboratories located in National Water Commission (CONAGUA) offices located outside of these basins. These 2 networks monitor the levels of physical, chemical and bacteriological substances. In 2012, CONAGUA will begin to implement a five-year programme to subcontract an important part of the monitoring responsibilities to private companies/laboratories that will allow for the monitoring and measurement of all of the substances currently mentioned in the different Mexican wastewater and potable water regulations.

The NOMs have improved water management in Mexico through the articulation of clear guidelines and complimentary financial tools to increase revenue. In the first seven years of implementation, revenue increased 300% - from around US$2.2 million to US$6.6 million[22] - producing substantial resources for installation of new water treatment mechanisms.

Notwithstanding, the implementation and design of the system demonstrates some room for improvement in several areas. Firstly, specific cases of poor monitoring (despite the enlistment of the institutions mentioned above)[23] have resulted in lower tax revenues than should have been the case. On the design side, separate charges for suspended solids are redundant as abatement of other substances (e.g. COD) often already results in high rates of suspended solid abatement. That is, treatment or filtration geared towards a singular, particular pathogen or chemical often results in a diminished quantity of others. Similarly, the volume component provides an incentive to increase pollutant concentrations as pollution charges are often determined by the total volume of a load. Furthermore, where water use prices are low, polluters can meet the standard by dilution of pollutant substance (therefore still dumping that same amount but with obscured measurability), thus encouraging higher water use without reducing the overall pollution load. Implementation of such a mechanism must therefore be carefully designed alongside other water management policies, and in response to the specific, localised pollution conditions.

[18] For example, OMS-127 establishes the bacteriological and physical chemical limits for human consumption, OMS-179 regulates the surveillance procedures that water authorities must meet to remain compliant with OMS-127, and OMS-230 establishes the sanitary requirements that public and private supply systems must meet.
[19] Measurement of organic pollutants in surface water.
[20] For more information on Mexican water policy, visit the Mexican National Water Commission (CONAGUA) website
[21] Ibid.
[22] Huber *et al.*1998, see above n5. Values are calculated from currency exchange rates from 1997.
[23] Ibid.

# CONTEXTUAL FACTORS

## CREATING THE RIGHT ENVIRONMENT FOR ECONOMIC INSTRUMENTS

Each of the three countries analysed in this Brief has demonstrated success in managing water quality through economic instruments. Colombia's water tax on the introduction of pollutants into water bodies has reduced toxic loads; Brazil's pollution abatement efforts have been enhanced by its pollution-based tariff system; and Mexico has tied pollution charges to wastewater rights, thus localising and assigning responsibility for negative environmental impacts.

In Colombia, the establishment of a strong national environmental authority provided the necessary leadership to create a hierarchy of institutions and distribute responsibilities. In all three countries, effective implementation rested upon strong national legislation with clearly delineated regulatory and enforcement capacity at the local level. In both Colombia and Brazil, state agencies effectively monitor pollution limits and enforce standards through relationships with stakeholders and polluting firms at local levels. In Mexico, similar characteristics are reinforced by carefully delineated standards for varying sectors, identified and evaluated by multiple stakeholders. Enforcement was effective thanks to the local proximity of regional governmental agencies to monitor sources. The relationship between environmental authorities and those responsible for discharge has been particularly important, with intermediary institutions responsible for deploying an effective monitoring programme.

Mechanisms for measuring, monitoring and recording pollution content and loads are fundamental when it comes to challenging polluters to change current practices and assume responsibility. In the Colombian case, long-standing monitoring databases provided evidence for the evolving discussions concerning the most effective policies. Maintaining such comprehensive databases requires not only adequate technology, but also trained agents working within a single body responsible for quantifying water quality.

Governments in all three countries also created a systematic approach for collecting revenue. Without monitoring and subsequent enforcement of the economic component of these instruments, the amount of revenue collected would have been substantially reduced, as occurred in some specific cases in Mexico. Collecting a body of reliable data improves knowledge about how pollution affects water quality and what kind of taxes are necessary to address both current and future problems.

The need to integrate all stakeholders into the policy process is evidenced by the contrasting experiences in Colombia and Mexico. Efforts to implement a water tax in Colombia were successful, in part, because the target reduction of total pollution was determined through a consultative process with polluters and those who suffered the consequences. This process created a strong sense of buy-in from polluters and simultaneously increased awareness of pollution costs amongst users. In Mexico, on the other hand, implementation was delayed due to fierce opposition by polluters who had not been consulted.

## LESSONS LEARNED

1. In Latin America, economic instruments are providing successful mechanisms for managing water pollution and enhancing the longevity of national water resources.
2. To function effectively, these instruments must be applied in well-coordinated institutional environments where responsibilities surrounding data and revenue collection are clearly delineated and implemented between all levels of government (departmental, municipal and district), environmental agencies and research institutes.
3. Accurate, transparent and agreed tax and charge rates reinforce polluter commitment.
4. National legislation reinforced by a system to measure and evaluate capacity building of regional environmental authorities assists successful implementation at the local level.

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