

Research Paper

Contributing to water security through water tariffs: some guidelines for implementation mechanisms

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ABSTRACT

The reform of water pricing practices and tariff mechanisms plays an important role in improving water supply services. However, setting tariff policies is a process that is rife with controversy. The current urban development rhythm and consequent challenges, in several developing cities, requires an urgent review and the establishment of an increasingly more 'integrated' management system with a suitable water tariff policy to promote water security. Many lessons can be learned from the successes and failures of water pricing policies in other countries and world regions, taking into account the context, status and development of the water supply sector. In this paper, several case studies are assessed throughout different countries or regions (South Africa, Vietnam, Malaysia, Singapore, Australia, and Europe) to provide key information able to support successful policy 'transfer routes'. Based on those lessons, key policy recommendations are summarized to pave the way towards water security, particularly in rapidly growing urban centres that suffer already from water stress.

Key words | growing urban centres, pricing policies, water security, water tariff implementation

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INTRODUCTION

The reform of current water pricing practices and tariff mechanisms plays an important role in the worldwide context of policy initiatives designed to improve water supply services (Dinar *et al.* 2015). In the context of cumulative socio-political drivers (access to water, public health, flood protection, environmental protection, limits on natural resources, intergenerational equity and resilience to global change), there is a demand for several service delivery functions to achieve an adaptive multifunctional infrastructure and urban design. This requires a transition from a purely water supply driven urban centre to a water sensitive one (Brown *et al.* 2009). Such shift requires institutional coordination, policy coherence and stakeholder engagement to evaluate investment needs, as well as inherent costs and

prices. The acknowledgement of a water hierarchy (1-reduce, 2-reuse, and 3-recycle) could frame water sensitive designs for urban development able to consider interdependent approaches including the whole water cycle (e.g. rainwater). The fulfilment of all different 'water system services' considering the overall welfare as well as social equity and environmental sustainability while addressing both risks (hazards, exposure and vulnerability) and uncertainties (promoting robustness, flexibility and resilience) is what frames water security (Hoekstra *et al.* 2018).

Around the world, namely in the least-developed countries, it is becoming increasingly difficult to meet the population demands for water, resulting in shortages (both in quantity and quality), flood vulnerability and other

problems (United Nations Department of Economic and Social Affairs (UNDESA) 2017). Therefore, for those countries, it is paramount to develop and implement mechanisms that help solve the problems, and suit the current development needs of the community and surrounding areas.

Water tariffs can be considered a critical management tool for sustainable water supply (WS) as they provide a possible link between supply (e.g. cost recovery) and demand (e.g. demand management) able to reach multiple objectives. The pricing of water services appears to be, however, a difficult task for governments at national and local levels (García-Valiñas & Picazo-Tadeo 2015). Major challenges are faced in water pricing and tariff establishment when selecting a tariff structure that is responsive to the objectives of both the utility and its community (Whittington 2003). Setting tariffs is a political process that is rife with controversy. A poorly designed water tariff structure could result in abundant use of limited water resources or unjust WS marginalizing the poorest (Pinto & Marques 2017).

Since the capacity and experience needed to develop tariff strategies that can counter existing and emerging water problems vary, we introduce particular ‘policy transfer’ features. The objective is to outline effective policy interventions beyond the jurisdictions where they were implemented, using case studies to assess operational links needing to be traced over time, rather than frequency or incidence. Thus, pricing policies ‘incubated’ elsewhere are provided to guide the due implementation of future water tariff structures. The selection of case studies relied on their development context and characteristics of their policy implementation strategies.

The next section of this paper discusses several aspects of implementation of common water tariff structures. We then describe the experience of several countries and world regions (South Africa, Vietnam, Malaysia, Singapore, Australia, and Europe), before making some key recommendations. Finally, we draw some concluding remarks.

UNDERSTANDING WATER TARIFFS

Objectives and challenges

Poorly performing water tariffs have not been acknowledged as a societal problem until recently, mainly due to issues

such as growing water scarcity and climate change. Although water tariffs are a conceptually simple way to promote multiple objectives, if not duly structured the outcome may be catastrophic (Pinto & Marques 2017). Besides recovering costs to provide them at an affordable price, the debate has expanded, and further objectives have been deemed achievable (American Water Works Association (AWWA) 2012). However, those objectives may be difficult to reconcile.

While providing clean water services for the community, governments must consider that managing and operating WS services implies associated costs. According to the Organisation for Economic Co-operation and Development (OECD 2010), WS costs include: (1) capital as fixed cost, (2) operation and maintenance (O&M) as variable cost, and (3) the cost of servicing debt (as appropriate). These costs do not include externalities (positive or negative) or alternate uses of water (opportunity costs), which make up the full costs of WS. As costs increase, these must be recovered to sustain WS provision, which may be done by setting water tariffs along the community’s water consumption. It is therefore relevant to evaluate how the following relationships vary (Nauges & Whittington 2017): (1) water use and income, (2) marginal and average costs along target level of cost recovery, and (3) the price (marginal or average) to which customers are responding. Following the previous relationships, the main four objectives and issues to be taken into account while setting a water tariff may be set as follows (OECD 2010):

- (1) Environmental sustainability (i.e. discourage depletion of critical natural capital).
- (2) Financial sustainability (i.e. guarantee cost recovery and long-term maintenance of physical assets).
- (3) Economic efficiency (i.e. water is allocated to the most beneficial uses and economic resources are not wasted).
- (4) Social concerns (i.e. adequate access to affordable water at fair and equitable conditions).

Pinto & Marques (2016) propose an additional objective:

- (5) Governance (i.e. promote clear, understandable and predictable tariffs, while considering implementation and administrative/management features).

Setting a water tariff structure that will achieve all the above objectives is a challenging task for all governments given the trade-offs between the objectives. Fees collected from the users should ideally be high enough to ensure cost recovery and discourage wasteful consumption of water, but at the same time low enough to allow affordable access to the services. Adding to this difficult trade-off, water tariff setting may be subject to institutional constraints, such as legal restrictions, informational problems or underlying informal rules, recognition of water as a basic human right by the UN, and also political constraints (Dinar *et al.* 2015). Water prices have been said to be a politically sensitive (perhaps explosive) issue throughout the developing world (Lehmann 2010). Therefore, setting a water tariff is a particular challenge for developing countries, whose population with generally low incomes, tend to be reluctant to accept any increase in water tariffs (for the case of Cochabamba, Bolivia, see Herrera & Post (2014)). Nonetheless, even in developed countries, when the implementation of pricing policies is not duly promoted, it may lead to social unrest, and inevitably to political upheaval (for the case of Tucson, USA, related to a water drought strategy, see Martin *et al.* (1984)). From another perspective, it has long been assessed that low-income households may not pose the most severe challenge for developing countries to set up improved pricing strategies. The prices paid to private water vendors are high and in several cases, customers are willing and able to pay the price for a regular water supply service (for the case of Onitsha, Nigeria, see Whittington *et al.* (1991)).

Political consideration and due implementation could play a strong role in water tariff setting, given the need to maintain popularity among the public.

Implementing water tariffs

Water tariffs may be structured under different components, mainly: fixed and volumetric components; adjustment features; and other charges.

The link between tariff design (mainly connected to rate setting) and the utility's costs is a key element, and has been widely discussed (AWWA 2012). Such a link is centred on each tariff component's level and the assumptions

considered. If we follow economic theory, tariff levels should be set equal to the cost of producing one more unit of output. That is called marginal cost pricing, and may be short-run (SRMC) or long-run (LRMC). SRMC has been suggested as a non-reliable basis for setting water tariffs due to possible discontinuities between cost recovery requirements and new investments (e.g. when a system reaches full capacity, the SRMC increases significantly and proportionally to required investments), as well as in the quantity and level of required price changes (Anstey & Graham 2014). LRMC may consider expected demand forecast and expansion plans (so-called Turvey approach), or without considering those may simply average capital costs to approximate the likely marginal costs associated with a change in demand (or so-called average incremental cost). However, internalizing marginal costs into the water tariff may conflict with other policy objectives (as poor people often cannot afford water supplied at marginal costs), may be costly to operate (in part due to metering), and may not be politically viable. A tariff design should avoid controversy, and not become a focus of public criticism (Whittington 2003).

Water tariffs around the world are designed under different tariff mechanisms. Indeed, there are several design possibilities to meet the desired objectives. Design selection should be properly assessed to avoid the misapplication of tariff structures (e.g. environmental concerns and behaviours, water consumption, expenditures, and socio-economic characteristics). Despite the WS trend, sanitation (e.g. wastewater, WW) tariffs face a different reality (Appendix A, available with the online version of this paper). The number of utilities that present no charge for WW services, even if decreasing, still presents a considerable problem (Global Water Intelligence (GWI) 2016). When water prices are lower than its O&M costs, a proper solution would rely on stakeholder engagement initiatives, instead, authorities avoid raising water prices as far as possible. Around the world, the relation between water prices and cost coverage is vast, ranging from a very small share of O&M costs (as in Ashgabat, Turkmenistan), going through most percentage points to full-cost recovery (for some interesting commitments, see Dinar *et al.* (2015) and GWI (2016)).

Water tariffs are a political decision which should play a relevant role in sending appropriate stimuli to consumers. In

this regard, subsidies have often been the ‘way out’ to support cost recovery of water services, however subsidies obviously will not sustain water services financially in the long run. The right balance has to be found between all sources of revenue, considering both repayable and non-repayable sources of finance (e.g. loans, bonds, tariffs, taxes, transfers). The same applies to the achievement of other objectives, where pricing policies should be followed by non-pricing ones, as water demand management policies (e.g. through education and water saving devices). There is evidence of synergetic effects between them (Grafton *et al.* 2011).

The transfer of those policies should follow a learning approach instead of opportunistic, branded, or pressured routes (Minkman *et al.* 2018). While considering the specific context, the objective is to focus on transferability, process design and adoptability of those policies. The interaction between source and adopting actors, as well as the availability of construed insights are key to successful outcomes (de Loë *et al.* 2016). We will focus on the latter.

MECHANISMS TO IMPLEMENT WATER TARIFFS: EXPERIENCE FROM SOME COUNTRIES AND WORLD REGIONS

South Africa

South Africa has been a ‘water-stressed country’ with a history of inequalities of access (Chetty & Luiz 2014). Recently, there has been some success, with Free Basic Water (FBW) and Free Basic Sanitation (FBS) national policies introduced in 2001 in recognition of the primary importance of having access to adequate, safe, appropriate and affordable water and sanitation services, to use water wisely and practice safe sanitation. South Africa was considered an encouraging example at the UN experts’ meeting on the right to water, as innovative policies were pursued that sought to realize the right to water while making water management more effective and sustainable (United Nations Educational Scientific and Cultural Organization (UNESCO) 2009). Those policies oblige utilities (usually at local level) to deliver free basic water and sanitation. Nonetheless, it is also highlighted that a mindful use must be made, services provided over and above a basic

service must be paid for. As a result, there was a substantial increase in access to clean and safe drinking water (World Health Organization/United Nations Children’s Fund (WHO/UNICEF) 2014), from a national average around 80% (1990) to 95% (2012), although not such a significant change regarding improved sanitation as coverage increased from 58% (1990) to 74% (2012).

While the FBW, and to some extent the FBS, policies have been implemented relatively promptly and successfully in most urban areas, implementation in the suburban, informal and rural areas has been much more difficult, with many not yet seeing the rollout of this basic service. There is a myriad of reasons for this lack of implementation, mostly related with financial, technical, political and logistical problems at municipal level. These may be related with a misapprehension of the national policy, or with policy gaps linked to unplanned settlements (Rodina & Harris 2016).

Vietnam

Vietnam represents a typical developing country case in managing WS services, where low tariffs are applied for urban water systems under increasing block tariff (IBT) arrangements and, hence, largely subsidized by the government (Asian Development Bank (ADB) 2010). Vietnam also represents a typical situation where political considerations often prevent the timely application of tariff adjustments (ADB 2010). Furthermore, under Vietnam’s legislation, clean WS systems; water drainage systems; and WW as well as waste collection and treatment systems are highlighted as areas for private sector participation. Thereby making this sector among the highest levels of private investment in the country. Nonetheless, even when WS and WW systems are managed by the private sector, tariffs must follow the range given by the Ministry of Finance and agreed upon with local government. As stated by the International Bank for Reconstruction and Development (IBRD), this creates an unsupportive investment climate (IBRD/The World Bank 2014).

There is also a need to address the sector management inefficiency, including lack of accurate or up-to-date information (e.g. on the extent or condition of the assets and non-revenue water) and the lack of accountability (ADB 2010). In terms of solutions, Vietnam has progressed

particularly through corporatization and connection fee waivers to address the poor population (ADB 2014). The subsidization would come from existing customers, such a move is promoted to discourage illegal water connections.

Tariffs are normally set at a level that covers basic operational costs but which does not support new investments relating to asset maintenance. This situation of low tariffs gets worse when related to rural areas, in which there are several subsidies. However, looking forward, the central government aims to remove all subsidies linked to WS by 2020 (Trujillo *et al.* 2015).

Malaysia

Before the introduction of the Water Services Industry Act 2006 (WSIA), the responsibility for water resource administration in Malaysia was shared between various agencies under both the Federal and State Governments. During that period, state authorities had been fully responsible for WS infrastructure development including financing and O&M, often via limited liability firms wholly owned by the state (Mustafa *et al.* 2011). However, by 2005 about half of the states in Malaysia experienced a financial deficit in their water operations, mostly as a result of loss of revenues from non-revenue water due to leakages, under-meter registration, pilferage, and also as a result of setting water tariffs below cost recovery levels (Lee 2005). The same author states that, overall, in 2005 the Malaysian water sector experienced a revenue-cost deficit of about 9.1% of O&M costs. Malaysia further experienced lack of coordination amongst various stakeholders, ineffective regulatory structure and poor enforcement, capital expenditure constraints and varied success of privatization projects (Lee 2005). Therefore, the WSIA was put in place to pave the way for a new era for the water industry. The Act mandates the Federal Government to have executive authority with respect to all matters relating to water systems and water services (Mustafa *et al.* 2011). Therefore since 2006, the Federal Government began to gain full control over water systems and services in the country, starting with buying water assets in Malacca State (December 2008) and Negeri Sembilan (early 2009). At least four more states have embarked on the new licensing regime with the Federal Government-owned water state authority. The goal of the Federal

Government is to achieve full-cost recovery and financial independence of all water operators (State or private) and the Federal Government-owned water asset authority.

Singapore

Singapore presents an extraordinary case, where its Public Utility Board (PUB) has won many international awards. Although Singapore does not have any surface or groundwater sources, PUB manages the entire water cycle from rainwater/wastewater collection and water production (desalination) to water/treated 'used water' distribution. Furthermore, private companies own and invest in the plants (i.e. desalination and reuse/recycle) and sell the water produced to the public utility (Leong & Li 2017).

Singapore applies a full-cost recovery principle to its water tariffs (see <https://www.pub.gov.sg/about>, last visited 06/12/2017, to understand the costs entailed). This approach is designed to reflect the scarcity value of water by incorporating the high production costs of desalination and recycled water, as well as to reflect ecological value by incorporating sewerage treatment costs (United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) 2012). Water prices in Singapore also cover a water conservation tax, a waterborne fee to collect every drop of water for treatment before release, and a sanitary appliance fee.

In aiming for full-cost recovery in the water price, Singapore took a brave step with a price reform in 1997 by moving away from IBT, and reducing to a two-blocks tariff, while applying the same rate for industries and businesses. This resulted in a price increase of 120% for households. Such a system discouraged overuse by households and successfully reduced consumption. However, the drawback of this system is that it favours small-size households rather than low-income households. To address social equity concerns, a rebate scheme was put in place considering the type (size) of household (e.g. number of residents).

Australia

Australia is one of the driest inhabited continents, with its territory often suffering from physical water shortage, and thus water management is one of the most important issues for Australia.

Regarding water tariff mechanisms, there are two structures that are applied throughout Australia which include volumetric linear (VL) and IBT (OECD 2010). However, phasing out of the IBT structure towards a VL approach was recommended to ensure capital expenditure recovery and also to reduce administration costs (Aither 2017). To promote efficient water use and address water scarcity problems, a VL approach was recommended based on LRMC. Other measures have also been recommended to promote efficient water use, including removing remaining cross-subsidies, property rates-based charges and free allowances. In general, water prices must follow the principles set by the National Water Initiative (NWI) in 2010. The 2010 NWI pricing principles aim to recover capital expenditure, cover asset refurbishment/replacement (lower bound pricing) and a return of and on capital to reflect the cost of asset consumption and cost of capital (upper bound pricing) (Department of the Environment Water Heritage and the Arts (DEWHA) 2010). Based on these principles, State Governments set bulk water prices, and water is then distributed and billed in each region by either the local council or water authority. Currently, the majority of water regulators in Australia aim to reflect LRMC in their tariff structures, although different rates are applied. Nonetheless, several issues require attention. Crase *et al.* (2015) state that ‘there is still opportunity for political influences, even though the NWI is committed to full-cost recovery with regulatory oversight that seeks to objectively align costs and prices’. In a report to Infrastructure Australia, Aither (2017) highlights the relevance of obtaining a national commitment from governments to manage the impact of rising water bills on low income households through mechanisms other than broad-based water price reductions, and including an achievable suite of refinements beyond the pricing commitments (e.g. genuinely independent regulators, water saving devices), designed to improve them.

Europe

The requirement to pay for all the expenses that enable a continuous provision of services and adequate functioning of the utility regarding the water cycle (e.g. shared waterways), led European countries to search for transnational solutions on a community basis (Barraqué 2003). The European Union (EU) is a remarkable case, where its members

launched a Water Framework Directive (EU-WFD) to assemble common guidelines, namely to achieve cost recovery and to develop proper incentives (e.g. user-pay and polluter-pay principles, see article 9, EU-WFD).

This legal framework has promoted distinct actions in the creation of sustainable tariff structures. In Appendix B (available with the online version of this paper), a survey of the current trends is presented. Accordingly, water tariffs may contain several components that may be linked to customer characteristics possibly complying with sustainability objectives. Related to the tariffs themselves, it is important to highlight the role of taxes, as VAT alone varies from 0% (e.g. in many WW tariffs) to 25%. Furthermore, as analysed by Reynaud (2016), water affordability may become an issue under full-cost recovery.

The case of Ireland is worthy of note. As part of an assistance programme agreed with the European Commission (EC)–European Central Bank (ECB)–International Monetary Fund (IMF) ‘troika’ (November 2010), to recover from an economic downturn, the government committed to introduce domestic water charges in 2012/2013. The whole process raised considerable social unrest, and although introduced in late 2014, by 2017 the scale of protest and push-back against charges resulted in their suspension. The main reason was not related to willingness to pay for WS costs, but rather on the inability to divorce water pricing policies and external political commitments (Murphy 2016), as well as the sentiment of a ‘double payment’ (i.e. the introduction of a tariff did not translate into a decrease of general taxation, see Dukelow (2016)). Moreover, civil society organizations questioned water taxes and their expenditure, namely due to an increasing infrastructure backlog, as well as the requirement for further investments as with water meters. Those reasons led to a misinterpretation of the real objectives of the pricing policy.

Furthermore, some countries developed specific guidelines regarding water tariffs to solve financial shortcomings (Pinto & Marques 2015). In Portugal, the water regulator published tariff recommendations to provide guidance on cost analyses, tariff structures and levels.

Discussion and main findings

The context is very relevant when considering pricing policies, particularly the status and development of each

sector and region. This way, anticipation and flexibility must be considered to target changes namely in population, consumer behaviour, climate, and technological options in the course of the long-lived related assets. The implementation and success of pricing policies is dependent on the 'governance arrangements' used. Considering these contextual factors, the need to anticipate some of these changes/shifting priorities and to promote options able to adapt (e.g. through the link technical choices – financing strategies – pricing policies), some general findings are drawn in [Table 1](#) to promote adaptation in changing contexts and with shifting priorities.

KEY RECOMMENDATIONS AND WAYS FORWARD

The first overall recommendation is that tariffs should be designed in accordance with each country and/or municipality circumstances. In general, one should aim for suitable mechanisms to protect the poor and vulnerable, and (as necessary) differentiate tariffs by categories of consumers, with a cost recovery viewpoint. In terms of tariff mechanism choices, each mechanism has its own strengths and weaknesses, with some countries, usually high-income countries, preferring to move away from IBT towards VL-based rates, while others, usually middle-income countries, are aiming to maintain IBT. Again, all approaches can be effective in their own way to address the specific problems that each situation presents.

Water tariffs are instrumental to manage supply and demand of limited water resources. Based on policy and mechanisms applied elsewhere (i.e. case studies), the following key recommendations have been summarized to support decision makers in tariff design, management and implementation to pave the way towards water security.

Adopt an integrated approach to water resources management

Sustainable and equitable water management can only be achieved with an integrated, and holistic approach that addresses all aspects of WS including management, institutional, policy as well as stakeholders' integration:

- *Management integration* refers to the management of the water cycle in its entirety. Both in terms of services and technical/technological choices. Starting with sources (i.e. taking into account whether or not sources are scarce and depletable), until final release back to the environment, namely considering the cost of pollution and sanitation management. Singapore sets a good example in this regard, as the much higher production costs of next available water sources as well as final treatment before disposal have been incorporated into its water tariffs. Afterwards, come the technical choices for combined management (e.g. centrally piped technology or distributed systems; grey infrastructures or nature-based solutions), and required business model and institutional arrangement.
- *Institutional integration* means a close coordination between water ministry and planning ministry and other relevant ministries and authorities at national/federal and local level, to ensure a harmonized infrastructure and public services planning.
- *Policy integration* refers to a policy coherence between WS and sanitation as well as policy coherence across other competing sectors in the use of water (e.g. energy industry and agricultural policies).
- *Stakeholders' integration* requires the engagement of all relevant stakeholders in the planning, implementation and monitoring/evaluation of water resources. In Australia, proposals for water prices are often subject to public debate.

Review existing regulatory and institutional framework on water tariffs and water resources management

Revisiting existing regulations on water tariffs is a good way to ensure that the pricing system objectives have been clearly understood and met. The evaluation of water tariffs can be carried out, as suggested by [Pinto & Marques \(2016\)](#), based on a set of criteria mainly related to economic efficiency, financial sustainability, governance, environmental and social concerns. In a broader perspective of water resources management, an integrated set of WS regulations will also be necessary to ensure water security. Vietnam has been praised by ADB as having embodied its

Table 1 | Main findings and lessons learnt

Case	Main findings	Lessons learnt
South Africa	The key factors in successful implementation of FBW and FBS are good planning; the honest assessment of water service authorities capacity and consequential contracting of experts to fulfil the role and responsibilities the providers cannot fill; political support for those policies; and accountability.	Even with good planning, resources have to be made available to allow proper implementation in vulnerable areas. There is a requirement to build and retain resources (e.g. human and financial) for due policy implementation and management.
Vietnam	A typical case for a developing country where the Government maintains water tariffs at low levels under an IBT, perhaps to attend the needs of the low-income population group.	With current O&M budgets set at rates which are very low by international comparisons, these would not enable utilities to maintain acceptable levels of service, thus it is not the desirable way forward to sustain water business in the country.
Malaysia	A brave step in reforming the WS governance (from a disorganized situation at state and federal levels) can enhance coordination and improve management, in situations with or without private participation.	Depending on the situation, a federal act may be a relevant solution to promote new policies. In this case, moving competencies from state to federal level, may bring the opportunity to apply more suitable pricing policies (hopefully).
Singapore	In summary, Singapore presents a successful case where combined management, coordination and policy coherence seek full-cost recovery. Singapore follows the same approach as Australia in moving away from IBT towards VL-based structures to ensure full-cost recovery.	These types of tariffs may raise affordability problems, nonetheless, rebate schemes may prove a valuable solution.
Australia	Sets an ideal example with its mature water business where water tariffs reflect LRM, thereby ensuring sustainability of businesses in the future. The step of considering 'customer participation' as a focal point in the regulatory process. To consider synergetic approaches besides pricing policies.	Although the pricing principles are set at national level, at local level, the situation may be different, with 'politicized' situations. There may be a need for capacity building at local level.
Europe	Common guidelines are an important point when trying to improve transnational relations, and to make sure there is a reliable cost recovery that leads to suitable service levels.	The case of tariff recommendations may be important for capacity building. Furthermore, there is a need to avoid mixing water policies with other matters (case of Ireland) while promoting a proper knowledge dissemination across customers.

WS and sanitation in laws, decrees, circulars and decisions (ADB 2014).

Along with a regulatory framework review, the assessment of institutional roles is also important, to understand how WS services have been guided and what needs to be done to improve the effectiveness of WS management.

Raise public awareness for the implementation of water tariffs, and promote education and capacity building regarding sustainable water resources management

This stems from stakeholder engagement but has a more particular purpose. Raising public awareness on how water tariffs were set is an important aspect in their implementation, as a

successful implementation will rely on the acceptability of the system by the public as consumers.

However, raising awareness on tariffs alone will not ensure efficient water consumption. Promoting education about water issues and its ecological value as well as building capacity to improve the management of water resources (e.g. the use of smart technologies) are also important factors. In the end, those points are also bound to contribute towards the acceptability of water tariffs.

CONCLUDING REMARKS

To implement policies that will have impact on social liveability, as in the case of water tariffs, the experience of

other countries is of great support. From the experiences of other countries, many lessons can be learned on the successes and the failures related to water pricing policies.

Water tariffs are not a stand-alone policy or a magic bullet by themselves. They must be followed by appropriate support policies. Additionally, all the variables of the chosen tariff must be carefully studied to avoid subverting its theoretical principles (Pinto & Marques 2017). In some cases, water tariffs may not be the best solution to reach a particular objective (e.g. affordability), and it might be necessary to consider other options. In the case of subsidies applied to all customers, it is important to guarantee the effective access for customers, and to understand their household characteristics (e.g. size, consumption patterns). Otherwise, the subsidies will not be well targeted and will certainly miss the ones that need them the most.

In summary, with the current growth of urban centres in developing countries, and consequent challenges, there is an urgent need to review and establish an 'integrated/sensitive system' with a suitable water tariff policy to enable sustainable management of water resources towards water security. Water security may translate in sustaining livelihoods, human well-being, and socio-economic development, as well as ensuring protection against waterborne pollution and water-related disasters, preserving ecosystems in a climate of peace and political stability. Therefore, ensuring water security through water tariffs is a key development policy goal for developing countries.

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