JOINING EFFORTS TO SAVE THE PLANET WATER

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Abstract

The time Quality was directed only to specific products is over. This phase was followed by the era of processes in Production, Services and Management and those, nowadays are only a part of the Universe of Sustainable Evolution.

To conquer its real sustainability, our Planet has macro scenarios where Quality means combined actions from Private and Public Sectors.

One of these (scenarios), without any doubt, is the one related to the Water Problem.

At a very inspired momentum, AIQ and ASQ decided, in Dallas, in May 2014, to structure a Task Force to join efforts in global actions in benefit of the welfare of the Planet. The first challenge is focused on the water crisis.

This essay has as its main objective to contribute to call the World attention to this theme ¨Joining Efforts to Save the Planet Water¨, not only presenting technical studies, but mainly concrete analysis, metrics and data.

SAVE THE PLANET WATER

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1. FOREWORD

Saving our planet's water is one of the goals of people who are aware of the impact of their actions. Saving it means safeguarding it, protecting it from threats to its purity, restoring its good quality, knowing how to use it, using it in other ways, and even replacing it.Perhaps this is the most important of goals, because without water mankind's existence is doomed.

While this is inexorably certain, it is also certain that mankind has other goals inherent to our wishes and how we pursue our life's objectives, be they questionable or not. So many and so different are these goals that one cannot reach them, put them in order, and prioritize them.

A quick scan of newspaper headlines today leaves us appalled, flabbergasted, in disbelief, afraid and suspicious of the future. Can we imagine that in the various and significant portions of the planet where peoples kill one another for oftentimes unfathomable ideas there is awareness of the need to preserve water when even our species is not preserved? It is hard to believe!

A more in-depth analysis of the news and information also tells us that many are the actions taken toward the development of peoples which, however, are carried out through the meandering paths of corruption and lack of technical expertise, and end up thwarting the announced goals. We then ask again: can we imagine that under such circumstances people are in fact consciously tackling the need to conserve water? The same answer is given as well: it is hard to believe!

However, thanks to the human race's diversity, we also find worldly pockets of excellence where human beings are able to coexist despite their differences by mutually respecting one another while remaining close to their own decency, ethics, culture, knowledge, and actions dedicated to their very existence, in harmony with the resources gracefully bestowed upon them by the planet.

The widespread dissemination of the good examples found in these pockets will sow promising initiatives in fertile land and, in the other hand, will be lost in the dust of the devastation caused by wars and harmful human actions.Those who are able to spot the promising initiatives are tasked with putting them in place, disseminating them, and if possible, improving them.

For us Brazilians, and more specifically us from São Paulo, this initiative by the IAQ – International Academy for Quality – and ASQ – American Society for Quality – could not have come at a better time, as they join efforts and set up a Task Force to address the global issue of water, this vital asset.

In fact, as everyone knows, vast areas in the country have been facing the longest drought seen in the past 80 years, in regions not used to a dearth of water, and where rainfall rates have been historically systematic, generous, and regular.

In the city of São Paulo, capital of the state of São Paulo, and its Metropolitan Area, the hub of the country's development-oriented initiatives and home to over 20 million people, the fear of an imminent lack of water has forced the public authorities and the population to acknowledge how important water is as well as how pressing the need to conserve it is. Startled by the lack of water that once used to flow abundantly, more than 80% of the population have quickly changed their habits and reduced their demand for water by about 40%. In many cases, reduction rates have been much higher.Once again, people have shown their ability to adapt to the living conditions they come across.

The likely causes of this unexpected and frightening long drought have been the subject of many discussions. A wide variety of differing opinions has emerged ascribing the phenomenon, for instance, to logging in the Amazon forest that has lowered the moisture of the air moving from the North to the Southeast, thereby compromising the flow of the so-called flying rivers that end up coming down along the way, where the São Paulo Metropolitan Area is also found. Other opinions pin the drought on climate changes that have impacted rainfall regimes and concentrated it within shorter periods, caused more floods, and spaced it for longer periods, thereby causing more severe dry spells. There are other opinions still that ascribe such changes to the formation of large islands of heat created by the population increase in big cities. These islands at times prevent rain clouds from forming, and at others help lead to unusually intense rainfall.

In any case, whatever the cause may be, the focus to train on is water, that which floods us, that which we lack, that which we must have.That which floods us, we need to contain to make the most of its multiple applications. That which we lack, we need to seek. That which we must have, we need to protect and use wisely.

The desperate search for other water sources to aid those supplying the São Paulo Metropolitan Area has led to a new development in the country: the increasing conflicts over the use of water.While the 20 million residents of the São Paulo Metropolitan Area face a harsh, unexpected drought, another 15 million, now in the state of Rio de Janeiro, are also beleaguered by the phenomenon. Both have projects to use the same river that bathes the two

states, the Paraíba do Sul, and which under Brazilian law is a “federal river,” that is, it belongs to Brazil as a whole instead of to the federation's states.

There have always been conflicts over the use of water in the country, but more frequently between drainage basins inside the same state. One of this magnitude, involving the two richest states in Brazil and 15% of the country's entire population and over water for human consumption, is the first.

Until recently, a situation such as this was thought to be unlikely, given the country holds nearly 12% of the world's fresh water and has always been considered abounding with water resources for all uses, except for some areas in the Northeast. However, that fact ended up clouding people's view of the actual situation, i.e., that water is in fact a finite asset, that its distribution across the country's vast territory is nowhere near being even, and that its good quality must be pursued, obtained, and retained.

The misguided perception of abundance, added to the chronic lack of investments in the population's basic education, lack of massive investments in basic sanitation, lack of planning and control of the cities' growth and of the use and occupation of urban soil have worsened the situation as the waters of most rivers bathing the country's urban centers have been left to become polluted and improper for conventional treatment and use.

Hence the need to go get water from increasingly more distant drainage basins at increasingly higher costs, which has led to escalating conflicts that demand more complex solutions.

The Alto Tietê drainage basin, by which the São Paulo Metropolitan Area is located, is the best example of this anomalous situation. The Tietê River, its main stream and one that traverses the entire region, has an average long-term natural flow of 80 m^3/s, of which only about 20 m^3/scan be used for public supply, originating from reservoirs at its headwaters and other tributaries. The remainder of the water is polluted to such an extent that it is allowed to flow downstream. In case these waters were of suitable quality they could also be used for public supply and to meet the area's current demand without the need for bringing in water from neighboring drainage basins. The water in neighboring drainage basins could be kept as a reserve for contingencies, something the area lacks in the critical drought situation it is experiencing.

This article describes how the São Paulo Metropolitan Area found itself suddenly in the midst of an unprecedented water crisis, and how it reshaped procedures and behaviors to try and revert a looming situation of chaos. The main characteristics of the water sources supplying the São Paulo Metropolitan Area are presented to help readers understand the scenario described.

One of the main steps taken has breathed new life into the Responsible Water Use Program (*Programa de UsoRacional da Água* – PURA), kick started ten years ago by SABESP, the company in charge of this area's public supply. The program has been put in place in state and city government agencies, and its recommendations are being increasingly followed by the population.

Finally, we talk about the metropolitan population's response to the need for lowering their consumption and the beneficial paradigm shift the water crisis has brought about.

2. BRIEF HISTORY OF THE SITUATION

The São Paulo Metropolitan Area is 700 meters above sea level, on the plateau that begins at the Coastal Mountain Range named *Serra do Mar* that cuts it off from the nearby seaboard. Its area is basically intertwined with the Alto Tietê drainage basin, which covers 5,720 km^2. Its main drain is the Tietê River which, from its springs in the foothills of the Coastal Mountain Range by the city of Salesópolis, runs 130 km E-W down to the city of Pirapora do Bom Jesus, the basin's lower boundary. The TietêRiver crosses several cities along its path, including the city of São Paulo with its nearly 12 million residents. The Metropolitan Area comprises 39 cities, including the capital, and is home to about 20 million people, as previously mentioned.

Throughout its 461 years, an anniversary celebrated on January 25, 2015, the city of São Paulo has grown without plans that considered the area's natural limitations for the implementation of what would become the metropolis it is. One such limitation is exactly the low availability of water, given it is located by the headwaters of its main river, Tietê.

From that standpoint alone, from the moment the population's growth and the lack of sufficient basic sanitation came together, water for human supply started being harvested from areas yet to be impacted by humans, where waters are clean and far from the urban center. A remarkable example was the construction of the Rio Claro System back in the 1930s, which brought in nearby waters from the Tietê River springs 70 km from the capital through a massive complex of riveted cast iron channels 1.80 meters wide, aqueducts, and tunnels.Higher capacity systems followed, such as Rio Grande and Guarapiranga in the city's south side, close to where the land meets the sea.

In the early 1960s, the estimated population growth in the São Paulo Metropolitan Area (then referred to as “Greater São Paulo” - and which was already home to about 5 million people) pointed to the need of securing more water for public supply and other purposes.

The São Paulo state government then decided to implement a new, large, clean water system that would cater to the growing water needs for a long time. That is how the Cantareira System came to be, comprising several reservoirs located in the neighboring drainage basin of the Piracicaba River and interconnected by tunnels and channels that import those waters into the Alto Tietê basin. Construction started in 1973 and was completed in 1981, offering an additional

33 m^3/s flow to the Alto Tietê basin.By the time construction finished, another 8 million people had moved into the area.

In fact, the implementation of this new system provided the São Paulo Metropolitan Area for decades with the water security needed and for which it had been strategically devised.

Along with the first works of the Cantareira System, the government created SABESP - *Companhia de SaneamentoBásico do Estado de São Paulo* (the São Paulo State Basic Sanitation Company) - tasked with implementing the Brazilian government's guidelines set forth in the National Sanitation Plan - PLANASA. The federal government-sponsored program financed capital investments and helped set up state water and sewer companies using funds from the FGTS (*Fundo de Garantiapor Tempo de Serviço*) a public program meant to create an economic reserve to be used by workers as they retired or in case they were laid off, and which amassed a significant amount of money.

SABESP is a state-controlled company responsible for supplying water and collecting and treating sewage in 364 cities in the state of São Paulo. It is considered one of the world's largest sanitation companies in terms of the population served.In 2002, the company adhered to the New Market regulations of the São Paulo Securities, Commodities and Futures Exchange - BM&FBOVESPA. The São Paulo state holds a minimum share corresponding to more than half of voting stock.

In the São Paulo Metropolitan Area, SABESP now operates all water supply systems implemented so far, such as the Alto Tietê System built by the São Paulo State Government through its Department of Water and Electricity – DAEE.

Today, these eight systems have the following characteristics, as described on SABESP's website:

Cantareira – The largest in the São Paulo Metropolitan Area. The treatment station is capable of treating **33,000** liters of water per second, meant for 6.5 million people in the capital's north, center, east, and west sides, as well as the cities of Franco da Rocha, Francisco Morato, Caieiras, Osasco, Carapicuíba and São Caetano do Sul, in addition to portions of the cities of Guarulhos, Barueri, Taboão da Serra and Santo André. The system comprises the rivers Jaguari, Jacareí, Cachoeira, Atibainha and Juqueri(Paiva Castro).

Alto Tietê – The system is formed by rivers Tietê, Claro, Paraitinga, Biritiba, Jundiaí, Grande, Doce, Taiaçupeba-Mirim, Taiaçupeba-Açu and Balainho. **Fifteen thousand** liters of water are treated every second to serve 4.5 million people in the capital's east side and the cities of

Arujá, Itaquaquecetuba, Poá, Ferraz de Vasconcelos, Suzano, Mauá, Mogi das Cruzes, a section of Santo André, and two districts in Guarulhos (Pimentas e Bonsucesso).

Guarapiranga – Located close to the Coastal Mountain Range, its water comes from the Guarapirangareservoir (formed by rivers Embu-Mirim, Embu-Guaçu, Santa Rita, Vermelho, RibeirãoItaim, Capivari and Parelheiros) and the Billings Reservoir (Taquacetuba River). It yields **15,000** liters of water per second and supplies 4.9 million people in the capital's south and southwest sides.

Rio Claro – Located 70 km from the Capital, it yields **4,000** liters per second. The water comes from Ribeirão do Campo River and is treated at the Casa Grande Station. It supplies 1.5 million people in the capital's district of Sapopemba and portions of the cities of RibeirãoPires, Mauá and Santo André. The system was built in the 1930s and expanded in the 70s.

Rio Grande – A branch of the Billings Reservoir.It yields **5,000** liters of water per second and supplies 1.2 million people in Diadema, São Bernardo do Campo, and portions of Santo André.

Alto Cotia – The water comes from the Pedro Beichtreservoir, formed by rivers Capivari and Cotia. Water is taken from the Graça reservoir and conveyed to the Morro Grande Treatment Station. Its production of **1,200** liters of water per second supplies approximately 410,000 people in the cities of Cotia, Embu, Itapecerica da Serra, Embu-Guaçu and Vargem Grande.

BaixoCotia – The water comes from the Cotia River Reservoir. **Nine hundred** liters are treated per second to supply about 361,000 residents in Barueri, Jandira and Itapevi.

Ribeirão da Estiva – Takes water from Ribeirão da Estivariverand yields **100** liters of water per second. Supplies 38,100 people in the city of Rio Grande da Serra.The system was chosen to be fitted with and use the new technologies developed by SABESP or via partnerships with universities and research centers. The purpose is to turn it into an automation technology reference center for all water production phases.

However, the security offered by this water source complex was gradually dwindling not only as the Metropolitan Area became more populated but also as the area around the Piracicaba River basin started demanding more water for various purposes. That area is renowned for its industrial and farming might in the São Paulo state countryside.

Although since 1995 the São Paulo State Government had been planning to secure new water sources to serve the two regions (Alto Tietê and Piracicaba), even back then the government detected the need for people to change their water-related habits and use it more responsibly, and for developing procedures of wastewater reuse.

Based on that spot-on insight, in 1996 SABESP launched its Responsible Water Use Program (PURA), whose purpose is to work on the demand by encouraging responsible use through technological actions and awareness-raising initiatives to foster a culture change among the population regarding the waste of water in order to tackle its scarcity.The main focus was the drainage basins in critical water availability conditions, especially the Alto Tietê drainage basin where the city of São Paulo is located.

As an incentive to such practices, via State Decree 45.805 of May 2001, the São Paulo State Government created the State Program for the Responsible Use of Drinking Water to obtain a 20% reduction in the water used by state agencies, offices, foundations created or funded by the state government, and companies in which the state government holds a majority interest, as well as by other entities directly or indirectly controlled by it.

In turn, Decree 48.138, published in October 2003, created measures to encourage those same entities to save and responsibly use water, considering the need to raise awareness, advise, and reeducate public and private agents for them to use water responsibly and efficiently. The decree also described the Managers' job.

In 2012, the São Paulo State Government enacted Decree 57.829/2012, which requires PURA to be put in place across the state.

3. RESPONSIBLE WATER USE PROGRAM - PURA

To give the example, SABESP started putting the Program in place at bodies run by the state of São Paulo and internally dealing with a large number of people, such as hospitals, correctional facilities, schools etc..

To do that, an administratively structured program was designed containing well established rules and a set of coordinated actions allowing SABESP and the state bodies governed by the Program to start interacting, detecting the corrections to be made to the buildings' plumbing, fitting water-saving equipment, training the institutions' managers, giving environmental sustainability courses to support water use-related behavioral changes, and monitoring the improvements implemented and their results in terms of water use and maintenance until the program moved on from monitored management to being managed by the institutions themselves.

These actions were consolidated into four handbooks, each one describing the activities required to achieve their purpose. Hence, the company issued the Manager's Handbook, the Controller's Handbook, the Multiplier's Handbook, and the Cleaning Handbook.

The **Manager's Handbook** guides the planning and management actions for implementing PURA, involving the following main activities:

- ***Auditing the use of water*** to understand a building's physical characteristics, its plumbing systems, water sanitation equipment, the population involved, the activities carried out using water, and how much water is used in the building;

- ***Diagnosing the use of water*** to generate an organized summary of the information obtained from the water use audit to draw up an Intervention Plan containing specific actions for each type of building and considering each system's own characteristics. The diagnosis is obtained through the following main activities:
  • Inspecting the plumbing for its operation and maintenance;
  • Detecting visible and invisible losses and leaks;
  •Survey of the water quality;
  • Survey of the consumption profile;
  • Survey of the age of the building;
  • Obtaining the history of the plumbing system's maintenance;
  • Registering the type of supply system (mixed, public network, wells, and tanker truck) and the number of meters;
  • Registering the water tanks;
  • Recording the users' procedures and routines regarding the use of water in their activities;
  • Describing bad waste-related habits;

- ***Intervention Plan,*** under which corrective actions are to be carried out to save water in the building, focusing on the critical issues of the system looked into. These actions are mostly the following:
  • Correcting leaks and reducing losses;
  • Setting up water-saving equipment;
  • Conducting an environmental education campaign;
  • Disseminating procedures for people's everyday life that lead to water savings (“saving tips”).

- ***Evaluating PURA's implementation*** by comparing consumption rates before and after the interventions. The results are relayed to users and disseminated to other applications to encourage water savings.

The **Controller's Handbook** is meant for those involved in the actions described in the Manager's Handbook and provides step-by-step explanations of how to carry out the activities related to the water use audit, water use diagnosis, intervention plan implementation, and evaluation of the results obtained. It gives how-to details, actual examples of how things have been done, supporting documents for leak inspections, instructions on how to set up water-saving equipment, instructions about the maintenance of water sanitation equipment, technical specifications, spreadsheets for the collection of data and information etc..In short, it is a hands-on manual about how to put PURA in place.

The **Multiplier's Handbook** is a teaching tool for the environmental education of the users required to follow PURA's guidelines and offers educators current information about the topics of environmental conservation and preservation of water resources. It is meant to impart knowledge and give educators tools allowing them to, at school and in their local context, develop activities that help educate students to be contributing members of society who think and act by themselves, and are capable of taking an in-depth look into the ideas put before them and the social reality they share.

The **Cleaning Handbook** was put together to support this activity in public buildings, which was PURA's original goal, given the pressing need for this service in those locations to prevent infections and contaminations, keep sites and equipment in good conditions, provide greater safety, contribute to the good performance of the actions to be carried out, improve the quality of services provided to the population and the very employees, and ensure basic hygiene conditions. It describes cleaning techniques designed to save water, suggests cleaning equipment and products appropriate for each cleaning and conservation area found in the various types of public buildings.

The Responsible Water Use Program – PURA being implemented by SABESP for several years has gained new momentum as a result of the water crisis plaguing the São Paulo Metropolitan Area along with some cities in the state's countryside and southeastern Brazil, to the point the City Administration of São Paulo now requires city public bodies to have it in place as well.

Publicized by the media through SABESP's website, it has also stirred up the interest of common citizens who, facing the real threat of having no water to drink, brought their contributing-member-of-society side back to life and immersed themselves in the search for solutions to prevent the worst from happening.

Hence, SABESP has been recently asked to put together a **Guiding Handbook** dedicated to the responsible management of water in households and educating people on what and how to do to save water.

4. THE POPULATION'S RESPONSE

The Cantareira System, which as mentioned before had been responsible for supplying approximately 1/3 of the population in the São Paulo Metropolitan Area, for some years now had been faced with a demand greater than it was able to supply, considering its project's capabilities. Therefore, its useful volume started giving signs of depletion and storage less and less water before the dry season without, however, compromising public supply.

When rainfall waned late in 2013, it was expected that at some point it perhaps would be necessary to adopt water saving or lower supply measures, or both. The rain that should have come did not, and the situation grew worse. The other water sources also started seeing their stored water volumes go down and their situation was critical by the time the 2014 dry season began, as they waited for the rains that should have started in the last months of 2014 and which also failed to fall. The Cantareira System had its reservoirs' water levels drop below the catchment height for conveyance. The longest dry spell in the past 80 years had staked its claim.

In charge of public supply in the São Paulo Metropolitan Area, SABESP acted quickly and started using water from the dead volume in the reservoirs of the Cantareira System by setting up emergency pumps and digging channels to interconnect its reservoirs.

At the same time, the company launched a campaign to explain the situation and educate users on how to save water. This campaign was intensified late in 2014, acknowledging and affirming that the only short-term measure to prevent the water supply to the population from being interrupted would be for people to join the efforts to save as much water as possible. Bonuses were given on water bills as a result of the savings obtained, while fines were charged from those who upped their consumption.

The result was somewhat surprising given how fast the population responded and accepted the call for them to save water. In fact, more than 80% of the population decreased their consumption by about 20%.

Other steps were taken, such as the partial interconnection of the available supply systems and the reduction of water pressure to decrease losses and the supply.

Aiming at the medium-term, SABESP expedited processes to implement new water sources, design of wastewater reuse plants, and find more long-term solutions capable of restoring the water security the area once enjoyed after the Cantareira System was implemented in the 70s and 80s.

5. THE OUTCOME

What has happened, and is still happening because supply issues are far from being considered overcome, is a practical example of the maxim that says crises generate opportunities. The opportunity to appreciate water as an essential, finite asset has been taken and is expected to continue to be so, whatever the future situation of the water sources may be.

What we can say is that we are before a radical paradigm shift. The historic flow series are different now, the uncertainties about the unchanging nature of seasons have come to stay, and people's behavior toward water has changed.

The fact that the situation of the water sources in the Metropolitan Area, especially that of the Cantareira System, is only expected to return to normal in perhaps three years is worrisome on the one hand. On the other, it is beneficial, as it may be the time necessary to consolidate the behavioral changes toward the use of water. It may also lead to greater conservation of water streams, more attention to the proper use and occupation of urban soil, more substantial improvements to water quality via increased collection of household sewage, and mostly to the development of new reuse technologies, among other welcome initiatives.

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