

Wastewater Management in Hanoi: The Possibility of Using a Soft Path Approach

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Abstract: Hanoi is known as the City of Lakes because there are some one hundred natural or manmade watercourses within its territory. However, in common with all of Vietnam, more than 60% of the city's water resources derive from beyond the country's borders. Much of that water is polluted, both within Hanoi and downstream because wastewater is discharged directly into the Nhue and Day rivers via the Nhat Tuu and Ba sewers, among other channels. International attempts to revive the To Lich River in the city, notorious for its black color and unwholesome smell, have proved to have only limited success. There is some scope for new materials to improve filtration effects and experiments in this area continue. Rapid urbanization in Hanoi has been intensified by the sudden decision to increase the city's size so that it became comparable to the southern capital of Ho Chi Minh City. This has led to large areas of industrial land being incorporated into municipal water management systems. One possible means of relieving the pressure on these systems would be to employ approaches derived from the soft path of water management. To date, most scientific investigation of these issues depends almost entirely on technocratic approaches to water management issues and the attempt to force technical solutions to deal with social issues. Consequently, this paper investigates the possibility of understanding how Hanoi residents interact with current wastewater management approaches and how their needs might be better met in the future.

Keywords: *Hanoi, sanitation, soft path approach, wastewater management.*

1. Introduction

Viet Nam has one of the fastest rates of urbanization in the world, with almost 43% of the country's population expected to be living in cities by 2030. The process of urbanization in Vietnam takes place very quickly. Consequently, major cities in Vietnam such as Hanoi, Ho Chi Minh City, Hai Phong and Da Nang are facing the problem of heavily polluted water (Ministry of Natural Resources and Environment, 2017). In these cities, domestic wastewater is discharged directly into receiving sources (i.e., rivers, lakes, canals and ditches) daily (ARUP, 2017). Furthermore, many factories do not process wastewater to reach the required national technical standards on the environment, while many hospitals and health facilities do not have proper wastewater treatment systems (Ministry of Health, 2017). At present, the level of pollution in canals, rivers and lakes in the major cities is very heavy (Ministry of Natural Resources and Environment, 2017). Hanoi faces particular problems with respect to water management because of its intensive industries, its rapid urbanization that has not been accompanied by concomitant improvements in water management and the fact that, unlike other cities in Viet Nam, the majority of its water sources derive from beyond its borders. In particular, major rivers that pass through Chinese territory are liable to be dammed, often more than once.

This leads to decreased flow, negative impacts on ecological systems and the loss of sedimentation in lower reaches of the rivers and, hence, greater erosion, with further loss of livelihoods and ecological resources. These problems have tended to have greater impacts on more vulnerable members of society since they have less ability to deal with external shocks and fewer resources in resorting to market-based solutions. Research has indicated that buying bottled water is many times more expensive than having water piped into households (Danierie & Takahashi, 1999). The problems attendant on withholding water from urban communities have been amply demonstrated by the privatization of the water supply in South Africa. These and similar problems are not, of course, limited to Viet Nam. Thinking about water management from an internationalist perspective in the era of climate change led to the re-evaluation of the concept of integrated water resources management (IWRM), which resurfaced in the first decade of the century as a means of bringing about the Millennium Development Goals. IWRM has been defined by the Global Water Partnership (Global Water Partnership, 2006) as a process that promotes the coordinated development and management of water, land and related resources.

In order to maximize the resultant economic and social welfare equitably without compromising the sustainability of vital ecosystems. Odendaal (2002) explains that the purpose of IWRM is to find the right balance between protecting the water resource itself while meeting social and ecological needs and promoting economic development. This approach recognizes both the need for sustainability and awareness of the reality of economic development. It has some valency with Vietnamese thought, which emphasizes the country and its people being defined by the presence of water and its management – in common with the other countries of the Greater Mekong Subregion, Vietnamese agriculture relies upon wet paddy rice cultivation and, hence, the food security of the people depends on the ability to manage water as required. The Vietnamese term for the country, *dat Viet*, meaning both rivers and mountains, indicates the longstanding belief that there is an organic relationship between the Vietnamese people and the land and, hence, both a requirement for proper care of the land together with the ability and knowledge to do so. In addition to this, the Vietnamese Communist Party has adopted what for Marxist-Leninist movements is a standard Promethean approach that asserts humanity's mastery of nature and the right to make nature fit with the requirements of the people who live within it.

IWRM in this context, then, represents the ability of the Vietnamese people to manage water resources according to their own needs and in line with the government's stated developmental goals. In a parallel development in thinking about water management, Gleick (2002) introduced the concept of the soft path of such management, which 'seeks to improve the overall productivity of water use and deliver water services matched to the needs of end users, rather than seeking sources of new supply.' It is helpful, in this case, to think of the needs of people and organizations rather than the means by which they may be achieved. People want to consume food and other products and take advantage of available services; historically, meeting these needs might have required the use of water (sometimes on a very intensive basis) but that need not be the case in the future. Various initiatives suggest alternative means of meeting these needs with greatly reduced use of water, although there are unavoidable lower limits to what can be achieved in this respect. Nevertheless, more can be achieved by an approach that "... complements [centralized technology and infrastructure] it with extensive investment in decentralized facilities, technologies and human capital (Wolff & Gleick, 2002)." In some ways, this approach is conversant with the Vietnamese government's embrace of the smart city concept.

Smart city development (SCD) began with the attempt to manage mobility flows through real-time analysis of big data sets but has subsequently evolved into a wide range of initiatives aimed at making the quality of life of citizens better (or at least maintaining the same level) while paying more attention to the needs of sustainability and the carbon footprint of the city as a whole. In Viet Nam, most cities have been encouraged to present a plan for their SCD according to local needs and capabilities. Following the usual Vietnamese model of development, individual cities draw up a plan for SCD with recognized targets and timelines and then submit these for approval by central authorities. Once approved, city authorities are expected to bring the plans to reality. Cities have generally created plans that match their strategic intentions – some emphasize tourism management, for example, while most plan to use facial recognition software for security purposes. It would be appropriate to include water management approaches in SCD, although there are no such provisions for this in the current iteration of the plan being used in Hanoi. The use of IWRM and the soft path for water development mean that, at least for some citizens, their receipt of water services will occupy the same conceptual space as the mundane interactions with the state that make up everyday politics. This concept aims to explain how everyday resistance to vertically imposed power can bring about large-scale political change.

Writing at first about the collapse of collectivist farming in northern Vietnam (and subsequently expanding the analysis in terms of both space and time), Kerkvliet (2005) observed: "Persistent struggles over labor, land, harvests, draft animals, fertilizer, and other resources contributed significantly to the collapse of collective farming. Even more striking, the struggles were rarely open and organized. They manifested themselves instead in the way people lived, worked, and went about doing – or not doing – the things they were supposed to do." Although it is not expected that Hanoi citizens are actually resisting the water management regimes in place, it is anticipated that people will be making their daily variations on their use of such services and interactions with service providers that indicate gaps between what is available and what is required. That such a dynamic of urban living does take place in urban Vietnam is demonstrated by the lives

of street vendors (e.g., Lincoln, 2008, Turner & Oswin, 2015), who the authorities would like to regulate and remove from many parts of the city, thereby removing their livelihood opportunities. In common with street vendors attempting to survive elsewhere, Hanoi Street vendors have adopted a range of tactics that enables them to navigate the restrictions placed upon them, albeit temporarily. The current paper aims to investigate through personal interviews the nature of this everyday politics in the case of Hanoi and the citizens' use of water services. In doing so, it is hoped to determine the extent to which the soft path is being used and, hence, the extent to which generalization of the results may be claimed.

2. Wastewater Management System in Hanoi

Looking deeper at the Hanoi wastewater management situation, rapid urbanization makes the quality of the natural environment more and more impaired, affecting the quality of life of the people. In Hanoi, domestic wastewater accounts for a large proportion, about 67.6% of the total wastewater generated in the area and only about 20.6% of the city's total domestic wastewater are treated (Ministry of Natural Resources and Environment, 2017, National Environmental Report, 2017). Therefore, to improve the water environment in Hanoi, wastewater should be treated onsite and managed as a decentralized system, in the same way that plays a vital role in wastewater treatment in small communities (Libralato et al., 2012). Green technological options can be considered to minimize the negative influence of untreated wastewater on surface water bodies such as wastewater treatment systems that operate through a complex synergy of soil, water, vegetation and atmosphere ((Paruch et al., 2019) that are collectively known as nature-based treatment systems (NBTs). NBTs such as soil filters, constructed wetland, algae ponds or multi-soil layering systems are being applied popularly today (Mahmood et al., 2018, Paruch et al., 2019, Singh & Kumar, 2017) and could prove to be effective environmental management solutions.

For Hanoi, particularly in low population density or suburban areas. Constructed wetlands were basically created based on traditional soil filtration (An, 2015). After about 30 years of the government-directed "production priority" outweighing the importance of environmental issues, Hanoi has seriously polluted all its five rivers, respectively from east to west, the Kim Nguu River, the Set River, Lu River, To Lich River and Nhue river. In fact, more than ten years ago, all of the five rivers were already seriously polluted. In the dry season, sometimes, the river bed is shallow and the bottom inert. These rivers have the natural function of draining rainwater and wastewater for the Hanoi area. The drainage culverts system of Hanoi is a combined sewage system that remains unchanged from the past to the present (Ministry of Natural Resources and Environment, 2017). According to the Hanoi Department of Construction, the total amount of domestic wastewater in Hanoi city needing to be treated is about 900,000 m³/day. In fact, only about 20.6% of the city's total domestic wastewater is treated, while the remaining more than 700,000 m³/day is still untreated and instead is discharged directly into the environment. The total amount of wastewater treated in 2015 was 185,600 m³/day and night, distributed in WWTPs as follows:

Table 1: Volume of Wastewater Distributed in Hanoi WWTPs in 2015

Name of Factories	Treated Volume <i>M³/Day and Night</i>	Design Capacity <i>M³/day and Night</i>
Kim Lien	3,700	3,700
Truc Bach	2,300	2,300
Bac Thang Long - Van Tri	5,600	42,000
Yen So	174,000	200,000
West Lake	15,000	15,000
Thong Nhat Park	13,300	13,300
Total	185,600	

Source: Hanoi Department of Construction (2017).

Nature Based Treatment Technology: Nature Based Treatment (NBT) technology has been used to treat wastewater for a long time. Many on-site systems, such as soil trenches, constructed wetlands, high-rate algal ponds and compound media filter beds, have been used to treat wastewater in small household communities (Matamoros & Bayona, 2013, Ma et al., 2015). All of these methods can be applied to treat decentralized

sewage with different efficiencies. The use of soil for wastewater treatment and environmental remediation has existed for a long time and is used in many parts of the world, especially in Japan, India, the Netherlands, Germany and Thailand (Luanmanee et al., 2001). Constructed wetlands (CWs) are basically created based on traditional soil filtration and seem to have started in Germany, based on research by Kathe Seidel in the 1960s and by Reinhold Kickuth in the 1970s (Kadlec & Wallace, 2009). CWs treatment systems are generally divided into three categories: free water subsurface (FWS) CWs, subsurface flow (SSF) CWs, and hybrid CWs. SSF CWs may be further classified according to flow direction into vertical subsurface flow (VSSF) and horizontal sub-surface flow (HSSF) systems (Kadlec & Knight, 1996). The FWS CWs are effective in the removal of organics through microbial degradation and removal of suspended solids through filtration and sedimentation (Kadlec et al., 2009).

Constructed wetlands play a huge role in wastewater treatment; CWs are often built to treat wastewater in areas where sewer infrastructure is not available. The Water Environment Research Foundation (WERF, 2006) summarizes as many as 1,640 projects using small-scale wetland ecosystems (<200 m³/day or by total area). The area is responsible for <6 ha in wastewater treatment in the US and Europe. Some 50% of applied projects treat less than 2.6 m³/day and night, mainly based on the size of one US household; nearly 90% of wetland systems in the database serve a population of fewer than 5,000 people and 70% are identified for use in domestic wastewater treatment. Thus, the number of artificial wetland systems for household wastewater treatment in the world is very large. WERF (2006) also summarizes the results of denitrification and total nitrogen removal in vertical wetland construction wastewater treatment systems. The technique of treating wastewater by tree-planting CWs is quite popular to treat domestic wastewater. Studies have shown the significant effects of oxygen on nitrogen transport and nitrogen removal of tree-planting CWs with the vital roles of soil and *Phragmites australis*.

Soil is a natural material with the ability to filter and very good adsorption of pollutants (Nga, 2014, Sato et al., 2005). Laterite is capable to treat domestic wastewater with high efficiency (Yen, 2016). Scientists have also shown that *Phragmites australis* (common reed) can import 0.3 kg of oxygen/day/m of roots. Reed (*P. australis*) has also been selected as a plant species in CW systems in many countries such as Austria and Denmark (Brix & Arias, 2005). Vertical CWs planting *Phragmites australis* has the potential to eliminate N-NO₃⁻ in wastewater. N-NH₄⁺ can be treated through nitrification or absorption by aquatic plants (Farahbakhshazad & Morrison, 1997; Chadde, 1998, Moreno et al., 2002). In all of these approaches, little if any attention is paid to the human dimension since it is evident from the observation that people intervene in wastewater and water management systems in urban environments in various ways. Consequently, the purpose of this paper is to investigate human interactions with water management in Hanoi to understand how improvements from a human perspective may be made.

3. Methodology

This paper reports on both primary and secondary research efforts made to understand peoples' responses to water management, specifically wastewater management, in Hanoi. Primary research involved personal interviews of relevant individuals, including leaders of non-governmental organizations, government officials and water management academics. Interviews used a semi-structured approach and were recorded for subsequent transcription and interpretation from the original Vietnamese into English. Content analysis was used to identify the main findings, which are presented below.

4. Day-to-Day Use of Water

Environmental concerns in Hanoi have become high in recent years. The Air Quality Index figures have been repeatedly at a dangerous level and this has resulted from a combination of extensive use of coal across the north of the country and under-regulated industrial activities: recently, mercury was released into the air following a factory accident. Market failures are rife, such as the case of three men hired to dispose of dangerous industrial waste who simply dumped it in a nearby river, thereby subsequently making tap water unusable for 1.4 million Hanoi residents ("Hanoi Tap Water 'Safe for Consumption after Contamination Episode: City Leader," 2019). This episode, which is not unique, revealed the problem of fragmentation among the various supply companies which, currently, work independently of each other and have been

accused of lacking needed capabilities (Loan, 2019). By contrast, Ho Chi Minh City's water supply is provided by the Saigon Water Company (Sawaco), as a unified provider. In Hanoi, four companies provide services, which are VIWASUPCO, HAWACO, Son Tay Company and Ha Dong Company.

Together, these companies extract 1,000,000 m³/per day of groundwater, which helps contribute to the city's land subsidence problem (Wright-Contreras et al., 2017). The fragmented water supply system has tended to amplify the differences between service levels depending on geography. Periurban areas see residents combining the use of piped water when available with the purchase of bottled water and of privately-owned well water, which is generally filtered personally. As a result, levels of satisfaction vary in different parts of the city. An important determinant of the level of satisfaction with services is the level of information available and the willingness of people to believe that information: some respondents in a previous survey were willing to use their judgment of whether a source of water was or was not safe rather than rely on official or institutional advice (Nguyen, 2017). The situation was similar for wastewater, with the overall system being considered to be unsatisfactory and the results of spreading pollution very evident in the dead rivers that once flowed through the city and the evidently stressed lake system that once would have provided storage and hydration for the people. A survey of 300 urban residents by Indochina Research found that water pollution ranked third among five principal concerns related to pressing social issues.

Along with food safety, air pollution, sexual harassment and healthcare (Anh, 2019). These issues have clear implications for gender, in that they tend to be more evident to women and are more likely to be encountered in their daily routines. More generally, the World Bank has estimated that polluted water, under-investment in water treatment and overdependence on rivers coming from overseas could cause as much as a 6% decrease in national GDP (Sen, 2019). Recently announced plans by Hanoi city authorities featured the expansion of fees to both residential and industrial users of the wastewater system. It has been argued that the level of income that could be raised by these means will continue to indicate systematic under-investment (Hai, 2019). Sufficient investment could help in the self-regulation of water services in the city. One respondent observed that: "The Hanoi Lake system has the ability to regulate extremely severe and extreme climates, and we must protect it." This sense that previously effective forms of water management have been allowed to deteriorate was a theme repeated more than once. Those claims were made by scientists armed with data makes takes them beyond the level of nostalgia.

The Role of NGOs: The role of non-governmental organizations (NGOs) in water management in Hanoi and other parts of the country tends to indicate the intersectionality of the community interests with which NGOs tend to be concerned. One respondent observed: "There must be a holistic approach, which is a holistic consideration of needs to have a development vision, which should then be used appropriately and effectively. At the present, there is more focus on groups with more power like hydropower development groups. They use water more like water grabbing. Another example is the big project like coal-fired thermal power plants which use water to cool the system and then pollute the environment. In other words, at present, they lack an overall vision and there is a lack of coordination among related departments." While the NGO is motivated by the desire to improve the quality of life for communities, that quality of life depends on water which is subject to processes beyond the initial purview of the NGO. To challenge the problems caused by industrialization that damage water supply, it is necessary to challenge state-private sector links and the (implicit) contract between the governments.

This can bring about conflict if it appears the NGO is trespassing in areas for which it is not licensed. Another respondent spoke about an NGO she had established that had three areas of activity: a clean air and water program that involves extensive outreach work; a sustainable energy program involving education and community involvement and, thirdly, a green community program that helps embed research results into community practice. Such a project logically incorporates the various elements required to deal with the intersectionality of water and community development and this reflects a change in policy on behalf of the Vietnamese government which was to reverse its previous level of restrictions on foreign NGOs and to encourage their spread, as demonstrated by Decision 59/2001/ QD-TTG on 24th April 2001, which set up the Foreign NGOs Committee which now regulates their activities. The Women's Union, in various branches, works in cooperation with some international NGOs and provides local expertise and capacity for them.

Although this suggests a level of additional bureaucracy in the activities involved, it does provide opportunities for closer involvement with some local communities.

Discussion

As Hanoi, together with the rest of the country, comes increasingly to be influenced by capitalist development, some elements of such a change that have been identified in comparable cities elsewhere may also be discerned here: the gentrification of central parts of the city and relocation of pre-modern or non-aesthetically pleasing elements (e.g. street vendors); replacement of traditional distribution and consumption patterns by profit-making systems and the introduction of business management education aimed, as Sartre observed, at producing graduates able to take their place in the emergent bourgeois structures. Do these processes represent what Harvey (Harvey, 2005) called 'accumulation by dispossession?' This cannot really be argued in the case of water management because the roots of the problems inherent in this case predate the creation of the *doi moi* (economic restructuring) process and it is the processes of urbanization that have done the most to contribute to the worsening of the problems and this has, to a significant extent, been brought about by the intensification of industry in the periphery of the city to boost production for state-level development targets. Currently, wastewater management is hampered by being managed by commercial interests obliged to act within constraints to prevent inequality but also preventing sufficient investment.

Soft path for water elements has been included in water management by some NGOs in Hanoi to a certain extent and perhaps to greater extents in some other, secondary cities of the country. It would not be correct to call Hanoi a primate city as McGee (1967) would have it but, nevertheless, it does contain a significant amount of the nation's principal political, cultural and historical institutions and that represents a certain conservatism of thinking when it comes to change. This is far from the ossification of central Bangkok and there is little doubt that the country's leaders see Hanoi as being an open, global city, as the building of the Formula One track rather indicates. However, it does make change an issue that should be approached with due care and involve the various layers of administration that make up municipal administration. In terms of SCD, it is apparent that there is little possibility that water management will be included in it for the foreseeable future. To some extent, these results from the nature of the Vietnamese planning model, which requires locally, produced plans to receive central authorization before being brought into reality in such a way that it does not violate what has been agreed upon. In general, this means that the current smart city plan will need to be implemented at least in significant part before it can be updated to incorporate much-needed water management elements.

5. Conclusion

This paper reports on research in progress to determine the everyday interactions between the people of Hanoi and the water services they receive, especially in the case of wastewater treatment. It has been shown that water management in the city is characterized by under-investment, fragmentation of authority, widespread pollution, over-reliance on international river supply and inadequate planning for the future in what is, inarguably, a complex situation. However, the research is ongoing indicates that these conclusions are interim for now and it remains to be seen whether they will be borne out by a more extensive understanding of the situation. This also holds for understanding the extent to which the understanding of the situation in Hanoi can be generalized to other cities in Vietnam and beyond. Research on water management in Hanoi is more advanced in terms of pure science than it is for the social sciences, although some progress has been made in this respect. Conditions within Vietnamese society as a whole make it more likely that the former may be conducted officially rather than the latter.

Consequently, recommendations drawn from social sciences require prudent management if it is to be hoped that they will in due course be implemented. In this case, it is recommended that technocratic city authorities incorporate voices from the population in drawing up plans for water management and the implementation of new schemes. It would be preferable if development priorities were adjusted to bring personal experience to the forefront but it is unrealistic to expect rapid industrialization to take a step backward in the foreseeable future. At least, better, more open and better-policed zoning regulations would help ensure that levels of pollution are reduced in residential areas. It is conventional to acknowledge research limitations in

this section and it is clear that any research based on a qualitative approach may be vulnerable to criticism of the sample of respondents achieved and how analysis of their views was conducted. This is true in the current case and the best approach to dealing with this is to conduct further research on the same and related subjects.

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