

## A Perspective Study on the Urban River Pollution in Malaysia

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In Malaysia 97 % of water is supplied and tapped from rivers and streams. However, the river quality in Malaysia remains highly polluted; especially urban river that passes through densely populated areas. This paper aims to investigate the river restoration programmes initiated by Malaysia, the public's views on river pollution and to identify the improvements needed to mitigate river pollution issues. In depth review of river restoration efforts in Malaysia and Japan was carried out as secondary data and subsequently a survey questionnaire was conducted with 300 residents in Klang Valley, Malaysia. As a result, data derived shown the key factor underlying the cause of river pollution is human factor with low awareness, information and knowledge leading to the lack of sensitivity in river restoration participants and programmes. Environmental education would be the key essence in curbing river pollution via the adoption of nature-oriented approach, bottom-up approach and establishment of a central river information system.

### 1. Introduction

With a land area totalling 329,750 km<sup>2</sup> with about 3,000 river basins (DID, 2010) in Malaysia, river streams are the source of life, providing water resources for industrial, domestic uses and recreational activities; but also as a mean of waste disposal (Mohammed, 2008). As Malaysia has abundant of rainfall throughout the year (Hashim et al., 2012), with average of 324 10<sup>9</sup> m<sup>3</sup> of rainwater yearly (Mamun and Zainudin, 2013), the public does not perceived water supply as a major concern. However, with the population expected to rise to 43 M by 2050 (NRE, 2012) and with the global climate change, continuous water supply might affect Malaysia in the future. The situation is worsening as Malaysia are experiencing river pollution issues (Mamun and Zainudin, 2013) from agro-based factories, livestock farming, land clearing activities, domestic sewerage and improper discharge from sewerage treatment plants (PMO, 2011). Furthermore, urban rivers are badly polluted due to heavy waste disposal from settlements, commercial areas, markets and food centres, hydrocarbon residuals from motor vehicles and silt loads from construction sites (Abdullah, 2002). Chan (2005) identified approximately 80 t of solid wastes entered the Klang River which flows through densely populated areas in Klang Valley, Malaysia. With the range of issues deteriorating the river water quality in Malaysia, the Ministry of Natural Resources and Environment (NRE) had classified about 41 % of rivers as polluted in the year 2012 (see Table 1 for the classification of Water Quality Index (WQI) in Malaysia (Fulazzaky et al., 2010).

Studies by researchers in Malaysian shown that there is low public participation (Chun et.al, 2012), and perception towards environmental sustainability, lack of enforcement (Chun et al., 2012) and structured approach in monitoring of implemented plans (Tan, 2013). Hence, Malaysia according to Chun et al. (2012) is in need to have a well-organized voluntary programme for continuous interests and to raise the level of awareness pertaining to river related issues. Therefore, this study aims to investigate the underlying cause of river pollution and to identify the improvements for river pollution instigating rapidly in Malaysia. The paper firstly, review the river pollution efforts initiated in Malaysia to identify the weaknesses of its action plans and benchmark with Japan that had successfully curb river pollution issues in the past. By leveraging the literature, a survey questionnaire was designed and disseminated for primary data

gathering. The paper will conclude with a discussion on the data gathered and put forward a recommendation plan to mitigate river pollution issues in Malaysia specifically.

*Table 1: Water Quality Index (WQI) in Malaysia*

Parameter	Unit	Class				
		I	II	III	IV	V
Biochemical Oxygen Demand (BOD)	mg/L	<1	1-3	3-6	6-12	>12
Chemical Oxygen Demand (COD)	mg/L	<10	10-25	25-50	50-100	>100
Ammonical Nitrogen (AN)	mg/L	<0.1	0.1-0.3	0.3-0.9	0.9-2.7	>2.7
Dissolved Oxygen (DO)	mg/L	>7	5-7	3-5	1-3	<1
pH	mg/L	>7	6-7	5-6	<5	<5
Total Suspended Solid (SS)	mg/L	<25	25-50	50-150	150-300	>300
WQI	-	>92.7	76.5-92.7	51.9-76.5	31.0-51.9	<31.0

\*WQI: 81-100 =clean, 60-80 = slightly polluted and 0-59 = polluted

## 2. Literature review

The following section discusses the major river restoration and rehabilitation efforts carried out in Malaysia and Japan.

### 2.1 Malaysia

Malaysia rivers are not fully exploited for its recreational potential or heritage value according to Shamsuddin et al. (2008). This includes sacrificing its natural environment by substituting natural embankments with concrete banks. To preserve the natural beauty and functions of rivers, Chan (2005) states there is a need to look into the planning of urbanizations and development projects. As such, various plans had been introduced to cultivate rivers restoration projects. For example, "Love Our River Campaign" by the Department of Irrigation and Drainage (DID) in 1993, that aims to create and promote public awareness about the importance of rivers, the need to conserve and preserve the natural environment and to increase the knowledge and techniques on river management among the agencies involved (DID, 2013). However, the campaign was a failure due to a one-off basis of periodic campaign with selected rivers and managed by less trained officers in the facilitation and advertisement aspects (Chan, 2005). The DID initiation of the Klang River Cleanup Programme (1992 - 2000) had remained in Class IV (Table 1) after many years of implementation according to Chan et.al (2003). The programme failed due to the continuation of solid waste and rubbish disposal by public and irregular monitoring and coordination at the ministerial level (Tan, 2013). However, the Natural Resources and Environment Minister (NRE), Datuk Seri Azmi Khalid, claimed that the failure of the 15 y old "Love Our River" campaign was attributed to the public for being too busy to love the riverbanks' landscape beauty (The Star Online, 2007). While the Chairperson of the Environment and Traffic Management Committee, Datuk Dr Teng Hock Nan, lamented that the pollution of Pinang River was mainly caused by the public perpetuating filthy drains and rivers (Chan, 2005).

Although there were drawbacks in some campaigns, there were other river restoration programme that was well responded by the public and successful, e.g. the Pinang River and Ara River Conservation Restoration Programme (Chan et al., 2003). The success factor was contributed from the positive public response and involvement of non-governmental organisation (NGOs) in all levels of river management between the government and public (Parish, 2003).

Malaysia still lacks of local examples and studies to identify the success and effectiveness of public participation on river conservation issues (Chun et al., 2012). Various failure factors of the programmes were largely attributed to the lack of enforcement and understanding of the issues at grass root level by river pollution management agencies (Chun et al., 2012); unavailability of skilled personnel in facilitating the programme (Chan, 2005) for example expertise in water and waste management and poor knowledge regarding the causes of environmental issues (Mat Said et al., 2003). Hence, it is unjust to solely blame the public for the cause of river pollution and the failure of implemented projects and programmes. The success of river restoration and rehabilitation projects can only be ensured with the combined effort between the government, NGOs and local communities (Chan et al., 2003).

### 2.2 Japan

According to the Infrastructure Development Institute (IDI) and River Association (RA), a multi-nature river environment involved restoration and preservation of a diversified environment, securing sustainable environment, restoration and preservation of river habitats and their living environment, safeguarding the

water cycle as well as gaining the support and understanding of the community. In river preservation, river environment are firstly surveyed and studied then habitats and growth of natural life in rivers and dams are monitored regularly to understand rivers from an ecological viewpoint on how river improvements could be done (2006). It is equally important to understand the environment which aids in the conservation of a favourable natural environment e.g. stagnation and shaded areas by plants provided habitats for fishes. Besides, the creation of a multifaceted nature in rivers to maintain a liveable, nurturing and breeding environment for living organisms and diverse river scenery with consideration for the lifestyles of people in the region (MLIT, 2007). For example, in 1990, the River Bureau launched the “Ta Shizen Gata Kawa Zukuri” or “Nature-Oriented River Works” initiative (Nakamura, 2008) aimed to conserve and restore river corridors and their rich biodiversity that was enforced in 1997 was later amended as the River Law (Wada, 2008).

The success of Japan in river restoration efforts was made possible with the joint implementation of community projects by river administrators and municipal in creating rivers with natural settings (IDI & RA, 2006) and implementing programmes that focused on creating positive and relaxing atmosphere along river for recreation (MLIT, 2007). For example, the Ono River was restored in harmony with the historical townscape that used to be a prosperous traffic hub of the Tone River transport system (MLIT, 2007). Further, Japan emphasizes heavily on environmental education awareness (Law No. 130, 2003), that are provided through the Children’s Waterfront Rediscovery Project (MLIT, 2007), a coordination effort between the Ministry of Land, Infrastructure, Transport and Tourism (MLIT), the Ministry of Education, Culture, Sports, Science and Technology and the Ministry of Environment. The aims are to motivate society to learn from rivers and to promote the usage of rivers as children’s playground or as fields to experience nature-oriented activities. Additionally, awareness to strengthen river related activities, developments of leaders on river issues and creating opportunities to experience nature activities and environmental education (MLIT, 2007) via trained instructors (MOE, 2012).

To achieve an open river administration and enable two-way communication between relevant governmental agencies, NGOs and the community, Japan generated a river information system. The system discloses information on river water quality, water levels, flows, rainfall and ecosystem, information on public work as an innovative information sharing mechanism via the Internet (IDI & RA, 2006). With the reliance of this river information, it aid in publicising and to raise awareness to the community regarding the water environment health level (Tani, 2010). A proven success project adopted this river information system was the Ara River Community Net whereby the information network helped in building ties between companies, academic institutions, government agencies and the community (IDI & RA, 2006).

### 3. Research methodology

A random sampling of survey questionnaire was generated and disseminated to 300 respondents residing within Klang Valley, Malaysia. The target respondents were categorised into age groups with equal distribution of gender group to gain diverse opinions on river restoration improvement areas. The survey questionnaire aimed to (1) investigate the underlying causes of urban river pollution, (2) public’s attitude, awareness, and knowledge and (3) the recommended methods to improve community participation in river restoration programmes. A Cronbach’s Alpha coefficient of 0.748 was obtained, to validate the survey questionnaire reliability in the pilot test prior to its distribution and results were analysed using statistical software.

### 4. Results

The findings from the survey questionnaire shows that the connection between the community and river are diminishing for the past 30 y as the country continue its development. This was evident from the data collected with majority of 81.7 % are unaware of the rivers flowing in Klang Valley while only 60 % have previously physically been engaged with river oriented activities. Although businesses and social activities in the past had been closely related with the natural environment especially rivers, it does not apply to today’s urban community whereby social activities are more evolved with technological devices and shopping malls.

In view of river pollution level, 32.5 % perceived Klang Valley’s rivers as very polluted, while 51.7 % view as polluted. These results shows the responses are highly influenced by word of mouth and mass media rather than individual opinion and experiences. As such, only 68.7 % in all cases are interested to conduct their leisure activities involving rivers in Klang Valley. However, as majority of rivers in Klang Valley are constructed as straight rivers with concrete river bank, it had been perceived as drainage channels; resulting, river environment losing its bountiful living habitat and organisms.

There was also a strong relation identified between the responses for river turbidity and state. In the public's perception (91.2 %), polluted rivers are closely associated with muddy brown colour (high turbidity) whilst 97.7 % identified polluted rivers as muddy brown.

A majority of 80.7 % are unaware of the vital roles of rivers, while only 41.3 % recognise rivers as the main drinking source for the country. In the respondents' view, the top 3 major roles of rivers in Klang Valley are as habitat for living organisms (75.3 %), recreational activities (65 %) and drainage services (63.3 %). Based on the collected data, it shows that although public regards the essentiality of river, it does not impact their lives leading to poor public participation in river related projects. This was evident, as data shows only 15.7 % had participated in river restoration projects although 47.3 % are aware of river campaigns organised.

In terms of effort participation, 74.7 % agreed that river restoration projects are the government's responsibility while 52 % believed it's the NGO's effort. A majority of 72 % perceived that the community holds no responsibility in the execution of river restoration projects, but 86.3 % agreed that the success of river restoration projects should incorporate public opinions through the adoption of bottom-up approach (Philibert, 2008). With that, 59.7 % had responded positively their interest to participate in future river restoration efforts.

Although many initiatives in the past years to curb river pollution had improved the WQI for Klang Valley rivers, transiting from Class IV to II (Table 1); yet an account of 85.3 % still perceived river restoration projects in the nation as unsuccessful. The challenge in shifting public perception would be a major task for the government, thus instilling environmental education in the education system would be an initial step. Additionally, the use of social media today as communication platform would generate greater awareness on river information especially from various generation groups. For example, results shows that 82 % uses the Internet or social media to share their views on daily basis as compared to the older generation.

## 5. Discussion and recommendation

Although river issues in Malaysia are well documented in the National Policy on the Environment 2002 and the National Water Resource Policy 2012, it should be further improved by encouraging corporations, research academicians and NGOs in the river rehabilitation efforts. The NGOs comprises of individuals from different expertise areas (Chan et.al, 2002) could bridge the communication of information between all stakeholders. For example, academic researches containing scientific jargons are not comprehensible by laymen. Thus, with the presence of the NGOs, information is disseminated effectively to the level of respective stakeholders. Further, NGOs also play a vital role in anticipating public's negative view towards government initiative in river restorations and to obtain funding and support from corporations. For example, the Corporate Social Responsibility (CSR) policy such as W.A.T.E.R project funded by GEC-GAB Foundation (GEC, 2014b) and the Sungai Pinang River Care Programme funded by GEC-HSBC Malaysia (GEC, 2014a) are river restoration efforts funded by corporations in Malaysia.

The academic researchers play a prominent role by examining the living organisms, habitats and the surrounding environment for better river preservation. With this knowledge, it would aid in identifying new desirable solutions to mitigate river pollution issues e.g. new technologies in designing river profiles to aid river water aeration and development of an economic model for river sustainability.

At present, the only water information system available in Malaysia is known as InfoBanjir (DID, 2005) that provides real-time flood information. As such, the system need to be enhance to incorporate more real time river quality information e.g. river conditions, current restoration programmes, river pollution levels, progress of restoration works, river pollution source mapping from nearby industries and etc. An information platform of such will help to create more awareness, thus encouraging public and other stakeholders support and participation in river restoration effort initiated by the government.

Based on the findings from this study, polluted rivers is a norm for the urban Malaysia community. This is especially evident in the younger generation as they lack the exposure to natural rivers which are not found in the urbanized residential areas. Besides that, river projects in the past uses only a top-down approach (Chan,2005), whereby goals and actions are determined by the top management rather than driven by the public's needs and view known as bottom-up approach (Philibert, 2008). With the lack of transparency in the current top-down approach (Chan, 2005), the government need to allow community to take ownership and shares in the planning and sustainability of river conservation effort by adopting a bottom-up approach (Asmar et.al, 2012). The adoption of this approach would be a step to shift the mindset and enhance public's knowledge and engagement in river restoration programmes initiated by the government. Additionally, the nature-oriented approach that was successfully conducted by the Japan government should be adopted.

The focus of this approach is to restore the river's natural physical appearance and rich biodiversity by creating natural habitats and diverse rivers capes (Law No.130, 2003) to educate and promote the public on the usage of rivers for nature oriented activities.

The failure of river restoration programmes in Malaysia as indicated in the data gathered are mainly due to the poor participation and willingness from the public to be involved in the river restoration projects and campaigns. The reason lies in the lack of environmental education in Malaysian mind-set and its education system (Rajaratenam, 2012) that are heavily exam-oriented with less emphasis on learning the application of knowledge (Lahur, 2004). As a result, Malaysians are less critical and unaware of their surrounding nature and environment. Hence, Hungerford and Volk (1990) suggest the adoption of three pillars for environmental education and in future river campaigns namely, pillar of awareness, knowledge and skills that will induce responsible citizen behaviour. Awareness concerns the understanding and sensitivity to the environment and its allied problems, while knowledge encompasses the knowing of available choice of action together with its effectiveness and lastly skill that helps in identifying and solving environmental issues. Currently, the negative impacts on rivers due to human behaviour are immense. Therefore, rather than significantly increasing funding and resources for enforcement, tackling the root cause to gradually reduce the magnitude of the negative impacts is a more sensible solution. These would be further explored in the future.

## 6. Conclusions

The effort to ensure success in river restoration programmes will requires the collective effort of all stakeholders to play their equal parts e.g. government authorities, NGOs and the community at large. Several critical factors had been identified from this study; namely the inadequacy of public awareness and knowledge in river related affairs which subsequently lead to the need to instil environmental education to change the mind-set of Malaysian community. Additionally, transparency of information system to provide real-time river water quality, current river works and the adoption of nature-oriented approach from the authorities would increase public engagement and positive perspectives in the river restoration efforts. Sustainability of water source is essential in the nation's development. Hence, without the support and participation from the public, enforcement of policies and laws will be ineffective and inefficient by all means. The future work of this study will involve sampling larger population that incorporate in-depth perspectives from government, NGOs and related research bodies to identify the key parameters for implementation of nature-oriented approach in Malaysia.

## References

- Abdullah, K., 2002, Integrated River Basin Management, Universiti Sains Malaysia Press, Kuala Lumpur, Malaysia, 3-14.
- Asmar, J.P., Ebohon, J.O., Taki, A., 2012, Bottom-up Approach to Sustainable Urban Development in Lebanon: The Case of Zouk Mosbeh, *Sustainable Cities and Society*, 2(1), 37-44.
- Chan, N.W., 2005, Sustainable Management of Rivers in Malaysia: Involving All Stakeholders, *International Journal of River Basin Management*, 3(3), 147-162.
- Chan, N.W., Abdullah, A.L., Ibrahim, A.L., Ghazali, S., 2003, River Pollution and Restoration towards Sustainable Water Resources Management in Malaysia, National Seminar on Society, Space and Environment in a Globalised World: Prospects & Challenges, Penang, Malaysia, 208-219.
- Chan, N.W., Ibrahim, A.L., Hajar, A.R., 2002, The Role of Non-governmental Organizations in Water Resources Management in Malaysia, Proceedings of the Regional Symposium on Environment and Natural Resources, Kuala Lumpur, Malaysia, 68-79.
- Chun, M.H., Sulaiman, W. N. A., Abu Samah, M.A., 2012, A Case Study on Public Participation for the Conservation of a Tropical Urban River, *Polish Journal of Environmental Studies*, 21(4), 821-829.
- Department of Irrigation and Drainage (DID), Malaysia, 2013, Love Our River Campaign <[www.water.gov.my/component/content/article/19-river-management/413-love-our-river-campaign?lang=en](http://www.water.gov.my/component/content/article/19-river-management/413-love-our-river-campaign?lang=en)> accessed 23.10.2013.
- Department of Irrigation and Drainage, (DID), Malaysia, 2005, InfoBanjir <[infobanjir.water.gov.my](http://infobanjir.water.gov.my)> accessed 23.03.2014.
- Fulazzaky, M. A., Teng, W.S., Mohd Masirin, M. I., 2010, Assessment of Water Quality Status for the Selangor River in Malaysia, *Water, Air & Soil Pollution*, 205(4), 64-77.
- Global Environment Centre (GEC), 2014a, Sungai Pinang River Care Programme <[www.riverranger.my/index.cfm?&menuid=74&parentid=73](http://www.riverranger.my/index.cfm?&menuid=74&parentid=73)> accessed 24.03.2014.
- Global Environment Centre (GEC), 2014b, W.A.T.E.R Project <[www.waterproject.net.my/index.cfm](http://www.waterproject.net.my/index.cfm)>

- &menuid=2> accessed 24.03.2014.
- Hashim, R., Amran, M.A., Yusoff, M., Siarap, K., Mohamed, H.A., and Wong, C.J., 2012, The Environment Non-Governmental Organisations (ENGOS) in Malaysia Northern Region: Their Roles in Protecting Water Resources, *International NGO Journal*, 5(7), 167-170.
- Hungerford, H.R. and Volk, T.L., 1990, Changing Learner Behavior through Environmental Education, *Journal of Environmental Education*, 21(3), 8-22.
- Infrastructure Development Institute (IDI) & River Association (RA), 2006, *Rivers in Japan*, 1-78.
- Lahur, A.M., 2004, Plagiarism among Asian Students at an Australian University Offshore Campus: Is it a Cultural Issue? A Pilot Study, *Proceedings of the HERDSA Conference*, Sarawak, Malaysia.
- Law for Enhancing Motivation on Environmental Conservation and Promoting of Environmental Education, 2003, (Law No. 130). Japan.
- Mamun, A.A., and Zainudin, Z., 2013, Sustainable River Water Quality Management in Malaysia, *IJUE Engineering Journal*, 14(1), 29-42.
- Mat Said, A., Ahmadun, F.R., Paim L.H., and Masud, J., 2003, Environmental Concerns, Knowledge and Practices Gap Among Malaysian Teachers, *International Journal of Sustainability in Higher Education*, 4(4), 305-313.
- Ministry of Natural Resources and Environment (NRE), 2012, *National Water Resources Policy (NWRP)*, Malaysia.
- Ministry of the Environment (MOE), 2012, *The National Biodiversity Strategy in Japan 2012-2020*, Japan.
- Mohamed, M., 2008, Water Quality Models in River Management, 1<sup>st</sup> Technical Meeting of Muslim Water Researchers Cooperation (MUWAREC) Proceedings, 14-26.
- Nakamura K., 2008, River Restoration Efforts in Japan: Overview and Perspective, *The 4<sup>th</sup> International Workshop on River Environment*, Korea, 1-26.
- Parish, F., 2003, A Review of River Restoration Experience in East Asia, *East Asia Regional Seminar on River Restoration*, Kuala Lumpur, Malaysia.
- Philibert, I., 2008, Involving Residents in Quality Improvement: Contrasting "Top-down" and "Bottom-up" Approach in the Accreditation Council for Graduate Medical Education and Institute for Healthcare Improvement 90-Day Project.
- Prime Minister's Department (PMO), 2011, *10th Malaysia Plan (2011-2015)*, Malaysia.
- Rajaratnam, M. R., 2012, Exam-Oriented System: Evaluate Students on All their Abilities; *New Straits Times*, 11 March, <[www2.nst.com.my/opinion/letters-to-the-editor/exam-oriented-system-evaluate-students-on-all-their-abilities-1.58757](http://www2.nst.com.my/opinion/letters-to-the-editor/exam-oriented-system-evaluate-students-on-all-their-abilities-1.58757)> accessed 20.03.2014.
- River Bureau, Ministry of Land, Infrastructure, Transport and Tourism (MLIT), 2007, *River Administration in Japan*.
- Shamsuddin, S., Abdul Latip, N.S. and Sulaiman, A.B., 2008, Waterfront Regeneration as a Sustainable Approach to City Development in Malaysia. *Ecology on the Environment*, 117, 45-54.
- Tan, C.L., 2013, Saving Sungai Klang, *The Star Online*, 26 May <[www.thestar.com.my/Lifestyle/Features/2012/05/29/Saving-Sungai-Klang.aspx](http://www.thestar.com.my/Lifestyle/Features/2012/05/29/Saving-Sungai-Klang.aspx)> accessed 24.10. 2013.
- Tani, M., 2010, Japan's Environmental Policy <[www.rieti.go.jp/en/special/policy-update/039.html?stylesheet=print](http://www.rieti.go.jp/en/special/policy-update/039.html?stylesheet=print)> accessed 26.11.2013.
- Wada, A., 2008, River Restoration in Asia and Connection between IWRM and River Restoration, *Foundation for Riverfront Improvement and Restoration*, Japan.