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Research paper

Recognition of Local Authority for Better Management of Drinking Water at the Langat River Basin, Malaysia

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Abstract

Integrated Langat River Basin Management lacks appropriate leadership of appropriate agency due to the conflict among jurisdictions since Langat River drains through three different constituency. Meanwhile, pollution of the river and frequent shutdown incidents of water treatment plants in the basin are evident due to both point and non-point sources of pollutions. Moreover, the statistically significant trend of annual rainfall (2005-2016) and temperature (2005-2016) in the basin clearly indicates the impact of climate change because of uncertain rainfall and temperature patterns. Flood incidents (2004-2016) within the basin in comparison with the rainfall and temperature also indicate short duration heavy rainfall at local level to enhance the pollution of the river. Contrary, the review of literature and informal interviews with the public, private and civil sectors highlight the attitude problem of the stakeholders along lack of leadership of LUAS in managing the river and drinking water in the basin. Therefore, the 'proactive' leadership of Local Authority under the Local Government Act 1976 could be successful to coordinate with stakeholders through multi stakeholders' platform and several stages of quality control and quality assurance to manage water resources. The study suggests a new Langat Basin Management Authority under the Local Authority leadership as well as a Two-Layer water filtration technology in basin management. Henceforth, implementing the recommendations will facilitate Malaysia to achieve SDGs 2030 and National Transformation 2050 within the stipulated timeframe.

Keywords: *Proactive, Leadership, Partnership, Commitment, Integrated.*

1. Introduction

The man-made and natural incidents are evident in polluting the Langat river and its branches that resulted in shutting down of water treatment plants in the Langat Basin [1]. The pollution of Langat River by the unregulated industrial effluent is due to the lack of enforcement of policies. Moreover, the government has decided to review the policies such as the Environment Act 1974, the Selangor Water Management Authority Enactment 1999 and the Water Services Industry Act 2006 to impose higher penalty to the polluters [1]. For instance, the cross broader river pollution (e.g. Langat River) is one of the burning examples of lack of enforcement of polices due to absence of similar kind of state agency in Kuantan and Negeri Sembilan like the state agency 'Selangor Water Management Authority' (LUAS) in Selangor. In addition, the recent several shutdown incidents of Sg. Langat and Cheras Mile 11 water treatment plants (WTPs) in September-October 2016 was due to the odour pollution in Semantan river, Pahang which was channelling in Serai river of Selangor [2]. Moreover, all the WTPs in the Langat Basin follow the conventional method that is unable to treat the raw water when the chemical concentration as well as turbidity increases. Water is very important not only for the economic development but also for the human wellbeing [3, 4]. Therefore, Malaysia need adequate safe water for the sustainable development by 2030 as well as for the national transformation by 2050. Hence knowledge sharing with the exemplary cities/countries is very important for the sustainable water management. Therefore, the United Nations has also recommended integrated and holistic approaches of water resource management through the multi stakeholders' platform [3]. Thus, the government has decided to review standard operating procedures (SOP) for the treatment plants to include the investigation of odour pollution of raw water to help in taking decision of shutting down of the plants [5]. The government has also taken the initiative to form the task force comprising of Department of Environment (DOE) of Federal government as well as the Selangor Water Management Authority (LUAS), Kumpulan Air Selangor and the relevant municipalities of Selangor state government. The similar task force will also be formed in all the states of Malaysia in line with the Federal Government's National Blue Ocean Strategy (NBOS). However, the coordination among the institutes or stakeholders are still inadequate along with the lack of leadership of individual selves [6, 7]. Moreover, the empower of a river basin organization (RBO) depends on the mandate (geographic coverage and tasks), authority (formal and informal) and capacity (resources and financing). However, the success of RBO relies on the interconnection between and among the RBOs' performance, stakeholders' relations, leaderships and political supports [8]. Since Local Government is the lowest administrative unit of the state government at local level and it has the mandate to enforce river management through Local Government Act 1976, so the leadership of Local Authority will be effective in managing river and drinking water at Langat River Basin, Malaysia.

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2. Method

Review of literature and policies along informal interview with the key personnel of GO-NGOs, private and community sector helped to find out the gaps as well as possible solution approaches in drinking water management at the Langat River Basin, Malaysia. Informal interviews were also conducted with the water treatment plant (WTP) authorities in the Langat River Basin to get the information related to operation of WTPs along some technological solutions for safe drinking water.

3. Langat River Basin and Pollution Incidents

There are about 2,986 river basins in Malaysia, however, only 189 river basins are considered important basin in Malaysia based on the area (>80 km2) of the basin [9]. Since Langat river basin is situated at the fastest developing area in Malaysia and it covers about 2,350 km2 along its course of about 200 km, so the integrated Langat river basin management is a challenge to change the UNESCO HELP status (UNESCO 2010) to achieve UNESCO demonstration site. Langat river is unique in characteristic since it drains through three different constituency and the basin shares Selangor State (78.14%), Negeri Sembilan State (19.64%) and the Federal Territories of Kuala Lumpur (0.33%) and Putrajaya (1.90%) [10]. The major tributaries of Langat River are the Semenyih, Beranang and Labu river, however, there are about 40 smaller tributaries of Langat [11]. The total populations at Langat River Basin were 1,184,917 in 2000 with the growth rate of 7.64% (Elfithri 2016), however, the populations in the basin increased to 4,065,023 during 2013 [12]. Langat River is one of the prime drinking water sources for the basin and it provides drinking water to the half of the population in Selangor State, Malaysia [13]. For instance, it supplies drinking water to the VVIP (very-very important) area of Putrajaya where the Prime Ministers' Office is located. Apart from drinking water sources, Langat basin is vital for the presence of new township of Putrajaya, the Multimedia Super Corridor for the information technology industry, the paperless electronic village and township i.e. Cyberjaya, the Kuala Lumpur International Airport (KLIA), the Formula One Grand Prix Circuit at Sepang, several institutes of higher learning including universities, etc. [14, 15].

Unfortunately, the land use pattern has changed a lot in the Langat Basin due to this fastest development activities. The developed area within the basin has increased to 23.5% in 2013 compared to 2.4% in 1974 [14]. Hence both the forest and agricultural areas have decreased a bit in 2013 compare to the year 1974, while the mangroves and peat swamp area has drastically decreased to 9.4% in 2013 than 25.7% in 1974. Therefore, the availability of the water in Langat has been hampered along with the loss of ecosystem. Moreover, the rapid development activities have also increased the biological and chemical pollution of the river which need to be treated before drinking.

LUAS [11] has identified the location of point sources of pollution in the Langat River Basin, Malaysia (Figure 1). There are several industrial zones within the basin along Nilai industrial zone in the State of Negeri Sembilan. Hence, the discharge of the unregulated effluent in the environment is a real treat to the pollution of the world due to the lack of implementation of Environmental Quality Act 1974 along with its amendment through Environmental Quality (Industrial Effluent) Regulations 2009 [13].



Fig: 1: Location of Point Sources of Pollution at Langat River Basin Malaysia (modified from LUAS, 2013)

DOE [10] has also reported that the food services establishment 79% is the main polluter of Langat River along with sewage discharges 10.80% in 2013. Although industrial discharges reduced to 9.09% in the Langat River in 2013 compared to 84.09% in 2002 [16], it is still a potential source of chemical pollution in the river along with the additives from the food services establishment. Although sand mining/quarry is responsible of only 0.24% pollution in Langat River [10], however, there are total 86 extraction sites of sand and gravel among 198 extraction sites in the Sate Selangor (81) and Negeri Sembilan (5) were the highest in the Langat River Basin [17]. Similarly, the time series water quality data (2005 to 2014) such as Arsenic (As), Cadmium (Cd), Chromium (Cr) and Lead (Pb) from the Department of Environment Malaysia were collected due to its toxic characteristics in aquatic environment [18].

4. Shutdown Incidents of Water Treatment Plants

Total 9 water treatment plants (WTPs) are based on the raw water of Langat River [19], and these WTPs supply treated water in the Selangor, Kuala Lumpur and Putrajaya. However, these WTPs had to remain closed several times (major shutdowns >19 times) during 2006-2016 mainly because of the chemical pollution in river as well as flood incidents. For instance, Sungai Semenyih WTP had to shut down 5 times in 2016 because of odour pollution from the Nilai and Semenyih industrial areas [1, 20, 21]. Contrary, flood also contributed to several shutdowns of Sungai Langat WTP due to high turbidity in 2012 and the basin especially Kuala Lumpur area suffered in terms of potable water supply Moreover, the WTPs were unable to treat raw water when there was increased mudflow/turbidity in the river during floods because of much runoff resulted from heavy rain [22]. In contrast, the WTPs were also unable to treat the raw water when there were drought situations because of higher concentration of chemical in the water [23].

5. Issues of Poor Management: Policy and Institute

Department of Drainage and Irrigation (DID) is the leading government agency in river basin management of Malaysia, however, this agency is not back by any law through the Federal Constitution rather it was established as a technical agency to support Federal government [23]. Moreover, Selangor being the Federated State, DID officials are more liable to Federal government than the State government because they are paid by Federal government. As constitutionally river is the property of State government, so State also does not pay any amount to Federal government for the management of river. Apart from policies, for river pollution monitoring, DID also depends on Department of Environment (DOE) and lacks in local level enforcement e.g. encroachment of river bank. On the other hand, Selangor Water Management Authority (LUAS) is the state agency of Selangor government and owner of the rivers in Selangor through Selangor Waters Management Authority Enactment 1999, but it can't negotiate with different constituency of Putrajaya and Negeri Sembilan in terms of Langat river management. However, a few amendments in the constituency has put forward the issue of transboundary river management.

- River was fully owned by the State government by the Federal Constitution (9th Schedule; Article 74, 77; List II- State List; Item 6), but through amendment in 2006, Federal government gained power to manage river (9th Schedule; Article 74, 77; List III- Concurrent List; Item 8- Drainage & Irrigation) as well as water supply and services (9th Schedule; Article 74, 77; List III- Concurrent List; Item 9D) (GOM 2016) [25].
- Hence, Federal government can establish a separate 'Langat Basin Management Authority (LBMA)' through the 9th Schedule; Article 74, 77; List I- Federal List; Item 11; like the Murray-Darling River Authority (2007) in Australia [24].
- Local Government Act 1976 (Part VIII; Section 70) from the Federal Constitution (9th Schedule; Article 74, 77; List II- State List; Item 4) gives the enforcement power to the Local Authority (LA) to manage the river along controlling the pollution [26].
- LA has the power to impose a fine to the convicted not exceeding 5,000 RM or a term of imprisonment not exceeding 2 years or with both [26].
- LA can also fine the convicted not exceeding 500 RM for each day during which the offence is continued after conviction [26].

Moreover, the stakeholders as well as the individual selves are waiting for someone else to solve the problems. This paternalistic view of the individual selves also obstructs to recognize the appropriate stakeholders/institutes to manage the Langat River Basin. Furthermore, the different political interests between Federal and States government might also be a great problem in the implementation of policies.

6. Initiatives to Improve River Water Quality

Plantation is a good initiative to reduce the landslide incidents in the Langat River Basin. Less landslides incidents will be attributed to less pollution in Langat through less runoff. Moreover, the plantation will also combat the climate change i.e. short duration heavy rainfall, so there will be less flash floods. Less flush floods will reduce the urban and agricultural runoff in the Langat River. Dredging of the river and canals are also required for the navigability of the river along with the cleaning of urban/rural drains to reduce the intensity of flood impacts. Although sand mining is very important for the development activities, however, it should be controlled due to its release of trace metals and radionuclides in the water. For instance, in Selangor, there are more than 30 illegal sand mining sites mainly in Hulu Selangor, Sepang, and Kuala Langat districts in the last 20 years, while the government has given permits to only 46 sites for sand mining in private lands [27]. In the Langat, Lui, and Semenyih River Sub Basins, the mining area is about 3.28, 10.55, and 4.63 km^2, respectively, and the trend of mining areas is increasing [28]. Similarly, managing the waste of food services establishment within the Langat River Basin is an emerging challenge, since in 2013 Department of Environment has reported that 79% pollution of Langat River is from these food services establishments [10].

7. Constructed Wetlands

Constructed Wetlands in Langat River Basin would be very effective to reduce water pollution from effluent discharges by the industries. Putrajaya Lake within the Langat basin is one of the 32 Ecohydrology Demonstration Sites of UNESCO-IHP Ecohydrology Program (EHP) globally since 2010 and has been classified as an Operational Demo Site. It's the 1st man-made wetlands in Malaysia and the largest freshwater wetlands in the tropics (600 hectars) [29]. Institute for Environment and Development (LESTARI), Universiti Kebangsaan Malaysia (UKM) is involved in the management of the lake through the Integrated Langat River Basin management.

8. HORAS

Hybrid Off River Augmentation System (HORAS) project was agreed to implemented by Selangor state government for the meet up of water demand during dry seasons. Construction of the HORAS ponds is to be implemented in stages (divided into 4 phases) where 5 ponds will be constructed. 1st HORAS project (HORAS 600) is currently under construction. When it will be completed, it can supply 600 million litres water per day (MLD). The 2nd HORAS project (HORAS 3000) will supply 3,000 million litres water per day (MLD) [30].

9. Effluent/Waste Water Treatment Plant

Storm water could be a valuable resource if it can be treated properly (Khan 2017). In this regard, the constructed wetlands could be useful for the storm water retention and purification. Similarly, the industrial effluent should be treated by the effluent treatment plants before discharging in the environment. Accordingly, storm water should be treated by the waste water treatment

plant (WWTP) and the storm water management should also consider the solid waste management due to its runoff to the waterbody. Hence there should be proper dumping sites for the solid waste dumping.

10. Better Langat Basin Management: Recognition of Local Authority

Local Authority (LA) should be recognized to lead and control other stakeholders. Leadership in both top-down and bottom-up approaches might solve the implementation problems, since LA is the lowest government administrative institute at local level. Engagement and participation of all stakeholders will contribute to enhance the leadership skill of LA and/or individuals. Moreover, education (i.e. formal, informal, non-formal) and culture will also prepare next generations in taking leadership as well as enhance innovation and creativity at the individual level.

11. River Basin Management: Implementation of Local Government Act 1976

Since the transboundary Langat River management is very difficult because of its drainage through three different jurisdictions, so the promotion and implementation of Local Government (LG) Act 1976 will be effective for the management of Langat River. Moreover, the LG Act 1976 will also recognize the Local Authority (LA) as the main entity for the river management and enable the LA to coordinate better among the institutes such as it can act as a mediator to coordination between Federal (Putrajaya and Kuala Lumpur) and Selangor State government, between Selangor State and Negeri Sembilan State Government. Thus better management of drinking water in the basin along with the river management is directly related to the willingness to participation of the stakeholders in the water resources management programs.

12. Better Basin Management: Partnership Approach of Local Authority

Recognition of Local Authority (LA) will enable them to implement effectively the Local Government (LG) Act 1976 as well as coordinate with various stakeholders. Local Authorities are given mandate to enforce river basin management as well as monitor of the whole management approaches at local level. Therefore, the pro-active and effective leadership of LA will enable them to establish partnership with public, private and civil sector. For instances, Selangor Water Management Authority (LUAS) is responsible for the Langat River Management but they are unable to negotiate with the Federal territories and Negeri Sembilan State in terms of Langat River management, whereas LA can negotiate with them.

13. Better Basin Management: Commitment Approach of Local Authority

Capacity and capability building of Local Authority and/or individuals will help policy makers to improve environmental and water resources management programs. Therefore, ensuring capacity and capability building of all the stakeholders in every institution from top to bottom could be committed to perform his/her duties and responsibilities through this new innovative and creative kind of key performance indicators (KPI). The indicators of this new KPI could be as follows e.g.:

- Have you got training?
- Have you shared information among your colleagues?
- Have you monitored the performance of individuals under your supervision, etc.?

Introduce of new key performance indicator (KPI) will enable individual to share information to the colleagues/peers/friends. Therefore, the implementation of new KPI will encourage the lowest rank officials to participate in the training programs to enhance their leadership skill. Moreover, the new innovative KPI will enable bosses/individuals to perform their responsibilities properly to maintain his/her KPI. This will ensure transformation of individual selves from passive to proactive in taking leadership. Pro-active approaches by the individual will enhance the capacity and capability at the individual level to get best efforts. Therefore, individual will be able to think beyond boundary and act out of box. Moreover, the commitment of the Local Authority (LA) to perform the duties and responsibilities for the management of Langat River Basin is very important. Lack of knowledge on the Local Government Act 1976 might have demotivated them to be pro-active. Hence, the information awareness raising activities (such as seminar, campaign, television, radio, internet including mobile phone applications can be used for advertisement of environmental management) will not only influences the LA but also all the stakeholders to be proactive in taking leadership to manage the Langat River Basin.

14. Control and Coordination of Drinking Water Management

Malaysia has already established Academy of Sciences Malaysia (ASM) to produce better policy and planning for water and other sectors. Similarly, Malaysian Industry-Government Group for High Technology (MIGHT) is a public-private partnership organization in providing a consensus building platform for collaboration in developing policies and strategic advice to the government. Malaysian Foresight Institute is also established for effective integration and implementation of policy and planning. Meanwhile, National Integrated Water Resources Management Plan (Volume I & II) by the ASM is an exemplary road map of the Malaysian water sector as it mainstream water resource in the national economic policy, food policy, environment policy, health policy and energy policy. However, the integration and implementation of these institutes and polices are not adequate might be due to the lack of leadership, innovation and creativity among the stakeholders.

15. Elements needed to be Pro-Active for the Local Authority

In Langat River Basin, the pro-active and effective leadership of Local Authority (LA) is an urgent requirement for the Integrated and Holistic Langat River Basin Management along with safe and available drinking water supply to the household level. To be pro-active four elements (i.e. mandate, finance, manpower and support) are required for the LA (Figure 2). Meanwhile, LA has the full mandate to manage both the river and drinking water at Langat Basin. There are also finance and manpower for the LA, but the finance is not adequate as well as there is lack of training of the lowest rank officials to enhance multitasking capability in taking leadership. Moreover, the inadequate support from the multi stakeholders are the major problems in Langat Basin to manage the river lead by LUAS. However, LA could be better in arranging multi stakeholders' platform as well as networking with public, private, civil sector in managing and monitoring the quality of raw and drinking water.

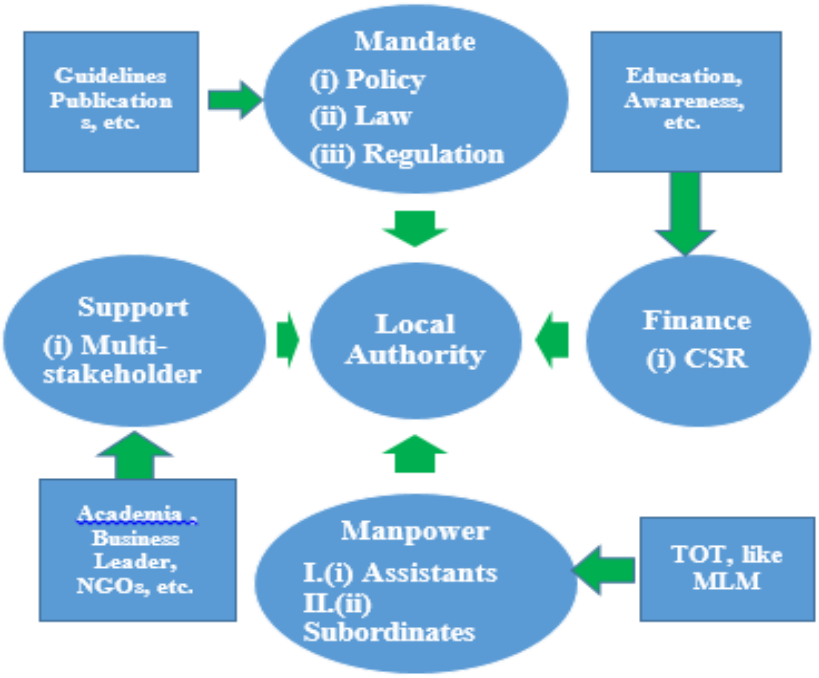


Fig. 2: Elements needed to be proactive for the Local Authority

16. Requirement of Data and Information

Quality data and information is very vital for the policy makers as well as researchers to produce better policies and modification of existing policies and guidelines. Hence, quality assurance (QA) and quality control (QC) of science, technology, engineering and mathematics (STEM) data as well as social science and humanities (SSH) data will help to produce better policy as well as updating existing policies through good database (Figure 3). Moreover, QA and QC at many levels will ensure precision and accuracy of data and information. Hence, individual will get the best authentic knowledge which will influence and inspire them to act good and to take leadership in doing good things through using their wisdom.

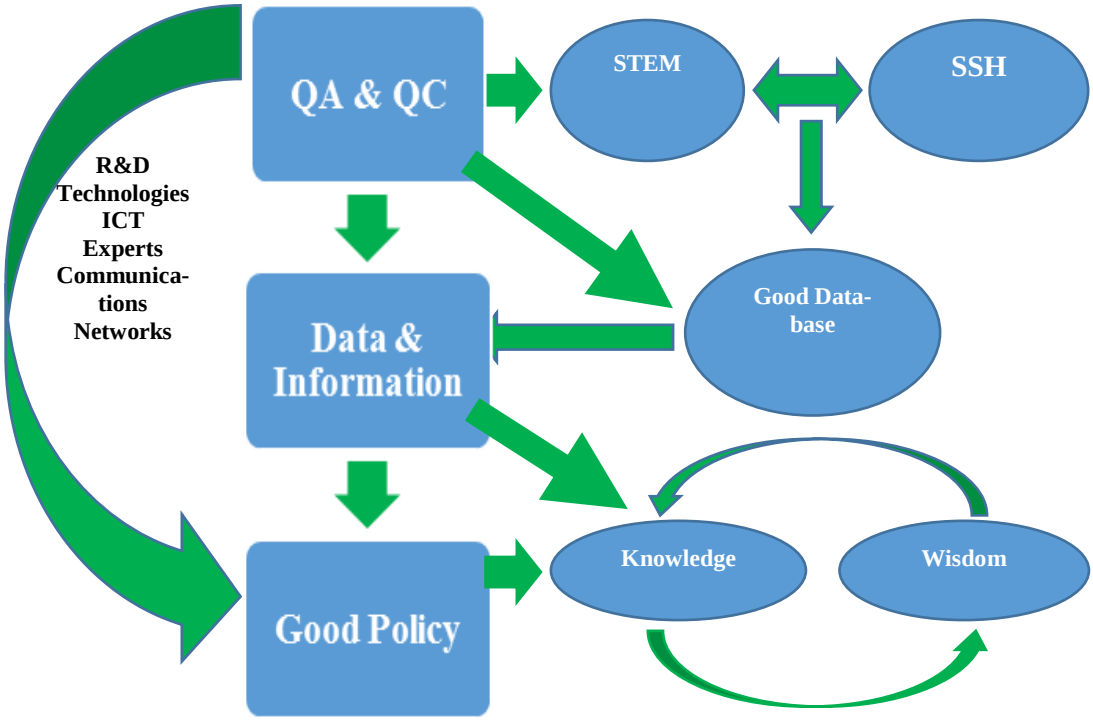


Fig 3: Data and information to produce good policy

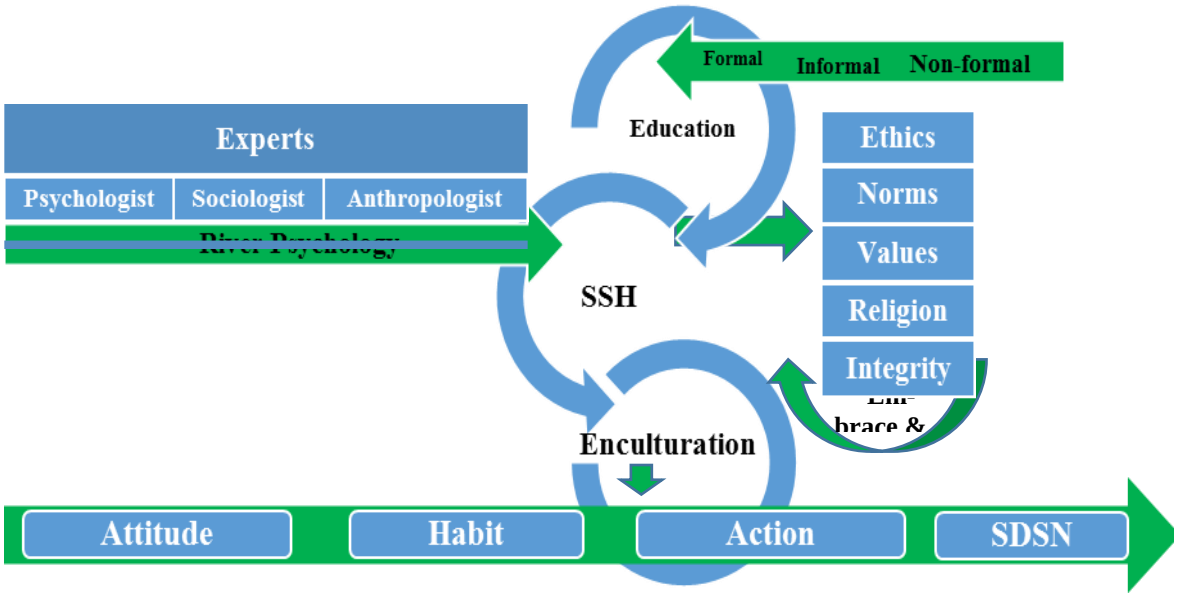


Fig 4: Changes in attitude will lead to sustainable development solution networks

17. River Stewardship through Multi-Stakeholder's Platform

The river stewardship through multi stakeholders' platform is a time demanding issue in Malaysia because of severe pollution of the rivers. Although the leadership of Local Authority (LA) is necessary for the management, however, without forming the multi-stakeholder platform and without bringing experts from different disciplines such as STEM (science, technology, engineering and mathematics) and SSH (social science and humanities) the management of the river as well as drinking water in Langat Basin will remain incomplete.

The proactive leadership of individual in managing the river is essential and to be remain active the paternalistic perspective (i.e. passive attitude and behavior) of individuals need to be changed. Therefore, psychologist must be present in the multi-stakeholders' platform to influence the human attitude positively (Figure 4). The enculturation at the individual selves will help to change attitude in management. Changing attitude will become habit and habit follows to actions. Moreover, changing attitude will transform the individual minds to be patience and tolerant, and habit of good actions will ensure good mental and physical health through integrated holistic approaches via sustainability science. Similarly, the required activities will help to recognize the nearest appropriate institute/individual for proper management. So, there will be adequate sustainable development solution network (SDSN). Moreover, the individual mind that pick-up changes in attitudes are brave and the individuals must be brave in taking leadership.

18. Conclusion and Recommendation

Recognition of Local Authority (LA) will ensure the better implementation of integrated river and drinking water management policies in Langat Basin. Since LA has the mandate to enforce river management, so the authority will also be able to take leadership, partnership and commitment to manage and monitor river and drinking water quality. Malaysian possesses 'Paternalistic' characteristic meaning from top to bottom everybody is waiting for someone else to perform the responsibilities, however, this paternalistic attitude can be changed through the pro-active leadership at individual selves. There should be adequate training and education under a new KPI to prepare individual to take leadership. In addition, a new Two-Layer supply water filtration technology could be introduced at household level since the contamination of supply water is obvious in between the water treatment plants (WTPs) and the households. Introduction of low-cost slow pond sand filtration at WTP instead of current conventional technology, as well as installation of carbon filter at the water supply pipeline before entering in the household and reverse osmosis filtration system at the kitchens' tap of the household maintained by the agency like water billing agency could ensure safe drinking water for all. Moreover, the cost-benefit analysis of the installation of Two-Layer supply water filtration instead of present conventional coagulation method could be a nations' interest of further study.

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