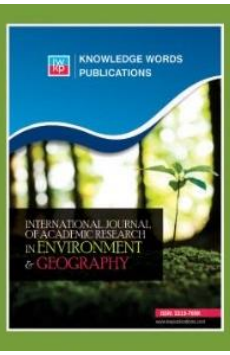

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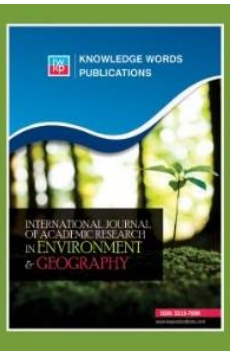
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Public Perception towards Environmental Awareness Case Study: Malacca River

Ang Kean Hua, Mohd Zuhdi Marsuki
University of Malaya, Kuala Lumpur, Malaysia Department of Science and Technology Studies
Email: angkeanhua@yahoo.com

Abstract
Water is an important resource for all living and non-living beings. However, there is a shortage of fresh water nowadays. This situation is related to various factors. One of these factors is water pollution. Water pollution occurs in Malacca state. Specifically, it affects the Malacca River. The main cause of water pollution is factories. If factories continue their activities, the environment will be harmed. Action is needed to stop this pollution before it destroys the environment. This research will explore the level of awareness of citizens in regards to water pollution. This research is divided into three parts. Part A analyzes the respondents' biodata. Part B investigates citizens' perceptions of river ecology. Part C describes citizens' perceptions of water pollution in the river. This study is a starting point meant to discover how great of a threat citizens view water pollution. Malaccan citizens have the right to voice their opinions regarding the water pollution. Their knowledge of the ecosystem showed that they still love the environment. They are embedded with moral and ethical values that dispose them towards caring about the environment. They know that they still have a responsibility to the environment. The people realized they can protect the environment from destruction. Malaccan citizens hope that by taking early steps, they can stop the polluting manufacturing activities.
Keywords: Water Pollution, Factories, Environment, Awareness, Destruction.

Introduction

Natural freshwater resources have diminished more and more (Jackson et al, 2001). This situation has led to world concern about water resources. Since lack of water is a limit to growth, many debates have been underway to generate ideas to sustain freshwater levels. Malaysia is one of the countries that are currently facing water issues. Although this problem is not immediately threatening, it may cause danger to human society in the long run. Malacca is one example of an area under threat of water shortage. Malacca is a state known as "The Historical State". Various developments were carried out by its state government. These developments included basic facilities that have helped local citizens in all aspects, such as the construction of factories which have provided employment opportunities for the people. Most factories are built

near the river in order to get access to a steady water source. Water is used to aid in the process of producing a new product. Eventually the end of the manufacturing process also produces waste fluid chemical which is poisonous. These waste chemicals cannot be recycled for any other purpose. Such chemicals should not be disposed of by dumping them into the river or planted to solve problems (Hizar, 2009). These actions have caused the environment to be contaminated; this contamination has spread to water, vegetation, soil, and the atmosphere. Destruction occurs when the environment starts to get harmed by human activities. An act stated by Allah s.w.t., says (Ismail, 2012);

"*Visible damage on land and sea because of what the hands of men, because God let them taste a part of (the consequences) of them, so they come back*." - Surah al-Rum, verse 41

According to Dr Hafizan Juahir, Head Department of Environmental Modeling, Research Centre For Environmental Forensics (ENFORCE) University Putra Malaysia, the water in our rivers is decreasing as a result of the land use activities that are too high, especially in residential areas. For example, he revealed that the length of Langat River, the main river between the rivers in Selangor and a source of raw water, is 149.3km. However, clean water only makes up 49.3 miles, while the remaining 100km is already polluted (Harian, 2012). He added that the Langat River is already at grade 3 or 4; if the water quality becomes worse than this, it will be considered a dead river. Before natural resources are destroyed, early steps are needed to prevent such harmful activities from happening. The purpose of this research is to explore the awareness of citizens of the negative changes in the environment. The case study for this research mainly concentrates on water pollution in the Malacca River.

Water is the main resource needed by citizens to carry out daily activities (Acreman, 1998). Water was a source for drinking, bathing, and cooking in the past. Water also became an important method of transportation and communication between peoples. The judgments showed that citizens are highly dependent on water to continue with their lives. However, with the passing of time rapid development became the priority in the state of Malacca. This rapid development caused people to forget their responsibilities toward the environment. Again, referring to Dr Hafizan Juahir, river conditions in the Hulu Langat district are now increasingly threatening as a result of too much development, especially condominiums, houses, and increasing population having a negative impact on the quality of water as a result of washing water, domestic waste, and rubbish in the river. So, the issue started to evolve when water in the river started to get polluted. The problem was felt when a group of fisherman could not manage to catch fish in the river (Nasbah, 2010). The main reason for this was that the fish was being poisoned to death (Johnson and Griffith, 1996). This situation gives an impression that rapid development leads to the destruction of important natural resources such as fresh water. As a result of water pollution, Malaccan citizens only depend on tap water to obtain water prepared by the state government and never have water resources taken from the river.

Materials and Methods

This research study is focused on public perception. The respondents involved are Malaccan citizens who were surveyed on the existing water pollution conditions in Malacca. This study involved about 200 respondents spread over the two regions that the Malaccan River spans. The two regions mentioned are the Alor Gajah and Central Malacca. The study area for two regions was a little bit different. Alor Gajah is an area for the upstream of Malacca River,

while Central Malacca is an area for the downstream of Malacca River. These two areas have a different population because Alor Gajah is a relatively rural area, while Central Malacca is an urban area. Therefore, most of the population will be concentrated at the Central Malacca for job opportunities. However, the total population of Malacca state consists of the total for three regions. As a result, the sample size needed to be re-calculated to obtain the correct sample. According to Krejcieand and Morgan, the population size studied can be calculated using a formula. The formula is stated as below:

Population Size Unknown

$$\text{Sample Size} = \frac{[(\text{Range} / 2)^2]}{[(\text{Accuracy Level} / \text{Confidence Level})^2]}$$

Range = (Total Population/3 Regions) X 2 Regions
Accuracy Level = Range X Desired Level of Accuracy (expressed as a proportion, 0.05)
Confidence Level: taking 0.05 level of confidence in calculation, so α will be 1.64)

This calculation gave an answer that 200 respondents was a suitable sample size. From the viewpoint of Muhamad Najid, it is suitable to have 200 respondents involved in a study. However, he added that a larger sample size is better, if possible, due to the increased accuracy of the results obtained from a larger sample size. So, the questionnaire will be separately distributed to two regions, which are 100 questionnaires at Alor Gajah and 100 questionnaires at Central Malacca.

The desired information was collected with questionnaires. The questionnaire was divided into several parts. Part A provided the information about respondent biodata. Part B asked about citizen perception of river ecology. Part C asked about citizen perception of water pollution in the river. The format for the questionnaire is in index form. The index included options of strongly disagree, disagree, normal, agree, and strongly agree. Each level corresponds to a certain value of percentage. Strongly disagree stands for 0% to 20%; disagree stands for 21% to 40%; normal stands for 41% to 60%; agree stands for 61% to 80%; and strongly agree stands for 81% to 100%.

Once the questionnaire was prepared, the survey distributed via questionnaires along the Malacca River. Citizens who live near the river provided accurate information when answering the questionnaires. After the questionnaires were completed, the data was keyed-in into the computer. The survey was stored in the computer as a softcopy. Computers helped to analyze the data. The computer also provided new information for making a decision in the research.

Results and Discussion

The information from part A shows the respondents' biodata. The number of male and female respondents was about even. The ages of the participations ranged from adolescent to adult. Most of the respondents were married. For this reason, the majority of respondents had lived in Malacca state for more than 20 years. Most of the Malaccan citizens surveyed were Muslims, Buddhism, Hinduism, and Christianity were the next most common religious affiliations. The education level item showed that the majority of respondents have a secondary level education. Most of the respondents have job in the private sector or are self-employed.

The results from ***part A*** are an important factor in influencing other parts of the questionnaire. The answers provided by the respondents will have connections with other parts. From a general point of view, the majority of respondents that were surveyed are educated. This gave them the opportunity to work in the private sector, for instance as factory workers. This situation results in the number of men being greater than the number of women in the factories, since the workers will stay there for a period of time. It is an opportunity for people to meet with other couples in Malacca state. The results showed that the majority of respondents are married and adult. Since they are already married, they will have already bought a house and lived in the area for a longer time. The experience and maturity of the respondents helped in the research study. This is because the information that the respondents provided was more true and accurate.

In part B, the information collected was more concerned with citizen perceptions of river ecology. The table shows that respondents had given their answers based on their experience and opinions. In their view, they are strongly agreed that water is the habitat of aquatic life. They know that polluted water in the river will affect the ecosystem. Respondents strongly agreed that evaporation of polluted water from the river is a cause of air pollution and bad odors. They also agreed that surface water runoff from acid rain will cause river water contamination. Moreover, the acidic surface water will cause contaminated groundwater. The respondents also agreed that water pollution can weaken the soil structure.

Part C provided respondent information that is connected with part B. Part C provided results about citizen perception of water pollution in the river. The table below shows that citizens rejected the statement that the Malacca River is clean. The water in the river cannot be of daily use to the citizen. Respondents strongly agree that industrial waste will cause the water to turn black in color, to become smelly, and to be contaminated. Respondents also strongly agree that polluted water causes disease and becomes a dirty habitat to animals. They realize that contaminated water can cause aquatic species to become extinct. Finally, they agree that water pollution can affect plant species.

Since respondents have lived in Malacca state for a long period of time, they have undergone many difficulties. Respondents realize that water is important for all living and non-living beings. They are aware that humans need water to continue living their lives. Allah s.w.t. says which means (Ismail, 2012):

"*He who made the earth unfold, the sky as a canopy for you, and He sends down rain from the sky, and producing fruits as food for you*." - Surah al-Baqarah, ayat22

In other words, it's important for human to thankful for water resources. Management or sustainability of water resources is very important to done wisely to avoid facing the problems associated with water. Even the aquatic animals need water as their habitat. The aquatic animals live in the water to find food and protection. It is a certainty that the animals need water (Smakhtin, 2003). In addition, animals such as fish also provide food for humans. Humans are one of the predators in the food chain. An interaction exists between humans, fish, algae, and water to create a natural ecosystem. This situation has created a complete balance in this world. However, development through land use, chemical construction, and natural demand can cause environmental destruction.

Table A – The respondents' biodata

Content	Frequency (F)	Percentage (%)
Sex : Man	104	52
Woman	96	48
Age : 21-30	50	25
31-40	95	47.5
41-50	51	25.5
51 & above	4	2
Status : Single	52	26
Married	147	73.5
Others	1	0.5
Number of Years Living in Malacca : 1 – 10 years	32	16
11 – 20 years	38	19
21 – 30 years	65	32.5
31 – 40 years	44	22
41 – 50 years	20	10
51 & above	1	0.5
Religion : Islam	101	50.5
Buddhist	50	25
Hindus	45	22.5
Christian	4	2
Education Level : Primary School	8	4
Secondary School	85	42.5
College	46	23
University	61	30.5
Employment : Government	28	14
Private	75	37.5
Self-employed	68	34
Retirees	1	0.5
Student	27	13.5
Others	1	0.5

Table B – The citizens' perception of river ecology

Content	Strongly Disagree		Disagree		Normal		Agree		Strongly Agree	
	F	%	F	%	F	%	F	%	F	%
1. Water is the habitat of aquatic life.	-	-	-	-	1	0.5	87	43.5	112	56
2. Polluted water in the river will affect the ecosystem.	-	-	-	-	8	4	59	29.5	133	66.5
3. Evaporation of polluted water from river will cause air pollution (bad odor).	-	-	1	0.5	4	2	54	27	141	70.5
4. Surface water runoff from acid rain will cause river water contamination.	-	-	1	0.5	41	20.5	116	58	42	21
5. Acidic surface water will cause contaminated groundwater.	-	-	1	0.5	27	13.5	118	59	54	27
6. River water pollution weakens soil structure and causes erosion and sedimentation of river basin.	1	0.5	1	0.5	35	17.5	103	51.5	60	30

*F – frequency; *% - percentage

Table C – The citizens' perception of water pollution in the river

Content	Strongly Disagree		Disagree		Normal		Agree		Strongly Agree	
	F	%	F	%	F	%	F	%	F	%
1. Malacca River is clean until it can be a source of daily use.	109	54.5	77	38.5	10	5	4	2	-	-
2. Industrial waste will cause the water in the river to become black, smelly, and contaminated.	-	-	-	-	7	3.5	81	40.5	112	56
3. Polluted water in river can cause disease, cause aquatic animals to die and become habitat to dirty animals.	-	-	-	-	4	2	86	43	110	55
4. Water pollution can cause the loss of soil nutrients and will affect the plant species.	-	-	2	1	41	20.5	98	49	59	29.5
5. Contaminated water can cause aquatic species to become extinct.	-	-	-	-	4	2	82	41	114	57

*F – frequency; *% - percentage

One example of such destruction in Malacca state is when factory construction causes water pollution (Petts, 1988) in the Malacca River. The main cause of water pollution is the chemical factories. The chemical factories produce waste chemicals when they generate a new product. Polychlorinated biphenyls (PCBs) are an example of the early products of the chlorine industry, which were to prove highly damaging to the environment (Jacobson & Jacobson, 1996).

According to the report, PCBs are non-flammable oily liquids or waxes which found use as hydraulic fluids, as additives to oils, in sealants, in electrical applications, and in paints. PCBs has proven difficult to untangle all of the toxic impacts, but many are suspected of promoting cancers, damaging the immune and reproductive systems, and interfering with hormone systems through endocrine disruption (Jacobson & Jacobson, 1996). PCBs are dangerous. Additional, the waste chemicals are dumped down the drain and let flow into the river (Figure 1). This continued action causes water pollution and eventually causes poisoning. Eventually the chemical waste turned the Malacca River black (Figure 2). It also produced a type of bad smell detectable as one gets close to the river. The water in the river became black, smelly, poisonous, and contaminated. For another example, consider the situation of Sungai Juru and Sungai Simpat Ampat, Penang. The river water found to be contaminated as a result of waste from residential area, manufacturing sector, agriculture and livestock flowing into the river. Therefore, the river water became black and foul-smelling (Harian, 2014).

When water pollution exists in a river, it has a high probability of killing the animals that use it as their habitat (Haslour, 1983). Eventually, this pollution will kill almost every animal living in the water. Agriculture activities have led to large increases in the levels of nitrogen and phosphorus in the environment (WWF). When in water, this overabundance of nutrients, in a process called eutrophication, can fuel the excessive growth of phytoplankton and algae, which can have devastating consequences. Harmful algal blooms can kill fish, marine mammals and seabirds and harm humans. If this situation continues, the contaminated water can cause aquatic species to become extinct. This because when the algae and other organisms that had been allowed to bloom because of the nutrient excess eventually die off, bacteria may suck up all the oxygen from the water as the algae decompose. This create a “dead zone” where fish cannot live (WWF). Moreover, the dead fish and polluted water can easily spread disease to human society. However, this may give dirty animals an advantage by providing them a chance to live in the river. Polluted water in the river will affect the natural ecosystem and destroy the food chain. This is the main reason that respondents give for strongly agreeing that water pollution may affect the ecosystem. In their opinion, if fish cannot live in the river, it is not possible for humans to use the water of the river either.

Figure 1. The picture shows the factory dumped waste chemicals into the drain and let them flow into the river
Picture taken on 01 August 2013, along the Malacca River

Figure 2. The picture shows the Malacca River, where the color of water in river has turned black due to the waste chemicals. It also produces a bad smell when one gets closer to the river
Picture taken on 01 August 2013, along the Malacca River

Malaccan citizens had experienced the way of life in Malacca state. They had explored and understood how to overcome bad situations when living close to the river. During the hot season, they need to face the bad smell produced by the river (Cees, 1974). The hot weather had evaporated the water in the river into gas. The gas was released into the air surrounding the river. This caused the Malaccan citizen to move to and stay in areas far from the river. However, this does not resolve the problem. When the gas is released into the air, this may cause the air to get polluted. According to the World Wild Life organization (WWF), when water in the atmosphere mixes with certain chemicals (particularly sulfur dioxide and nitrogen oxides emitted during the burning of fossil fuels), mild acidic are formed. So, this air pollution may mix up with moisture and cause even more pollution. When it rains, acidic water pours from the clouds and the rain is acid rain. Acid rain also weakens tress in forests and contributes to air pollution that can harm humans (WWF).

Acid rain drops onto the land and creates a water surface. The water on the land is acidic water. This surface water will flow from a higher area to a lower area. The surface water runoff will mix with existing water and cause contamination. This will increase the percentage of water pollution when the mixture flows into the river. This acid rain can leach toxic aluminum from the soil, which at low levels can stress fish in lakes and streams or, at higher concentrations, kill them outright (WWF). In addition, surface water runoff may absorb into ground to become groundwater. When acidic surface water is absorbed into the ground, it may also cause contamination. This situation can pose dangers to society because groundwater is a resource for people. Therefore, acid rain will aid in the pollution of the clean water.

The surface water runoff is easy to contaminate the clean water with and the acidic water can also affect the soil structure. Soil needs adequate sources of nutrients for plants to undergo the growth process. Pesticides and other chemicals used on crop plants have helped farmers increase their yields. However, scientists have found that overuse of some of these chemicals

changes soil composition and disrupt the balance of microorganisms in the soil (WWF). This stimulates the growth of harmful bacteria at the expense of beneficial types. Plus, the presence of acidic water will cause substantial changes to the structure of the soil due the ability of acidic water to destroy soil structure by changing the natural chemical composition of the soil. Broadly speaking, soil is the basis of wealth upon which all land-based life depends (Carter, 2003). Indirect damage to ecosystem is largely caused by changes in the soil chemistry. Increasing soil acidity through acid rain can affect microorganism which break down organic matter into nutrient form for plant to take up (Carter, 2003). When acid rain falls, it can affect forests because acid rain is absorbed into the soil making it virtually impossible for these trees to survive. As a result, trees are more susceptible to viruses, fungi, and insect pests. At the moment, acid rain moves through the soils, it can strip away vital plant nutrients through chemical reactions, thus posing a potential threat to future forest productivity. Moreover, the number of micro-organisms present in the soil also decreases as the soil acidifies, and this situation depletes nutrients available to plant life, as micro-organisms play an important role in releasing nutrients from decaying organic material (Carter, 2003). When this situation happens, plants find it difficult to carry out processes of growth and eventually die. If both the soil and the groundwater are acidic, plant species will be destroyed. The majority of the respondents are in agreement that water pollution can affect soil nutrients and can cause destruction to plant species.

Acidic water can cause natural disasters such as flash floods to occur. This is because of the changes in soil structure that are caused by acidic water. The main result of this situation that when plants has difficulty surviving, this will affect the soil structure because the root are unable to hold the soil and cause erosion. By the way, death plant can increase the probability of water surface runoff. For example, when the trees are unable to hold the soil and the raining fall is greater, this will increase the erosion potential because the impact of raindrops on the soil surface can break down soil aggregates and disperse the aggregate material (Ritter, 2012). The lighter aggregate material such as very fine sand, silt, clay, and organic matter are easily removed by the raindrop splash and runoff water; while greater raindrop energy or runoff amounts are required to move larger sand and gravel particles (Ritter, 2012). The water surface runoff will then flow into the river. Water surface runoff has the ability to transport the soil and together with the other material along the way into the stream. While traveling in the river, high water energy has a strong impact and erodes the river banks. This increases the chance of erosion. Other than acid rain, this will also increase the percentage of pollution in the river due to the erosion and other material transport. When energy transport has reached a maximum level, then transported material will be deposited in an area. This usually happens in the river downstream. The soil deposits in the river will decrease the depth of the river. This situation will increase the probability of flash floods due to sedimentation. Destruction of property is another consequence.

Conclusion

With the results and explanations provided above, respondents had displayed their knowledge of the polluted state of the Malacca River. Respondents strongly disagree that the Malacca River is clean until it can be used. Water pollution in the Malacca River has caused a lot of destruction to the environment. The cause of this destruction stemmed from human activities since humans are the key for all protection and can play the roles of savior or destroyer. Humans are an intelligent species. Humans know how to create technology to fulfill their demands. They

design technology to produce food in large quantities and in a short amount of time. They use the natural resources available to them. They cut down trees to make paper. They clear the forest to build buildings. They create a car to facilitate movement. They use water for processing chemicals. Every action performed by humans is to facilitate their own lives. Because of this, they have forgotten their responsibilities towards the environment, as in the case of the Malacca River.

Sometimes, the rapid development not only brings benefits, but also has a harmful impact on humans. For example, humans create the manufacturing industry that can lead negative impact on the environment, such as contaminated water. When this happens, contaminated water will easily spread infectious diseases, which will affect the quality of human life. In the context of Islam, Allah s.w.t. says;

"…and diligently (to get) what Allah has given to you from (the award) at the Last Day and do not forget to reward you in the world, and do good as Allah has been good to you and do not do damage, surely Allah does not love to those who do the damage." - Surah al-Qasas: 77

This verse clearly shows that Allah s.w.t. remind people to be kind to all creatures, including the environment, as Allah s.w.t. has done good for them. This means that in the developments of human beings, they must preserve the environment in the form of flora and, as Allah s.w.t is good to humans. If Allah s.w.t. created the environment in a beauty and balanced, then people are also obliged to keep the beauty and balance of nature as originally created by Allah s.w.t.. So, humans need to aware that they have a big responsibility in protecting the environment from destruction. This is because Islam teaches humans to be grateful. It is important for humans to remember that they are created from natural elements, such as water and earth. Therefore, they should appreciate all these elements by themselves in terms of preserving and conserving the environment (Abidfana, 2009). Allah s.w.t. says;

"And to Thamud, We sent their brother Salih. He said: "O my people! Worship Allah! Actually there is no God but from it. He brought you forth from the earth and settled you therein. So ask forgiveness of Him, then turn to the faithful and faith. Verily, my God is near, ready to answer." - Surah Hud, Verse 61

This research study is to show that water is essential for all creatures. Water is among one of the natural resources created by Allah s.w.t. to be used wisely. Human are too selfish and too greedy for fulfillment of desires without any regard for the environment, and this situation has caused destruction to occur. The destruction is refers to the absence of clean water for drinking or bathing because of contaminated water. This situation has not yet occurred because humans still feel that they have adequate water resources. However, clean water resources will not last long if the water pollution activities is continuous and there is no other alternative for the restoration of water resources. So, not only will human life be affected, the original ecosystem will also be threatened as a result of contamination. People may have forgotten that they are in need of enough clean water to sustain life, and that they themselves are actually composed of liquid (known as blood) to form proteins and other parts of organs. Therefore, early awareness is very important in helping to protect water resources from further destruction.

However, the situation is quite different in Malacca. Malacca is famous due to its history that existed in the state from the founding of the Sultanate, becoming the starting point of the center of government, a world trade center, experiencing colonialism by foreign powers, and so on. This has caused Malacca to be recognized by UNESCO World Heritage Site at 7 July, 2008

(UNESCO Official Portal). Therefore, Malacca has become an attraction to the tourist especially from worldwide to come and visit the state. So, the tourism activities become important to the country because it can generate economic revenue. However, many changes have taken place until the present day. This is because the state government feels that tourism alone is not enough to support Malacca. In desperate need for development, this has led to extremely exploitative land use. At the same time, without realizing it, the environment becomes affected, which also causes water sources to be harmed as a result of rapid development. Due to increased development and job creation, there is no reason to destroy the environment. The Malacca River is in serious condition. If no action is taken to stop human activities, the environment will be destroyed one day. Malaccan citizens are very hopeful that government can stop the harmful activities before it is too late.

Water is not an irreplaceable resource. Humans have tried to create machines that can recycle water and succeeded. However, the water pollution problem is still not resolved since successfully recycled water cannot be produced to match the original water quality. The recycled water was not drinkable. If society continues to promote water pollution, then this problem cannot be resolved. Take the Malacca River in Malacca state as an example. If government promoted environmental awareness while factories continued to pollute, then the solution will not be reached. Malaccan citizens are aware of the environmental problems. They hope that factories can find another solution by not dumping their chemical waste into the river. Lastly, Malaccan citizens want the water quality in the river to be maintained for the next generation.

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