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Public Perception in Water Resources Development Case Study: Malacca River

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Abstract

Malacca is a historical-based tourism destination. Tourism activities attract international and local tourists, together with local residents, which concentrate in Malacca Central especially near the Malacca River. Rapid development through land use and uncontrolled human activities cause contamination occur in Malacca River. Therefore, this research study has been conducted to determine public perception in water resources development. Quantitative approach applied, where questionnaire with Likert scale form are distributed for 400 respondents at Alor Gajah and Malacca Central along and adjacent to Malacca River. Meanwhile, research analysis used is chi square (χ^2) test with Cronbach's Alpha is 0.759. Analysis of results showed majority respondents agreed on Malacca River is polluted due to rapid development and human activities. Pollution in the Malacca River causes poisoning, death and extinction of aquatic animals, spreads various infectious diseases, affects soil saturation and plant species, harms local residents through bad odor or acid rain and natural disaster, and destroys the natural environment overall. Hence, government, the private sector, non-governmental organizations (NGOs), and local residents should join and work together to protect the river from destruction.

Keywords: Historical tourism, rapid development, human activities, polluted river, destruction.

Introduction

Malacca is tourism destination based on historical tourism and was recognized by UNESCO as a World Heritage Site on July 07, 2008 (UNESCO Official Portal, 2015) (Bernama Official Portal, 2008). Interestingly, Malacca is listed as one of the states that contributes highest economic value to the countries through the tourism industry (Tourism Malaysia Official Corporate Website, 2015). According to the geographical-coordinate, Malacca state is situated at N2°19'35.3" and E102°20'44.5", referring to World Geodetic System 1984 or WGS84 (Department of Survey and Mapping Malaysia, 2009). The state is surrounded by Negeri Sembilan to the north, Pahang to the east, Johor to the south, and the sea of the Strait of Malacca to the west (Melaka State Government Official Portal, 2015). Malacca can be divided into three districts, namely Alor Gajah, Jasin, Melaka Tengah or Malacca Central, covering 1,650 km² (Melaka State Government Official Portal, 2015). In other words, Malacca can be access using air transportation or land transportation. The total population in 2010 was 821,110 and this amount increased to 830,900 in 2011 (Melaka State Government Official Portal, 2015). In other words, the population is increased drastically especially the Malacca Central, because most of the local residents are concentrated in the district seeking job

opportunities. For example, most of the interesting places to visit are located in the city or Malacca Central, and this has created more job opportunities for local residents and also residents from other states. Therefore, the city of Malacca is packed with people who come, working, and settle there for a long period of time.

Rapid development has occurred in Malacca state, bringing a lot of benefits to the local citizen. However, the development inadvertently has caused several issues and problems in the environment, such as river pollution (Nasbah, 2010). River pollution not only affects local residents carrying out daily activities like fishing, bathing, and washing, but also disturbs them in terms of bad odor, bad scenery, disease spreading, and so on (Nasbah, 2010) (Jabar, 2010) (Hua, 2014). According to a report from Department of Environment (DOE) Malaysia in 2012, 195 out of 473 rivers are considered polluted, including the Malacca River. However, the Malacca River is slightly polluted and is not yet listed as extremely polluted. So, if this issue is not taken seriously, then it will lead to a greater variety of problems to Malacca state, such as in the tourism industry. Referring to research done by Hua and Kusin (2015), there are various human activities carried out along the Malacca River, which starting from upstream river involve with agricultural and livestock activities, middle stream river involve with factories and settlement activities, and downstream river involve with commercial and settlement activities. Therefore, this research study has been conducted to determine the public perception of water resources development in Malacca River.

Methodology

Since this research study involves public perception, the method to collect the data is based on a quantitative approach, namely a questionnaire. In the questionnaire, it can be divided into two parts, namely part A (demographic profile) and part B (public perception in water resources development). The questionnaire used is in the Likert Scale form, with 5 points (1-Strongly Disagree, 2-Disagree, 3-Normal, 4-Agree, 5-Strongly Agree), akin to a 'close-ended' approach. In other words, the questions will provide answers for respondents to choose with no need to give any comments. The sampling area for this research study is the Malacca River, especially respondents that live along and near the river. There are only two districts involved, namely Alor Gajah and Malacca Central, because the Malacca River only spans these two district (Melaka State Government Official Portal, 2015). The sample size was set at 400 respondents (Krejcie and Morgan, 1970), which is the appropriate number for the total population in Malacca State of 830,900 (Melaka State Government Official Portal, 2015). The analysis used in this research study is chi-square (χ^2) analysis, and the value of reliability test (or Cronbach's Alpha) is 0.759; this means that the items are satisfactory, suitable, and eligible for use in this analysis study.

Result and Discussion

Analysis for demographic profile and public perception in water resources development are shown in table 1, 2, and 3.

Table-1
Respondent's demographic profile

Category	Frequency	Percentage (%)	Total
Gender			
Male	200	50	400 (100%)
Female	200	50	
Age			
<20	1	0.25	400 (100%)
21-30	78	19.5	
31-40	183	45.75	
41-50	130	32.5	
51>	8	2	
Education Level			
Primary School	52	13	400 (100%)
Secondary School	166	41.5	
College	108	27	
University	74	18.5	
Occupation			
Government	30	7.5	400 (100%)
Private	86	21.5	
Self-Employment	131	32.75	
Retirees	78	19.5	
Student	75	18.75	
Number of Years Live in Malacca (years)			
1-10	40	10	400 (100%)
11-20	70	17.5	
21-30	130	32.5	
31-40	119	29.75	
41-50	40	10	
>51	1	0.25	

Analysis of Table-1 shows that there is a balanced number of males and females at 200, and a majority of respondents are aged 31-40 with the numbers of 183 (45.75%). Generally, they are self-employment (131 respondents or 32.75%) like business and working in private sector (86 respondents or 21.5%), where some respondents is also included in the age of 41-50 with 130 respondents (32.5%). Most of respondents only studied until secondary school (166 respondents or 41.5%) because they needed to carry on their family business and had been living at Malacca for almost 31-40 years (119 respondents or 29.75%), while some respondents were working in the private sector studied until the college level (108 respondents or 27%) and university level (74 respondents or 18.75%), with most of them living in Malacca for 21-30 years (130 respondents or 32.5%). There are minority respondents working in government sector (30 respondents or 7.5%) who have a bachelor or diploma degree. There are only some retirees (78 respondents or 19.5%) staying in Malacca for 41-50 years at 40 respondents (10%) with an age greater than 51 (8

respondents or 2%) and students with 75 respondents or 18.75% who studied in Malacca for 1-10 years (40 respondents or 10%).

Table-2
Respondent's perception on water resources

Category	SD		D		N		A			SA	
	F	%	F	%	F	%	F	%	F	%	
1. Water is the habitat of aquatic life.	-	-	2	0.5	44	11	174	43.5	180	45	
2. Polluted water in the river will affect the ecosystem.	-	-	2	0.5	59	14.8	148	37	191	47.8	
3. Evaporation of polluted water from river will cause air pollution (bad odor).	-	-	6	1.5	50	12.5	131	32.8	213	53.3	
4. Surface water runoff from acid rain will cause river water contamination.	1	0.3	13	3.3	98	24.5	196	49	92	23	
5. Acidic surface water will cause contaminated groundwater.	-	-	8	2	87	21.8	191	47.8	114	28.5	
6. River water pollution weakens soil structure and causes erosion and sedimentation of river basin.	1	0.3	7	1.8	102	25.5	179	44.8	111	27.8	
7. Malacca River is dirty.	-	-	6	1.5	47	11.8	158	39.5	189	47.3	
8. Industrial waste will cause the water in the river to become black, smelly, and contaminated.	-	-	7	1.8	54	13.5	156	39	183	45.8	
9. Polluted water in river can cause disease, cause aquatic animals to die and become habitat to dirty animals.	-	-	1	0.3	51	12.8	162	40.5	186	46.5	
10. Water pollution can cause the loss of soil nutrients and will affect the plant species.	-	-	32	8	139	34.8	164	41	65	16.3	
11. Contaminated water can cause aquatic species to become extinct.	-	-	3	0.8	66	16.5	171	42.8	160	40	

*F means Frequency; % means Percentage; SD means Strongly Disagree; D means Disagree; N means Normal; A means Agree; SA means Strongly Agree.

Next, analysis for respondent's perception on water resources is shown in Table-2. In the opinion of respondents, they strongly agree that water is the habitat of aquatic life (45%). However, respondents assumed that Malacca River is dirty (47.3%) due to industrial wastes that dump into river to cause river to become black color, with a smelly or bad odor, and contaminated (45.8%).

When a river is polluted, it can cause disease, poisoning, and death in aquatic animals, and become a habitat to dirty animals (46.5%). Contaminated river water can cause aquatic animal's species to extinction (42.8%). So, a majority of respondents strongly agreed that polluted water in river will affect the ecosystem (47.8%). At the same time, evaporation of polluted water from the river will cause air pollution (bad odor) (53.3%) and when raining, surface water runoff not only can cause groundwater to get contaminated (47.8%), but may also cause river water contamination to increase (49%). On the other hands, polluted water can cause the loss of soil nutrients and weaken the soil structure, which can lead to erosion and sedimentation of river basin (44.8%), and affect the plants species (41%).

Table-3**Respondent's perception through employment on water resources development****Variable A**

Employment	Industrial wastes and excretion wastes are discharged into rivers and cause the water to become black color, bad odor, polluted, and dirty VERSUS water pollution affect ecosystem through the lack of oxygen, food sources, and protection, for example death fishes due to poisoning will affect predator (e.g. snakes, eagles) to die.				
	SD	D	N	A	SA
Government	EC = - SR = -	EC = 0.2 SR = -0.4	EC = 3.3 SR = -1.8	EC = 13.1 SR = -0.6	EC = 13.5 SR = 1.5
Private	EC = - SR = -	EC = 0.4 SR = -0.7	EC = 9.5 SR = -3.1	EC = 37.4 SR = -0.6	EC = 38.7 SR = 2.1
Self-Employed	EC = - SR = -	EC = 59 SR = -0.8	EC = 0.7 SR = 0.4	EC = 14.4 SR = 0.4	EC = 57 SR = 0.5
Retirees	EC = - SR = -	EC = 35.1 SR = -1.7	EC = 0.4 SR = 1.0	EC = 8.6 SR = 3.2	EC = 33.9 SR = 0.0
Student	EC = - SR = -	EC = 0.4 SR = -0.6	EC = 33.3 SR = -0.4	EC = 8.1 SR = 0.7	EC = 32.2 SR = 0.1
Others	EC = - SR = -	EC = 0.0 SR = -0.1	EC = 0.1 SR = -0.3	EC = 0.5 SR = -0.7	EC = 0.4 SR = 0.9

*EC means Expected Count; SR means Standard Residual; SD means Strongly Disagree; D means Disagree; N means Normal; A means Agree; SA means Strongly Agree.

Chi-Square Test (χ^2)

	Value	df	Asymp. Sig (2-sided)
Pearson Chi-Square	38.501 ^a	15	0.001
Likelihood Ratio	49.388	15	0.000
Linear-by-Linear Association	18.348	1	0.000
N of Valid Cases	400		

a. 10 cells (41.7%) have expected count less than 5. The minimum expected count is 0.01.

Variable B

Employment	Polluted water in river can cause disease (diarrhea, fever, infectious diseases, skin disease, etc.), bring death and extinction to aquatic animals and become habitat to dirty animals VERSUS evaporation of polluted water from river will cause air pollution (e.g. bad odor) and bring acid rain that will affect larger area to cause pollution.				
	SD	D	N	A	SA
Government	EC = - SR = -	EC = 0.2 SR = -0.4	EC = 4.4 SR = -1.2	EC = 11.1 SR = -1.2	EC = 14.3 SR = 1.8
Private	EC = - SR = -	EC = 0.4 SR = -0.7	EC = 12.7 SR = -1.9	EC = 31.8 SR = -0.7	EC = 41.1 SR = 1.7
Self-Employed	EC = - SR = -	EC = 62.6 SR = -0.8	EC = 0.7 SR = 0.4	EC = 19.3 SR = 0.4	EC = 48.5 SR = 0.7
Retirees	EC = - SR = -	EC = 37.2 SR = -2.2	EC = 0.4 SR = 1.0	EC = 11.5 SR = 1.6	EC = 28.9 SR = 1.3
Student	EC = - SR = -	EC = 0.4 SR = -0.6	EC = 27.4 SR = -0.6	EC = 10.9 SR = 0.3	EC = 35.3 SR = 0.4
Others	EC = - SR = -	EC = 0.0 SR = -0.1	EC = 0.4 SR = -0.6	EC = 0.5 SR = -0.7	EC = 0.1 SR = 2.2

*EC means Expected Count; SR means Standard Residual; SD means Strongly Disagree; D means Disagree; N means Normal; A means Agree; SA means Strongly Agree.

Chi-Square Test (χ^2)

	Value	df	Asymp. Sig (2-sided)
Pearson Chi-Square	31.796 ^a	15	0.007
Likelihood Ratio	31.546	15	0.007
Linear-by-Linear Association	10.285	1	0.001
N of Valid Cases	400		

a. 10 cells (41.7%) have expected count less than 5. The minimum expected count is 0.01.

Variable C

Employment	Polluted surface water can cause underground to contaminated and polluted water will be absorb by plants and affect the plants species VERSUS polluted water absorbed by soil can cause the loss of soil nutrient and weaken the soil structure which can lead to erosion of river basin and sedimentation to occur, and brings natural disasters like floods, landslides, etc.				
	SD	D	N	A	SA
Government	EC = - SR = -	EC = 0.5 SR = -0.7	EC = 3.8 SR = -1.9	EC = 9.8 SR = 0.1	EC = 16.0 SR = 1.0
Private	EC = - SR = -	EC = 1.3 SR = -1.1	EC = 10.8 SR = -1.8	EC = 28.2 SR = -1.4	EC = 45.8 SR = 2.1
Self-Employed	EC = - SR = -	EC = 16.4 SR = -1.1	EC = 2.0 SR = 0.7	EC = 42.9 SR = 0.2	EC = 69.8 SR = 0.3
Retirees	EC = -	EC = 41.5	EC = 1.2	EC = 9.8	EC = 25.5

	SR = -	SR = -1.5	SR = 0.8	SR = 2.3	SR = 0.3
Student	EC = - SR = -	EC = 1.1 SR = -0.1	EC = 39.4 SR = -1.8	EC = 9.3 SR = 2.2	EC = 24.2 SR = 1.0
Others	EC = - SR = -	EC = 0.0 SR = -0.1	EC = 0.1 SR = -0.4	EC = 0.3 SR = -0.6	EC = 0.5 SR = 0.6

*EC means Expected Count; SR means Standard Residual; SD means Strongly Disagree; D means Disagree; N means Normal; A means Agree; SA means Strongly Agree.

Chi-Square Test (χ^2)

	Value	df	Asymp. Sig (2-sided)
Pearson Chi-Square	35.930 ^a	15	0.002
Likelihood Ratio	40.845	15	0.000
Linear-by-Linear Association	25.866	1	0.000
N of Valid Cases	400		

a. 10 cells (41.7%) have expected count less than 5. The minimum expected count is 0.02.

According to table 3, respondent's perception through employment on water resources development can be divided into three categories, namely variable A, variable B, and variable C. The analysis used in this part is chi-square (χ^2) test. In variable A, there is significant correlation ($\chi^2 = 38.501$, $df = 15$, $P < 0.05$) between employment (government: 13 strongly agree; private: 38 strongly agree, self-employed: 57 strongly agree, 14 agree, 1 normal; retirees: 33 strongly agree, 8 agree, 1 normal; student: 32 strongly agree, 8 agree; others: 1 strongly agree) with factors that cause water pollution in the Malacca River. Next, variable B showed a significant correlation ($\chi^2 = 31.796$, $df = 15$, $P < 0.05$) between employment (government: 14 strongly agree; private: 41 strongly agree; self-employed: 48 strongly agree, 19 agree, 1 normal; retirees: 28 strongly agree, 11 agree, 1 normal; student: 35 strongly agree, 10 agree; others: 1 strongly agree) with the impact of water pollution in the Malacca River. Lastly, variable C proved that there is a significant correlation ($\chi^2 = 35.930$, $df = 15$, $P < 0.05$) between employment (government: 16 strongly agree, 9 agree; private: 45 strongly agree; self-employed: 69 strongly agree, 42 agree, 2 normal; retirees: 25 strongly agree, 9 agree, 1 normal; student: 24 strongly agree, 9 agree; others: 1 strongly agree) and impact on the environment due to water pollution in the Malacca River.

The main reason for Malacca River to be polluted is due to increasing land use area, rapid development in the urban area, and increasing of human activities without control. For example, various factories, commercial, and settlement activities are concentrated at particular urban areas which will cause the river to be polluted. When the industrial and excretory wastes are discharged into the river without treatment, this will change the water to become black, and have a bad or smelly odor, and appear dirty and polluted. These problems do not end at that point, but will lead to other issues. Where pollution exists in the Malacca River, these problems will affect the nature of water bodies through loss of oxygen in water, which in turn will affect the whole ecosystem in an environment. For example, when there is a lack of oxygen in water bodies plus with chemical wastes, this will cause aquatic animals to be poisoned and die. Once the fish are dead, this will cause other predators like snakes to die due to a limited food source. Therefore, a majority of the self-employed and retirees are in agreement, because local residents that conduct business are located near the Malacca River and are always exposed to the current situation, always watch the changing

water quality and noting changes in color and lack of fish swimming in the river. Retired local residents staying for a long time in Malacca believe that the river water quality is changing to become dirty and that it is not the same as before. For example, previously local residents used river water for washing and bathing, but now there are no people that dare to approach the river due to contamination.

Next, once the water in river is polluted, it will bring with it a lot of disease, for example diarrhea, fever, infectious disease, skin disease, and so on. These problems could happen because when untreated chemical wastes from industrial are released into river, the reaction between the chemical wastes and river water will cause other dangerous solvents which encourage the growth of bacteria. This bacterium will affect the aquatic animals' lives and cause death. If the river pollution situation worsens, then this will affect the fish species and cause extinction. This situation provides benefits as a habitat to dirty animals in Malacca River. At the same time, polluted water in river can be evaporated and exist in moisture or gas, which can lead to air pollution (example bad odor). This air pollution can mix with other gases in the clouds, which bring acid rain to the Earth surface. Since acid rain can spread in a larger area, this may increase the percentage of water pollution especially towards the Malacca River. Hence, this is the reason for self-employed respondents agreeing that they can smell a bad odor every day when running the business. In their opinion, the bad smell harms people, especially tourists that are uncomfortable to travel due to the bad odor. This situation will cause their business to decline and affect the economic status. This is followed by the majority of retirees who also agreed that when animals are dead, they bring diseases together with chemical wastes dumped by industrial businesses. So, when polluted water is exposed to hot season and it may cause evaporation process to occur, which not only brings a bad odor but also acid rain.

Lastly, when the rain falls to the Earth's surface, the water will be absorbed into the soil to form groundwater. So, if the rain is acid rain, this will cause underground pollution which will be absorbed by plants. It definitely will cause the plants species to become wilted. Not only that, the polluted surface water from acid rain will also cause the loss of soil nutrient and weaken the soil structure once it is absorbed into the soil. Therefore, the soil structure is weakened, which may lead to erosion of river basin and sedimentation, and this can bring natural disasters like floods, landslides, and so on. Again, it is possible for the majority of self-employed and retirees respondents to agree because when raining, before the water surface runoff enters the river, it will erode the river bank and transport the sediment together entering the river which cause river to become more shallow. When this happens, all materials included in the soil erosion from the river bank will be transported and deposited in the river, leading to a decrease in the quantity of water in the river. So, these actions can lead to a nature disaster, such as a flashflood. When there is extreme raining at urban area, most of respondents with business near the Malacca River will have a little worry and concern for flashfloods because they have experience with natural disasters. Therefore, the majority of respondents are hoping that the flashflood will not happen again because this incident can bring bad experiences and trauma to local residents.

Conclusion

This research study has shown that local residents are well informed about water resources development in Malacca state, especially for the Malacca River. Most of respondents are agreed that Malacca River is polluted due to rapid development on land use and uncontrolled human activities. When the Malacca River is polluted, it will cause various problems to happen that affect aquatic animals such as poisoning, death, and possible extinction. Pollution will also affect ecosystems,

spread various dangerous diseases, affect the quality of human life through bad odor and acid rain, cause groundwater to be polluted and decrease quantity of freshwater for drinking, affect plant species and weaken the soil structure through causing the loss of soil nutrient, as well as lead to natural disasters for local residents. Therefore, the government, private sector, non-governmental organizations (NGOs), and local residents should work together to protect the river from destruction and be responsible for the river, which in turn will also affect human quality of life.

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