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Original Paper

THE PROSPECT OF CO-MANAGEMENT IN MANAGING OPEN WATER AND ESTUARIES RESOURCES WITH SPECIAL REFERENCE TO INDONESIA: A LESSON LEARNED

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ABSTRACT

Indonesia is a maritime country, composed about 17,500 islands. It has a great endeavor of open water resources such as river, lake, dam, pond, swamp, etc. which are spread over the country. Multi-tribes and –races are attributed to its habits, tradition, and culture of the communities lived. Given such large territory, especially Indonesia is formed of thousands island, it will be costly to set a formal enforcement and surveillance in securing the open-access resources (like fisheries, water, etc). Fortunately, each community has an indigenous or traditional system to manage the resources. For example: Ikan Larangan (in West Sumatra), sasi (in Maluku), Subak (in Bali), Sedekah Laut (in Java) and so on (Susilowati, 1996; 1999). Rather than waiting a complete formal resource management (and need to be set up by the government) and do not know when will be effectively apply, thus it will be more reasonable and timely to revive the traditional system of resource management belongs to the respective community. In short, community involvement in resource management is urgently encouraged, particularly in developing country with limited budget like Indonesia. This paper is attempt to compile an experienced of Co-management approach to manage the open water resource done by Susilowati (1999, 2002, 2004, 2006, 2007). An institutional analysis (Pomeroy and William, 1994) and Pinkerton (1989) with necessary modification were applied to the respective studies. The results indicated that there is a fairly prospect to empower the competent stakeholders (community, government, private, independent parties) to be involved in managing the open-access resources. However, all parties need to be encouraged for a high intention in participation, commitment and somehow to create their sense of belonging to advocate the resource management. It is easy to say but hardly to be materialized all the things for Indonesian context, except the leaders (formal and informal) in the respective region are really committed to conserve the resource.

Keywords: community, resource, management, co-management, open access, Indonesia, Java.

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INTRODUCTION

Indonesia is basically an archipelago and agricultural country. Nearly three-fourth of people lived in rural area and involved with agricultural activities. People are mostly involved in agricultural and fisheries sectors.
Lately, the role and involvement of community in development activities becomes a significant in Indonesia, especially after the socio-political reforms was running. There is policy and paradigm shift in governing activities from top-down to decentralized systems. The authority devolvement from national government towards provincial and local government are progressing from time to

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time since decentralization law No.22 / year 1999 has been promulgated in 2001. There are shifting in functions, tasks, authority and responsibility from centralized government to the local government. Currently, most of the designed programs now are directed to the grassroots targets. Communities and the related stakeholders are expected to play their roles in development. Thereby, participation and sharing responsibility among the stakeholders are needed as the key-success to achieve the sustainable development. River management in a region is also delivered to the local government with necessary coordination with central government. Several evidences of success and failure in managing river in Indonesia are found with its variation. This is subject to the commitment deserved by the authority and stakeholders in resource conservation.

One of the severed problems faced by the city manager in Indonesia, including Semarang and its surrounding (as of now) is the illegal unregulated and unreported (IUU) resettlement and most of them are located in the bank of rivers or canal (Susilowati, 2004; 2006). Consequently, environmental quality of the rivers or canals (open water resource), are deteriorating. This situation is also taking place on almost all of the urban rivers like Kaligarang, Semarang, and Babon rivers.

This paper attempts to compile several studies that have been conducted by Susilowati *et al*. (2002); Susilowati (2004; 2006; 2007) to provide a picture of community involvement in resource management (river). At the same times, the prospect of co-management approach and the degree of stakeholders' involvement in managing the river(s) have also been discuss in this paper.

MATERIALS AND METHODS

(1) Study Area: there are four rivers were observed in this paper, namely: Babon; Semarang, Banjir Kanal Barat (or known as Kaligarang river) and Tuntang. All rivers are located in Semarang (Municipality and Regency).

***(2) Data and Sampling*:** Cross-sectional survey was designed to collect the data through face-to-face personal interviews by the trained enumerators. The respondents of each study area were varying. It is depend on the characteristics of the community and the competent key-persons in the field. The distribution of respondents is shown bellows.

Table 1. Distribution of Respondents Surveyed*

No	Rivers	Respondents (persons)
1.	Babon	- Community (n=120) - Key-persons (n=30)
2.	Semarang	- Community (n=45) - Key-persons (n=30)
3.	Kaligarang	- Community (n=90) - Key-persons (n=30)
4.	Tuntang	- Community (n=90) - Key-persons (n=20)

*: surveys were conducted during the respective time period of research.

The samples were selected by quoted-geographical clustered sampling. Primary data are considered as the main materials for analysis in the respective study. In order to provide alertness of the enumerators, training was given to all enumerators before they undertook the survey. To facilitate ample information for analysis, the secondary data were also collected from the concerned institutions (Impact Assessment Board, River

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and Irrigation Office, Central Bureau of Statistics, and the Provincial, Municipal/ regency Government Offices) and some other various related publications.

(3) Method of Analysis: This paper is aimed at providing a comparison of the prospect of Co-Management approach in managing open water resource in four rivers in Central Java-Indonesia. A research framework as outlined by Pomeroy and Williams (1994) was applied to identify the prospect of co-management level; and the key conditions are given by Ostrom (1990, 1992) and Pinkerton (1989) were used in this study with necessary modification as applied in Susilowati (1999;2001a; 2001b) and Susilowati *et al* (2002) and Susilowati (2004; 2006; 2007). The multivariate analysis (Hair Jr. *et al*.,1998) have been employed and also was complemented by descriptive statistics (see Mason *et al*., 1999; SPSS, 1996).

RESULTS AND DISCUSSION

Resource Description

(1) Babon River: River is considered as one of the strategic resource in Indonesia since it carries multi-functions especially for the inhabitants along the watershed. Many industries are placed along the Babon river stream. Because of that, Babon River is potentially high in pollution. In order to achieve the goals of clean river program (Prokasih), thus clean-production program should be imposed to the business activities along the river. In comply with this requirement then awareness among the stakeholders to conserve the river is highly stipulated.

Babon river is lied over the three regions, i.e. Semarang District where the upstream located while the downstream passing the Semarang Municipality and Demak District. This river has been used for multi-purposes by the communities' lives in its adjunction (e.g. water source, canal disposal, mining, etc). Thereafter many transboundary environmental problems have been rising here.

Babon river is lead over the three regions of Semarang District, Semarang Municipality, and Demak District. However, the research was carried out along Babon River and its adjunction under the jurisdiction of Semarang Municipality only. Further, the study areas were divided into three river's segments, i.e. up stream (Rowosari village), middle stream (Penggaron Kidul village) and down stream (Banjardowo village). In 1999 the water of Babon river was sampled from several point intake (in early rainy season). The results indicated that the BOD, COD and DO are increasing and exceed the minimum standard. The BOD was ranged between 18.98 – 80.28 mg/l, while the DO was about 2.20 – 3.80 mg/l. Water temperature was between 30-33 °C. The following table shows the chemical indicators of Babon river water.

Table. 2 Chemical Condition of Babon River

No	Coverage	Physical Condition			Quality Standard		
		BOD mg/l	COD mg/l	DO mg/l	BOD	COD	DO
1	Up stream	18.98	28.98	2.2	6	10	>=6
2	Middle stream	43.20	94.20	2.2	-	-	>=3
3	Down stream	80.28	161.76	3.8	-	-	>=3

Note: water sample was taken in August 1999 (morning)

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(2) Semarang River: *'Kali'* (local terms of river) Semarang is the only river that flows in the heart of Semarang city. It keeps worthy histories of Semarang during Dutch colony. At that time this river was used as transportation for Chinese and Arabic traders. Thereafter, the China-town and Arabic settlement are located nearby the river as of now. History said that the river bank was also utilized by Dutch people for recreation place, then, its river-view was built for business and office complex. Now this complex is known as '*Kota-lama'* or old town of Semarang. The stream of Semarang river starts from the southern part of Semarang, precisely from Kaligarang dam, then down to east until near Kariadi General Hospital and Flower market (defined as upper-stream) and passes behind Lawang Sewu building, Mayor Semarang Office, and Jalan Inspeksi in Thamrin (defined as middle-stream). To the north goes to China town, Johar Market, Mberok Bridge and stream down to Java Sea (defined as lower-stream).
Until 1970's, Semarang river was remain used by community for washing, bathing and rearing fish. Even reach to early 1980's many home industry of '*tempe-tahu'* (a kinds of dish made by soybeans which famous known as Javanese dish) utilized this river to wash the raw materials. However, all of those activities were dramatically gone due to the river is no longer sufficient enough to accommodate these purposes. Today, *Kali* Semarang is utilized by community for sewage, disposing garbage and drainage. The river body of Semarang River becoming shallow and narrower, then adversely due to the river bank is utilized for illegal settlement and other purposes.

The upper-stream section is partly covered by concrete and use for street. Evolution of Semarang's land development by nature was composed by fragile alluvial soil of sedimentation. In other hand, city development grows very fast and brought shifted in land-used, infiltration of sea water due to demanding in water supply, enlargement in settlement area, etc. These conditions then accelerate the process of pushing-down the northern part of Semarang land below sea level. Therefore, during high-tide this area will be inundated by sea water. While, drainage infrastructure's capacity, including Semarang river, have not able to accommodate the waters in raining season. So that, it is happen Semarang known as 'flooded city' and even got a famous satirical song with lyric "*Semarang kaline banjir*".

The results indicated that the water quality of Semarang river is no longer safe for drinking water standard (class I). For the standard of class II, the DO is exceeded the safety standard in location of middle- and down-stream (T3 and T4). While the water sampled taken in T3 showed the Nitrate (NO_3N) has exceeded. The Sulfide (H_2S), Nitrite ((NO_2N), BOD and COD in all points of sampled are already exceeded the normal indicator for water quality standard class II.

(3) Kaligarang River: is a natural river and its spring is located in Ungaran mountain in the southern part of Semarang city. Since Dutch colony, the down-stream of this river was enlarged and it functionated as a canal for flood control. This is way then down-stream of Kaligarang river then called by Banjir (local: flood) Kanal (from canal). People then called as Banjir Kanal Barat which is continuation of Kaligarang river. In addition, there are two canals for flood control of Semarang City, namely: west and east canal of Semarang.

The upper-stream of Kaligarang river is mostly formed of agricultural based (forest and paddy field) and human settlement. This segment is considered as the water captured of Semarang City. While, gravel and sand mining, industries, human settlement are placed in the middle-stream of Kaligarang. Moreover, the water of Kaligarang is tapped as a raw water by Semarang Municipality's water supply company to serve Semarang

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people in the downtown and northern parts of Semarang.

Kaligarang river is mainly used by community and industry to dispose the liquid waste, particularly in the down-stream since no other river ended till Java sea in the northern part of Semarang. Agricultural and fisheries activities are benefitted from this river for irrigation. All drainage infrastructures in the west-northern part of Semarang with densely populated are captured by Kaligarang river.

Due to a heavy burden, nowadays Kaligarang river is often overflow whenever a heavy raining come. Adversely, Kaligarang river is degrading from time to time due to deforestation in the upper-stream and mining activities in middle-stream. High turbidity and sedimentation can not be avoided in the down-stream and particularly in estuaries. In fact, maintaining the river itself seems not properly given by the local government. Therefore, the river becoming narrower and shallow then many delta found along the river in down-stream and its estuaries. It was noted that the heavy flood in 26 January 1990 with flood debit ± 1.540 m^3/second. It caused losses in material for about 8,5 billion rupiah and hundred's victims of people.

Along Kaligarang river, the BOD, COD and DO have been exceeded the quality standard. The water quality is degradating whenever toward the downstream as performed by the physical condition of water in **Table 3.**

Tabel .3 Water Quality of Kaligarang River

No	Segment	Physical Condition			Quality standard		
		BOD mg/l	COD Mg/l	DO Mg/l	BOD	COD	DO
1	Upper	2,886	21,65	7,03	2	10	>=6
2	Middle	3,802	22,26	7,03			>=3
3	Down	7,566	40,82	7,49			>=3

Source: The Environmental Impact Management Board (Bapedalda) of Semarang Municipality, April 2004

(4) Tuntang River: Several springs of Tuntang are from Telomoyo and Merbabu mountains. This water accumulated in Rawa Pening (natural dam) and is used for electric power generation. Tuntang river streams from Semarang and Grobogan regencies then off in Java sea passing trough Demak regency.

During moonson Tuntang water's debit is significantly increased and sometimes overflow to its adjunction area, particularly in the downstream. The water salinity of Tuntang river is relatively high (brackish), therefore it is not suitable for agricultural cultivation. But in fact, community along the river is very demanded to utilize the water for their activities, particularly for farming, rearing the fish, etc.

The BOD, COD and of Tuntang river are about 4282 mg/l and 22.39 mg/l, while the CO is 6.38 mg/l. Given such data, the river observed is still in safe condition for water supply, bathing and cultivation (farming and aquaculture). The physical attribute of Tuntang river is shown in **Table 4.**

Rule-in-used

River is considered as the strategic resource since it carries multi-functions especially for the inhabitants along the watershed. Densely housing, business activities and industries are placed along the urban river like Semarang and Kaligarang rivers. Due to all of these activities, this river has high potential in

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Tabel .4 Water Quality of Tuntang River

Sampling time	Mg/l Station 1			Mg / l Station 2			Physical Condition		Quality Standard BOD	Quality Standard COD
	BOD	COD	DO	BOD	COD	DO	BOD	COD	>6	>3
Juni01	2.4	6.25	6.4	1.8	4.69	5.7	6	12	6	3
Jul 01	9	5.37	6.4	2.5	10.7	5.6	6	12	6	3
Aug 01	10	11.1	6.3	10	13.8	5.8	6	12	6	3
May 04	19.5	36	4.4	14	28	5	6	12	6	3
Jun 04	8	11	4.6	21	18	6.8	6	12	6	3
Jul04	17.5	12	4.7	17.5	3	6.4	6	12	6	3
Aug 04	13	14	5.1	13	16	8.7	6	12	6	3
Sept 04	18.5	22.5	5.6	14	16	7.2	6	12	6	3
Oct 04	17	20.5	5.5	13.5	16	5.2	6	12	6	3

Source: Impact Assessment Board of Semarang Regency, 2003.

pollution and environmental damages. In order to achieve the goals of clean river program (Prokasih), thus clean-production program should be imposed to the household, business, and industries activities along the river (in urban and rural) and this has been guided by the rules, formally and informally. The formal rules related to the river management are summarized in **Table 5.**

In comply for the relevant rules then awareness among the stakeholders to conserve the river is highly stipulated. It is often found that people are not friendly toward the environment while doing their daily and industrial activities. In general, people in the region perceived that river has dual functions as a place to get resource and to through out garbage and sewage. Knowledge of people along the river toward technology and management skill is limited, whereas rule in-use is hardly consistently to be implemented in the region. Meanwhile the capacity of the government in surveillance and enforcement activities are very far from complete. Moreover, many people in Indonesia have an image that river is a place for the last destination to dispose the unused things. Therefore, when the dog or other pets is dead it will be through in the river as reported by Lucas and Arief (2000). It is indeed need to re-format the community's wrong-perception on the importance of a river. The formal rule-in-used are placed but the enforcement and compliance is very weak and weak. Thereafter, informal rules need to be revived and strengthen to provide a proper guidance for the people.

Interactions

(1) Resources Utilization: River in Indonesia is usually used for several purposes. Different community may have different motive in utilizing a river. As perceived by community (respondents), generally rivers are utilized for: human bathing, washing and disposing; irrigation, animal bathing; to get rid of waste; and drinking water. However the pattern of river utilization in upper- and middle- as well as down-stream is varying.

(2) Degree of Commercialization: In general, river in all study area is considered as the endeavored resource and people perceived loosely as the common property and open access. Although there are rules and regulations (formal and formally) in place, but due to a weak in enforcement and surveillance and particularly worsen by economic

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Table 5 Related Rules and Regulations for River Management in Indonesia, with special Reference to Central Java Province

No	Rules / Regulations	Description
1	UU No.11/ 1974	Drainage
2	UU No. 4/ 1982	Guideline for environmental management
3	UU No.27/ 1997	Guideline for environmental management (amendment)
4	UU No 7 / 2004	Guideline for water irrigation
5	PP No.22/ 1982	Water management
6	PP No.35/ 1991	River
7	PP No. 20/ 1990	Monitoring of water pollution
8	PP No. 51/ 1993	Environmental impact assessment
9	PP No. 19/ 1994	Dangerous and poisonous waste disposal management
10	PP No 27 Tahun 1999	Environmental Impact Assessment Analysis
11	PP No 82 Tahun 2001	Water quality and water pollution management
12	Presidential Decree No.32/ 1990	Conservation area management
13	Minister of Public works Decree No. Kep.39/ PRT/ 1989	Division of river area
14	Minister of Public works Decree No. Kep.48/ PRT/ 1990	Water resources management
15	Minister of Public works Decree No. Kep.49/ PRT/ 1990	Guidelines for water resource utilization
16	Minister of Public works Decree No. Kep.63/ PRT/ 1993	Border, watershed function, and territorial coverage of river and ex-river
17	Minister of Environment Decree No. Kep.02/ MENKLH/ 1988	Quality standard of liquid waste disposal of the running activities
18	Provincial Regulation of Central Java No. 1/ 1990	Guideline for Environmental management in Central Java
19	Provincial Regulation of Central Java No.660.1/ 26/ 1990	Water quality standard in Central Java Province
20	Provincial Regulation of Central Java No.660.1/ 27/ 1990	Classification of liquid waste disposal in Central Java Province
21	Governor of Central Java Instruction No. 660.1/ 11/ 1988	The procedure on alleviation of pollution and environmental destruction
22	Provincial Regulation of Central Java No. 20 Year 2003	Water quality and water pollution management of cross boundary regions in Central Java
23	Provincial Regulation of Central Java No 10 Year 2004	Sewage water standard

Note: UU = law; PP = national regulation
Source: Various publications, 2004.

pressure, thereby river is likely can be exploited for many purposes by community in the adjunction. It is hardly for community to be complier in conserving and maintaining the river whenever they see other parties are extracting and benefitting something from the river. Moreover, given less attention from the authority to conserve and to maintain the resource, thereafter resource is likely managed without a proper management. Due to missed-interpretation in decentralization concept, then many of natural resources (particularly in urban area) are potentially able be utilized by community, government and other stakeholders for commercial purposes.

Sand, gravel, stone, clay and water from the river are extracted by several parties. While the bank of the river is utilized for agriculture and fisheries activities. Many canoe boats are operated for bridging people movement from one bank side to another side. People are collecting fish and other creature

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(like worms) for commercial purpose. It should be realized that so many benefits granted by the river from time to time. But given such improper management, we should worry that all "benefit and grant" supplied by God

(3) Pattern of interactions: Pomeroy et al. (1994) claimed that co-management involves various degrees of delegation of management responsibility and authority between the local level (resource users or community) and the state level (national, provincial, and district governments). The interaction among the stakeholders to perform the management functions (planning, organizing, actuating, and controlling) in different segments of river (upper-, middle- and down-streams) are shown in the following figures.

In the upper-stream, role in controlling the resource is particularly done by the community itselves and followed by the academician and/ or NGO. While, the government mostly shared in planning activities. Organizing activities in river management are proportionately done by all related parties with government as the facilitator. Further, actuating activities are usually done by community and private parties.

Prospect of Co-management

Among the emerging conditions for successful co-management is that the more of these key conditions that exist in a particular situation or system, the greater the chance for successful co-management (Pomeroy *et al*., 1994). While the key conditions are given by Ostrom (1990, 1992) and Pinkerton (1989) is used to evaluate the success of co-management for several river observed. Every key-condition observed for evaluation was measured by likert scale (1 to 5) or conventional scale (1 to 10). Based on observation in the field and discussion with several competent key-persons, then judgment was made by researcher to evaluate the success of co-management application in the river studied.

The eleven key-conditions provided by Ostrom (1990, 1992) and Pinkerton (1989) were used in this study with necessary modification as applied in Susilowati (1999; 2001a; 2001b) and Susilowati, et al (2003) and Susilowati (2004; 2006; 2007) to figure out the prospect of co-management in Managing the rivers.

The total score of 11 key-conditions for successful co-management of each river are shown in several tables (see Appendix). In overall the results indicated that prospect of co-management is between marginally to pretty good.

In addition, the results indicated that a sharing in understanding and responsibility among the stakeholders as perceived by the respected community studied are remaining fairly good. There is an indication that community-based management may shed some lights to pursue resource (river) management. It is indeed need to provide empowerment for all stakeholders should be encouraged to attain for synergic-partnerships.

CONCLUSIONS

Capacity and quality of the rivers studied are deteriorating with several causalities and variation. Deforestration is mostly claimed as the main factor in upper-stream. While, mining and industrial activities are found as an activities in accelerating the degradation in the middle-stream of the rivers. Pollution from industries and domestic waste becoming a significant problem of rivers waterway. Adversely, illegal unregulated and unreported (IUU) resettlement nearby the river are not be given a promptly warning and proper action to do surveillance.

Based on an initial quick assessment using criteria provided (by

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www.healthywaterways.env.qld.gov.au),
Babon, Semarang and Kaligarang rivers are likely classified under poor health river. The chemical indicators showed that the water quality of the rivers is no longer safe for drinking water standard (class I) and even from several monitoring station showed that the water almost no longer fulfilled the quality for recreation and gardening (class II). Hence, involvement of the community might not sufficient for improving the quality and capacity of the rivers. It is indeed need sharing in: understanding, responsibility, sympathy and empathy as well as deserve for a good-will from all competence stakeholders in order to grow the spirit and sense belonging in managing the river. It is hardly to implement this recommendation in the coming couples of years. But we do not have other options. So far, the government of Semarang Municipality and Regency are paying less attention in maintaining these resource endeavors. In fact, as if there is no management in managing the rivers in the study areas (and perhaps, generally in Indonesia,) for the last five years. Thus, if we do not start doing something right now, means we let the rivers extinct. Similar condition is also happen with managing other rivers in urban area in Indonesia.

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