Stakeholders Involvement in Sediment Management in Rawa Pening Lake, Central Java, Indonesia

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Abstract: Lake Rawapening is one of the 15 lakes prioritized for preservation based on Presidential Regulation No. 60 of 2021. due to high environmental degradation caused by sedimentation rates that can reduce water depth and quality and harm ecosystem sustainability. This research aims to analyze the roles and contributions of each stakeholder and key actor in the utilization of sediment from Lake Rawapening. The research method used in this study is a qualitative survey method. The number of respondents in this study consists of 18 key informants, 15 main informants, and 3 supporting informants. The analysis used employs Actor Network Theory analysis with the Social Network Visualizer version 3.1 application. Research shows that in the utilization of sediments in Lake Rawapening. The government as the determiner of policy formation and implementation; the sediment utilization institution, which is currently inactive, playing a role in coordination and synergy among stakeholders; sediment dredging fishermen as sediment extractors; sediment porters as the delivery service from the boat to the sediment collection site; sediment collectors as raw material distributors and managers of the sediment collection process; and fertilizer distribution as the link between producers and farmers. The actor with the highest EVC in sediment utilization at Lake Rawapening is the sediment collector at node 5, who becomes the most important actor with an EVC of 100% due to extensive involvement with various parties. Fertilizer distributors from Purwodadi and Ambarawa followed in second place with an EVC of 87.51%, while sediment porters recorded the lowest EVC (0%). The collector at node 7 has the highest CC score (43.61%). Lake Rawapening's sediment collectors have a 39.45% control rate (BC score = 39.45).

Keywords: Actor Collaboration; Community participation; Environmental restoration; Lake conservation; Sediment control.

Introduction

Rawapening Lake in Semarang Regency, Central Java is a lake experience with an area of 2,670 ha. In general hydrology of Lake Rawapening owns strategic position that is the source for the flow of 16 rivers, which is the only one channel going out is the Tuntang River (Soeprobowati & Suedy, 2010). In addition, the role of Lake Rawapening also functions as a vital natural reservoir for various needs, including Hydroelectric power plants (PLTA), irrigation, and fisheries (Wulandari et al., 2021).

Currently, Lake Rawapening including one of the 15 priority lakes for saved based on Presidential Decree No. 60 of 2021. because height degradation environment consequence rate sedimentation that can result in

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reducing water depth and quality and harm sustainability ecosystem (Ali et al., 2024; Aprilliyana, 2015; Indrayati & Hikmah, 2020; Suratman et al., 2010).

Sedimentation is the main problem in Lake Rawapening (Sadewo et al., 2022; Soeprobowati, 2012). Causes Sedimentation in Lake Rawapening among other results weathering water hyacinth goiter, and land erosion results originating from the Sub-River Basin Areas (DAS) in the upstream section with its own steep slope, high torrential Rain, and dominated by land dry planted vegetables. Sediment accumulated at the bottom of Lake Rawapening own untapped potential fully utilized, if left alone in the long term can result in shallowing lake, decreasing ecosystem, and the declining water quality (Aprilliyana, 2015). The covered part of the lake water hyacinth goiter or open , have organic material content ranges from 61.99% - 74.82%, value This includes very high category , phosphorus content between 2.2 – 7.3% means classified as high , potential of hydrogen (PH) sediment between 6.3-7.8 means approach neutral (Purwandari et al., 2013).

Sediment in Lake Rawapening own potential for use Because own criteria fertility waters based on abundance of phytoplankton and its total phosphorus content is eutrophic going to hypereutrophic, as well as character physique textured clay, so own ability storing good water (Purwandari et al., 2013).

Based on the problem said, then to overcome the challenges of sediment accumulation and sediment utilization in a sustainable way, a comprehensive and integrative approach is necessary. One of effective approaches through involvement of every stakeholder coordinated interests based on *Actor-Network Theory* (*ANT*). Success implementation utilization sediment for reducing the impact of sedimentation the lake is very dependent on the involvement of actors involved in development and implementation, providing support, and run programs that support development utilization sediments, including can be done through ANT method. ANT is a conceptual framework for understanding and explaining complex interactions between every stakeholder interest in formation of social networks so that it can be known actors involved in utilization of sedimentation in Lake Rawapening (Sanudin et al., 2016). Research This aims to analyze the role and contribution of each stakeholder's interests in Lake Rawapening.

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Method

This study uses a qualitative approach. Qualitative research design is a research procedure to be conducted dig meaning, symbols, opinions, and objects research others of a natural quality and not mean to measure a certain degree (Sugiyono, 2021).

In general, the method used in this study is a survey in a qualitative way. Survey in a qualitative way It means a data collection method that focuses on observation, deep interviews, or group discussions. To get deep understanding about the experience, opinion, or behavior of respondents (Putra et al., 2024).

Data sources in this study taken from a number of Respondents including 18 key informants, 15 main informants, and 3 Supporter informants as primary data sources (Table 1). In addition, in order to support primary data, secondary data sources are also used including through data from scientific journal articles, proceedings, papers, assignments end (including Thesis, Dissertation, and Valid Internet Sources (Sugiyono, 2021).

Study carried out on a range July to by September 2024. Activities study held at Lake Rawapening Semarang Regency, Indonesia where election place study the as referring to Presidential Decree No. 60 of 2021 because height degradation environment consequence rate sedimentation.

Table 1. Informant Study

Informant	Agency	Amount (Person)	Information
Key Informant	Central Java Provincial Agriculture Service	1	Have in-depth information about
	Pemali Jratun River Basin and Protected Forest Management Center (BPDAS-HL)	1	regulatory policies and programs related to sediment utilization.
	Department of Agriculture, Fisheries and Food of Semarang Regency	1	
	Public Works, Water Resources and Spatial Planning Agency (PSDA) of Central Java Province, Banten District.	1 / 1	
	Ambarawa District, Tuntang District	1	Having a critical community-based view of natural data sources
	Non-Governmental Organizations (NGOs) or Community Organizations	1	
	Academics	4	Having knowledge relevant to the field of science but not directly focused on the utilization of sediment.
	Researchers	4	
	National Research and Innovation Agency	3	
Key informant	Fishermen dredging sediment	5	Having direct involvement in the utilization of sediment in Lake Rawapening
	Pemali Juana River Regional Office Sediment Collector	2	
Supporting Information	Student Executive Board of the Faculty of Animal Husbandry and Agriculture, Diponegoro University	3	Providing students' views on involvement in the use of sediment in Lake Rawapening

After the data is taken and pulled next done data analysis using Actor Network Theory analysis with Social Network Visualizer application version 3.1. More detailed, according to Callon (1984) socio-technical network analysis carried out through four mutual stages related from the translation process . The four stages are: problematisation, one or more actors formulate the problem; interest, all actors identified in the first stage are assigned roles; enrollment, the success of an activity to attract actors to be involved in solving a problem; and mobilization, when networks of actors are formed with stronger alliances

Use to see who just object research consisting of the most dominant informant influential in sediment utilization with a look at the Eigenvector Centrality (EVC) betweenness centrality (BC) closeness centrality (CC) data. analysis actors main with closeness centrality, betweness centrality (Carnia et al., 2021), and eigenvector centrality (Mulyani et al., 2022).

Eigenvector Centrality (EVC) is calculated centrality used To look for the most influential accounts with identifying influence accounts mentioned throughout the network, not only its influence to connected actors directly (Bonacich, 1972). Formula 1 calculate EC or Ec (n).

$$EVC(n) = X_i \frac{1}{\lambda} \sum_{j=1}^{n} A_{ij} X_j \qquad (1)$$

Where Aij is the neighboring matrix, n is the amount of stakeholder interest in sediment utilization, λ is dominant eigenvector values.

Betweeness Centrality (BC) is calculation centrality used to know the most influential actor, in distribution information based on as far as necessary, as connector in dissemination information network. Formula 2 calculate BC or Bc (n).

$$Bc(n) = \frac{\frac{\delta_{ij}P_k}{\delta_{ij}}}{N^2 + 3N - 2} \qquad (2)$$

Where $\delta_{ij}P_k$ is the number of shortest stages from the center of Node 1 stakeholder interests, while δ_{ij} is the sum of the sums of stakeholder interests in utilization sediment, and N is the amount of population in the amount of stakeholder interest in utilization sediment. BC values range from between 0-1, the more getting closer to 1 Good.

Closeness Centrality (CC) is calculated centrality used to know proximity actors in sediment utilization in Lake Rawapening. Measurement analysis This looks at the shortest distance between actors in the network. Formula 3 calculate CC or Cc(n).

$$Cc(n) = \frac{N-1}{\sum D_{ij}} \qquad (3)$$

Information: D as track relationship shortest between interest in utilization sediment i with j and N are amount member population stakeholder interest in utilization sediment.

Results and Discussion

Overview of Rawa Lake Dizziness

Rawapening Lake in a way experience is formed through the volcanic eruption process which flows basaltic lava and clogs Kali Pening flow in the Tuntang area. Rawapening Lake is located in the Semarang Regency area, covering 4 sub-districts that are Tuntang, Bawen, Banyubiru , Ambarawa , Central Java Province. In general geographical, Rawapening Lake is located at coordinates 7° 4' 00" South Latitude – 7° 30' 00'' and 110° 24' 46" East Longitude – 110° 49' 06" East Longitude. Lake Rawapening has a volume of 48.15 million cubic meters, an area of puddle lake of 1,850.10 ha with an elevation of $\pm$463. In addition, Lake Rawapening has a depth of 0.35 - 10 meters with an average of 2.17 meters. Also, it has a sedimentation of 778.93 tons / year with a sedimentation rate of 1.77 mm / ha / year with the current erosion rate of Lake Rawapening of 118.37 tons / year.

Function of Rawapening Lake

Rawapening Lake own function main in withhold rate surface water flow and storage flow the for various interest communities. This lake is used for various needs such as irrigation rice fields, raw water sources drinking, hydropower, control floods, tourism, fish farming with cages, and utilization of peat as compost.

Apart from being used as fulfillment needs of humans, Lake Rawapening also plays a role in the continuity of life of other creatures. According to Ravelia et al. (2021) it was stated that the fish fauna in Rawapening recorded 26 types, both original type and also introduction, and has been investigated since the 1930s. The types of fish that are native with Name location local are Tin Head fish, Tambakan, Gabus, Jeler, Wader Pari, Nilem, Kembo, Seribu, and Sili. While types of introduced fish are the Betok fish, Mountain Catfish, Siamese Goat, Swamp Goat, Tilapia, Red Tilapia, Black Tilapia, Catfish, Carp, Golden Tambra, Tawes, Atos Wader, Abang Wader, Mola, Koan, Gurami, and Eel.

Beside that, according to the Conservation Center Central Java Natural Resources stated in 2018 there were 23 types birds that can be found in Lake Rawapening (there are 13 types) water birds, 5 types protected birds based on Government Regulation Number 7 of 1999 concerning Types of Plants and Wild Animals, and there are 19 migratory birds).

Table 2. Types of birds found in Rawapening lake

Water Bird	Protected Water Birds Based on PP No 7 / 1999	Migratory birds
Casmerodius albus	Egretta intermedia	Casmerodius albus
Egretta garzetta	Alcedo coerulescens	Egretta garzetta
Ardeola speciose	Bubulcus ibis	Bubulcus ibis
Bubulcus ibis	Egretta garzetta	Ardea purpura
Ardea purpurea	Casmerodius albus	Alcedo coerulescens
Gallinula chloropus		Ixobrychus cinnamomeus
Egretta intermedia		Ixobrychus sinensis
Ardea purpurea		Ixobrychus eurhythmus
Nycticorax nycticorax		Egretta intermedia
Dendrocygna javanica		Collocalia linchi
Rostratula benghalensis		Centropus nigrorufus
Todiramphus chloris		Lonchura leucogastroides
Glareola maldivarum		Ardea purpurea
		Nycticorax nycticorax
		Dendrocygna javanica
		Rostratula benghalensis
		Lonchura punctulate
		Todiramphus chloris
		Cecropis striolata

Source: Central Java BKSDA, 2018

Reason Sedimentation of Rawapening Lake

Existence of ecosystem complex waters with various activities that are not controlled in their own right impact on the quality of the environmental waters. Water quality of Lake Rawapening affected by pollutant materials entering the body of water from which it originates from various sources. Source pollution can originate from flow rivers, garbage domestic public area lakes, tourism activities, agriculture and fisheries cultivation. Water quality in Lake Rawapening will become a determinant of the process rate and level of productivity of waters that can be produced.

Contents sediment dissolved in Lake Rawapening This own characteristics grains smooth containing organic compounds caused by decay water hyacinth goiter at the base waters, waste fish feed and waste House the stairs that enter to lake. Organic materials This can cause eutrophication, which is the process of increasing water fertility that encourages growth of aquatic organisms and usually has a negative impact on biota. Impact of eutrophication seen in Rawapening is potential increasing plant growth water hyacinth goiter in the inundation area of Lake Rawapening (Piranti et al., 2021).

The height nutrients that enter the lake body, especially nitrogen and phosphorus, become the reason for the height growth rate of water hyacinth goiter until difficult to control. Enter nutrients sourced from waste and agricultural activities that takes place in the DTA as well as remainder fish feed from cage net floating. Rawapening Lake has experienced the floating island phenomenon since the 1920s. Since that moment the problem of aquatic plants in particular water hyacinth goiter started to emerge. In 2005 it was observed water hyacinth goiter cover waters up to 65% even more, up to 70%, in drought season (Soeprobowati & Suedy, 2010).

Respondents' Characteristics

Respondents in the study This is informant key, informant main and informant supporters who are sampled from this study, picture about respondents who were made sample study categorized based on its characteristics that are type gender.

Based on Table 3 Respondent gender representation can influence perception of credibility in a significant way in various contexts, as proven by various research that shows that differences in perspective and experience between men and women can give more comprehensive insight (Clune, 2009; Toro, 2005).

Based on Table 4 balanced and inclusive representation various international institutions To prevent bias and increase legitimacy and public trust, so that create credible, fair and acceptable findings in a wide way (Daly & Lumley, 2005).

Based on Table 5 Representation education Respondents play role in credibility research findings. Research shows that the legitimacy of the informed form often exceeds respondents' level of understanding, so that causes concern about the ability to understand the study context completely (Ogloff & Otto, 1991).

Role and Contribution of Actors in Sediment Utilization

The community around Lake Rawapening, Semarang Regency, makes use of sediment at the bottom of the lake as an economic source to increase welfare. Potential sediment This has developed until entering micro markets in various areas. Sediment utilization needs to integrate various stakeholder interests so that the village's potential economy can develop further proceed by expanding business opportunities as well as increasing income and welfare house ladder.

This study found 59 perpetrators in utilization of sediment in Lake Rawapening, namely fisherman scraper sediment, preload sediment, collector sediment, producer distribution fertilizer from standard sediment material, BBWS Pemali Juana, PTPN IX, farmers vegetables, PT Berselingk Cipta Persada, cultivators mushrooms. Actors involved in utilization of Sediment in Lake Rawapening presented in Figure 1.
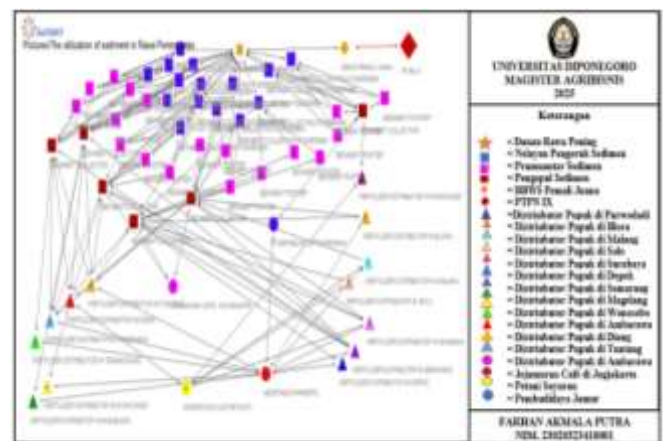

Figure 1. Actors Involved in Sediment Utilization in Lake Rawapening

Government plays an important role as a key component in determining formation and implementation of policy. This is to form economic policy through various institutional politics, which creates different economic environments that can give different results for stakeholder interests involved (Petrakis, 2020). Effectiveness This is often influenced by acceptance and resilience institutions, as seen in disaster management scenarios where compliance to the policies set policies is very important For achieving success (Riak & Bill, 2022). In addition, the relationship between government expenditure and taxation policy is very important to maintain economic stability, this thing shows the importance of a balanced approach in policy formulation (Fujisaki, 2016). Ultimately, synergy between involvement effective society and state institutions will grow conducive environment for successful policy, emphasizing the role of multifaceted government in forming and maintaining effective policies (Essien & Etuk, 2012).

Table 3. Characteristics of Respondents by Gender

Type Gender	Key Informant		Main Informant		Supporting informant	
	People	Percentage %	People	Percentage %	People	Percentage %
Women	7	38.9	2	13.3	0	0
Men	11	61.1	13	86.7	3	100
Total	18	100	15	100	3	100

Table 4. Characteristics of Respondents Based on Type of Institution

Agency	Key Informant		Main Informant		Supporting informant	
	People	Percentage %	People	Percentage %	People	Percentage %
Government Agency	7	38.9	2	13,3	0	0
Educational Institution	4	22.2	0	0	3	100
Research Institution	3	16.7	0	0	0	0
Community Social Affairs Agency	4	22.2	0	0	0	0
Not tied to an institution	0	0	13	86.7	0	0
Total	18	100	15	100	3	100

Table 5. Characteristics of Respondents Based on Education

Education	Key Informant		Main Informant		Supporting informant	
	People	Percentage %	People	Percentage %	People	Percentage %
SMA/SMK	3	16.67	14	93.3	3	100
D2/D3	1	5.56	1	6.7	0	0
S1	5	27.78	0	0	0	0
S2	5	27.78	0	0	0	0
S3	4	22.22	0	0	0	0
Total	18	100	15	100	3	100

Institutions Utilization Sediment

Utilization of sediment in an institutional way refers to systematic management and use of source Power sediments, especially in contexts such as reservoir areas and irrigation areas. Effective sediment management can change sediment from A not quite enough answer into A source of power, so that increases economic, social, and ecological benefits. These things in line deep study previously stated that institutional play important role in comprehensive evaluation framework for utilization sediment in the Yellow River and its utilization sediment own aspect social benefit bigger than economic profit directly (Hou & Wang, 2017). In addition, the concept source-oriented water management Power proposed for optimizing sediment allocation in the irrigation area, overcoming challenges in practice technology and management (Qing et al., 2007). In addition, institutional support for utilizing sediment can be obtained from training in source management of mineral resources, which emphasizes the importance of responsive institutions for maximizing the benefit of natural power sources for society.

Association in utilization of Sediment of Rawapening Lake called the Sedyo Association Standing pillars since in 2017, however, when This is the Sedyo Association Pillars Already No active since 2020 due to lack of effective member participation in organization, thing in line with what was expressed former deputy chairman of Paguyuban Sedyo Pillars.

According to I as deputy chairman community moment community Still active 2019 existence community is very important for help sale sediment and provide capitalization through business save managed loans group as well as training for increase mark sell , but moment This Already No active since 2020 because not effective enough in program governance and implementation and members not participating enough in association, when This if There is deliberation about utilization of sediment at the social gathering citizens, the hope a moment There is an institution like this for helping us.

Based on matter mentioned that community must turn on return Because to choose very important role in development business utilization sediment. This is in harmony from various previous studies that groups or communities can increase capacity through exchange knowledge, facilitating access to source power and assistance, as well as strengthening bid positions in marketing. In addition, encouraging solidarity, independence and welfare of farmers through collaboration and social support, as well as promoting sustainable agricultural practices, so that contributes to the improvement of farmer productivity and quality of life in an overall way (Ekowati et al., 2020).

In order to turn on return existing associations, all participating members must own awareness of the importance of each member's contribution. Every member of the farmer group plays a role as well as being active in activities in the farmer group will give different contributions depending on involvement in solving problems faced and deep every activity in the group. The ideal Gapoktan is in accordance with the demands of the future organization can be formed through support resource quality human beings.

Fisherman Sediment Scraper

Dredging sediment plays an important role in environmental management and fishing practice. Activities dredging, which is often required for looking after water channel, can in a way No on purpose affect fish habitat and sediment quality, which is very important for sustainable fishing. This is in tune in a study previously stated that implementation of an intelligent dredging management system can optimize dredging operations, minimize ecological disturbance, and ensure sediment disposal is done in an efficient and environmentally friendly way (Shah, 2024). Apart from that, dredging equipment specially designed for fishing can increase sediment extraction efficiency at a time reduce impact to ecosystem waters. However, it is important to consider the implications of dredging to dynamics nutrition; research shows that dredging can in a significant way reduce the rate of phosphorus release in the land restored wet, so that the potential increases water quality and provides benefits for fish population (Oldenborg & Steinman, 2019). Therefore, although dredging is very important to guard waters that can be navigated, managed must balance health ecology with the needs of the fisheries industry (Ferrans et al., 2022).

Fisherman sediment scraper is employee of sediment collector who has wages Rp. 90,000 per day. usually fisherman scraper sediment transport sediment in Lake Rawapening with a boat with a normal capacity for goods as much as 3 cubic and 2 liter engine, but to increase efficiency journey so that transport load sediment into the boat as much as 4-5 cubic meters. This is in line with what was expressed by the fishermen sediment scraper.

"I usually leave for take sediment starting at 5 o'clock so as not to hot and cold ashore back at 9am, usually normal boat load can only be 3 cubic, but for efficiency and pursuing order targets so that sometimes The boat's load is 4 -5 cubic meters, usually 1 boat is managed by 1 person with wages Rp. 90,000 each depart and ship This Not owned by I, however owned by Mr. Ag (collector) sediment) because I no cost for buy ship, in security take sediment yes like this is it sir (no) wearing footwear, no wearing a protective helmet and safety gear). During the day until the afternoon I catch fish in the lake with spice the fisherman usually I get 1 to 3 kg of fish per day.

Fisherman scraper sediment there are those who have been in the profession for a long time with experience more than 20 years, there are also fishermen scraper with age range 15-20 years-experience, but there are also those who become fisherman scraper not quite from 15 years. One of the informants who became fisherman scraper not enough from 15 years (SA) has experience Work as coolie building Then choose to become fisherman scraper sediment.

All over fisherman Sediment in Lake Rawapening No have your own boat for do activity taking sediment and get wages directly from collector sediment in accordance with how many boats arrived to land return.

Porter Sediment

Sediment porter is employee of sediment collector with own wages Rp. 90,000 per day / person. Porter sediment transport sediment from the boat to place collection sediment in a group of 3 people per group. The porter sediment transport sediment from the boat to place collector sediment use the basket around it Already There are holes so that moment collection sediment, water can go down to lower for reduce load and can speed up reduction water level in place transportation for distribution sediment to a number of distribution fertilizers in various areas.

"I am carrying sediment from the boat to place this (collection) sediment) from 9 am to transportation all over the load of 3 boats have been transported to place this, I suppose I finished at 2 pm, in security take sediment I Enough it's safe bro because provided Booth shoes and protective helmet However sometimes I am vulnerable hit by a motorbike due to from the boat to place sediment collection pass highway.

We transport sediment from the boat to place sediment collection in groups of 3 people per group with wage Rp. 90,000 per person/day until all overload sediment on the ship is finished. We transport sediment from the boat to place sediment collection with use basket This is it, sir (a basket with holes) what are the benefits? basket perforated so that water can go down to lower for reduce burden carry and can speed up reduction of water level in place collection for distribution of sediment to a number of distribution fertilizers in various areas.

Sediment Collector

Collector Sediment in Lake Rawapening Already there are those who have professions since 1985. It started from seeing the opportunity Rawapening Lake economy in the form of sediment that can be processed into various products like fertilizer and baglog

Mushrooms. Sediment collectors play a role in collecting, managing and utilizing sediment carried from upstream and settled at the bottom of the lake. Sediment collector owns a number of salaried employees as sediment porter and sediment scraper fisherman.

Raw sediment from Lake Rawapening sold by collectors with price Rp. 900,000 per truck, where the truck with 10 cubic capacity is provided by the buyer, so the seller accepts the clean price without additional costs. In the process of taking sediment, ship carrier own normal capacity 3.5 cubic meters, but to meet revenue targets, ships can be loaded up to an average of 5.5 cubic meters. Each boat worth Rp. 8 million and equipped with machine capacity 2.5 liters, which costs reach Rp. 5 million.

"I opened business at first from Mother I was in 1985, back then he had 12 boats for taking sediment with every normal boat can transport with a capacity of 3.5 cubic meters, but most for chasing order sediment, boat can 9 cubic capacity with machine 2.5 liters, 1 liter of diesel costs Rp. 6,800. at the moment This mother's boat I gave to her children (me, sister, and brother) to continue this profession, according to I taking sediment is very profitable Because every consumer purchases with price net Rp. 900,000 per truck with truck cost from buyers, as well as if purchased in a retail way 1 cubic valued at 95,000".

"At the moment sale sediment only the raw ones (not yet) processed become fertilizer and baglog for

cultivation mushrooms) and the average collector in the area here Already distributed to a number of areas for supply needs in various areas like Malang, Surabaya, Dieng, wonosobo, city Semarang, district Semarang, Depok, Bandung, Yogyakarta, Magelang, and Temanggung".

"Before me and uncle I sell sediment raw to Bandung, Depok and surrounding areas Semarang, but For this moment I only sell to around Semarang and uncle I sell to PT Berseling for mixture fertilizer Phosphate and around Semarang just me have 3 ships and uncle i 5 ships with capacity of 6 cubic meters each".

"I sell raw sediment to Malang, around Semarang and Surabaya only with 5 ships just with a maximum capacity of 6 cubic per ship".

Determination of Main Actor

Determine actors playing in utilizing Sediment in Lake Rawapening is very important To understand roles and responsibilities answer each party as well as ensure The success of the designed strategy. Data analysis *of Eigenvector Centrality* (EVC), *Betweenness Centrality* (BC), and *Closeness Centrality* (CC) was used to identify main actors. EVC, also known as Gould index, expands draft centrality degrees by giving comparable scores with scores of its neighbors. A node can have high EVC if its own lots bond or are connected with other nodes that also have high EVC (Bonacich, 1972). AVC scores are presented in Table 6.

Table 6. Eigenvector centrality score

Node	Label	EVC	EVC'	EVC"	%EVC'
4	Sediment Collector	0.247189	0.789944	0.039728	78.994420
5	Sediment Collector	0.312920	1.000000	0.050292	100.00000
6	Sediment Collector	0.065837	0.210395	0.010581	21.039516
7	Sediment Collector	0.254523	0.813381	0.040907	81.338087
8	Sediment Collector	0.272000	0.869233	0.043716	86.923290
9	Sediment Collector	0.214284	0.684787	0.034440	68.478685

Betweenness Centrality (BC) to measure an actor's ability to control or mediate connections between partner actors who are not connected in a way directly. The higher the BC score, the more strategic position the

actor in the network, so that the greater its potential for controlling interactions that occur (Watts & Strogatz, 1998). BC scores are presented in Table 7.

Table 7. *Closeness centrality* score

Node	Label	BC	BC'	%BC'
4	Sediment Collector	427.505704	0.129312	12.931207
5	Sediment Collector	449.159748	0.135862	13.586199
6	Sediment Collector	335.303504	0.101423	10.142272
7	Sediment Collector	540.712510	0.163555	16.355490
8	Sediment Collector	449.510187	0.135968	13.596799
9	Sediment Collector	434.159542	0.131325	13.132473

Table 8 *Betweenness centrality score*

Node	Label	CC	CC'	%CC'
4	Sediment Collector	0.007353	0.426471	42.647059
5	Sediment Collector	0.007463	0.432836	43.283582
6	Sediment Collector	0.006250	0.362500	36.250000
7	Sediment Collector	0.007519	0.436090	43.609023
8	Sediment Collector	0.007353	0.426471	42.647059
9	Sediment Collector	0.007246	0.420290	42.028986

Closeness Centrality (CC). The bigger the CC score, the closer an actor (node) to other actors (nodes) in A Network actor . Proximity physique or proximity distance will give diverse profits to an actor. For get information more early, more quickly carry out the exchange process, and can communicate directly with other actors without intermediary (Watts & Strogatz, 1998). CC scores are presented in Table 8.

Based on Table 6, 7, and 8 that collector sediment is stakeholder the most dominant interest in utilization of Sediment in Lake Rawapening because of own attachment the widest network and total data percent Highest EVC, BC, and CC compared to other interest stakeholders.

Conclusion

Government as determinant of formation and implementation of policy; institutional utilization sediment currently No active role as coordination and synergy between stakeholder interests; fishermen scraper sediment as taker sediment; porter sediment as service between from the boat to place sediment collection; sediment collector as a distributor of standard materials and management of the sediment collection process; and distribution of fertilizer as connector between producers and farmers. Actors with the highest EVC in utilization Sediment in Lake Rawapening is collector sediment at node 5 becomes the most important actor with 100% EVC because of wide involvement with various parties. Fertilizer distributor from Purwodadi and Ambarawa followed in second position with EVC 87.51%, while coolie transport sediment recorded the lowest EVC (0%). The collector at node 7 had the highest CC score (43.61%) and the Collector Sediment of Rawapening Lake was capable of control 39.45% (BC score = 39.45).

Author Contributions
The authors listed in this article have contributed to the preparation of the article. The authors have read and approved the publication of the article.

Conflicts of Interest
The authors have no conflict of interest in writing this article

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