The interrelation between actors in the hydrological function of green open space

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Abstract. The potential for real integration of Blue Open Space (BOS) in urban areas into the GI section is quite significant. Because of that, an understanding of the public, policymakers, academics, and professionals about the vulnerable and complex aspects of hydrology, especially groundwater resources, which are essential things done. This study using a qualitative method used for data collection through in-depth interviews. The role of institutions in the planning and management of Green Open Space (GOS) for hydrological functions that act as storage of water reserves and flood control knew by the interviews. The stakeholders came from the Central Government and DKI Jakarta Provincial Government with a total of 10 informants but the other names that come up from the interview added to the analysis process, so the total become 13. Blackbox on this network is the importance of the concept of integrating GOS with BOS in helping minimize Jakarta floods.

1. Introduction

The ecological function of GOS are for groundwater storage, which is influential in reducing the urban heat island phenomenon [1] and as one of the aspects of the city's sustainability, which is support the hydrological recycling and air quality[2]. Now, when comparing GOS to commercial, industrial, and residential land use, the availability has less presence. Therefore Green Infrastructure (GI is one of the crucial transitions in providing ecosystems in urban areas and is an essential component in sustainability [3]. The study explains that the potential for real integration of blue open space in urban areas into the GI section is quite significant[4]. However, in practice, functional and institutional aspects play an important role related to structural connectivity.

Furthermore, an understanding to the public, policymakers, academics, and professionals about the vulnerable and complex aspects of hydrology, especially groundwater resources, which are essential things done[5]. The implementation of sustainable consumption management will achieve if it has done. For example, municipal governments in the United States are actively investing in water resources and making policies for patterns in using water and limiting reactions to environmental, social, and economic pressures[6]. Based on the socio-economic conditions that need to be analyzed is the role of institutions that are related to regional apparatuses in the Provincial Government of DKI Jakarta in the planning and management of GOS which concern to the hydrological aspects of the city of Jakarta.

Social Network Analysis (SNA) is the linkage of actors between individuals or organizations[7]. The SNA assumes that dynamic structures play an essential role in understanding the behavior that observed and the results such as 1) relationships between individuals, 2) the impact of beliefs and actions, 3) access to resources, and 4) results based on a various socially constructed mechanism[8].
Using Actor Network Theory (ANT) in urban research to do the practice in terms of restrictions can be more explicit; thus, the consequences can obtain [9]. While the study said that ANT could trace the network relations between good actors that influence or are influenced by other actors [10]. The core elements of ANTb [11] are 1) actors consisting of humans and non-humans (something that can identify or abstracted has the same position in the analysis process [12], 2) Emphasizing the translation process between actors, 3) Emphasizing the process of searching the network and 4) suspicion of the power of itself such as the concept of "social," "social structure" and "society." The truth of the use of the ANT method is the recognition of the superiority of the mediation process [11].

2. Methodology
The method used in this study is a qualitative method used for data collection through in-depth interviews. These interviews aim to know the role of institutions in the planning and management of GOS for hydrological functions that act as storage of water reserves and flood control. The results obtained from in-depth interviews will be processed using the coding category, namely the results of the same or almost the same answers, and then grouped into the same category. For the analysis of GOS planning and management data on hydrological aspects, the analysis used is a policy analysis using ANT through in-depth interviews and then processing it using UCINET software [13].

The concept of ANT uses an exclusive social network analysis software called UCINET. It is conducting the analysis, which has the purpose of mapping relations provocatively and illustratively [14]. UCINET 6 is one of the social network analysis tools that are easy to use and has a broad reach in conducting analysis choices [15]. NetDraw one of the tools in UCINET has functions in making images of sociograms and sociometry after data entry is complete. The depiction of the relationship between stakeholders at UCINET indicated by values 0 and 1. Number 0 shows no interrelation between parties, while number 1 shows the opposite, namely interaction between stakeholders [16]. A positive relation is represented by a value of 1 while a neutral relationship with the number 0 [17].

The population in this research are cross-sectoral stakeholders involved in the planning and management of GOS related to hydrological functions. The total population of 11 informants representing each agency and the Regional Work Unit (SKPD) related to research namely the Ministry of Agriculture and Spatial Planning/National Land Agency (ATR/BPN), National Development Planning Agency (BAPPENAS), Groundwater Conservation Agency - Geological Agency of the Ministry of Energy and Mineral Resources (BKAT-ESDM), Ministry of Environment and Forestry (KEMENLH), Governor through the Deputy Governor for Spatial Planning and the Environment (DEPGUB-BTRLH), Department of Parks and Urban Forests (DPHK), BAPPEDA, Department of Human Settlement, Spatial Planning and Land Management (DCKTRP), Water Resources Department (DSDA), Environmental Agency (DLH) and Industry & Energy Department (DPE). The number of samples taken from the population uses a total population sampling technique, which is the type of purposive sampling by selecting the whole of the population.

3. Result and discussion
The results of the institutional social analysis of the stakeholders through in-depth interviews produce an analysis of the actor, his role in the network, and problems that arise.

3.1. Identification of actors
The stakeholders identified in this study through in-depth interviews came from the Central Government and DKI Jakarta Provincial Government with a total of 10 informants, consisting of ATR/BPN, BAPPENAS, BKAT-ESDM, KEMENLH, DEPGUB-BTRLH, DPHK, BAPPEDA, DCKTRP, DSDA, and DLH. At the end of 2019, the DPE merged with DSDA so that the number of agencies becoming informants changed to 10. Although the interview was conducted with ten informants, the other names that come up from the interview added to the analysis process. The other actors are the Directorate General of Water Resources - Ministry of Public Works and Public Housing (DITJEN SDA-KPUPR), Development and Environment Bureau (BPLH), and private parties
(INISIATOR). The following are excerpts from the results of in-depth interviews with resource persons from Bappenas related to the involvement of the DITJEN SDA-KPUPR on the GOS functions:

“...BAPPENAS is also looking for a model. It means that it is still encouraging that the Government, the regional Government may then include Public Ministry if there are projects about parks or settlements, the parks are not only functioned for green open spaces, but also blue open spaces...”

An informant from BKAT-ESDM mentioned the linkage of the DITJEN SDA-KPUPR in the GOS hydrological function:

"... that is, in PUPR, the manager of surface water. The Great Hall of those in Ciliwung that might be asked there, what are their programs for that ... ".

The explanation from the BKAT-ESDM informant is related to the duties and functions of DITJEN SDA-KPUPR [18], which are:

1. Formulating policies in the field of conservation and utilization of water resources;
2. Controlling water damage in surface water and utilization of groundwater;
3. Implementing policies in the management of water resources that are integrated and sustainable, and;
4. Preparing standards, norms, criteria, and procedures in the field of water resources management.

The informant from BAPPENAS in the following interview excerpt stated that the participation of the INISIATOR to support the urban hydrology function in general regarding groundwater storage could be taken into consideration when making policies:

“......They have to be able to collect water of how many m³ is that or actually from the side of the policy which is the easiest mm. So, if we are forced to develop a region, the developer must be able to accommodate 100 mm of rain. Well, later on, it will be easy, how much area are they, how many millimeters of rain, let them find a method. Should it be in the form of conservation, should it be in the form of a shelter....”.

3.2. Identify network links between stakeholders

The depiction of stakeholder relationships is represented by values 0 and 1, where are 0 indicates no relationship between the parties, and number 1 shows the interaction between the stakeholders’ relationship.

The initial preparation undertaken to support the implementation of in-depth interviews is to look for information related to the main tasks and functions of the stakeholders to support further the information provided when the in-depth interview. The results of the in-depth interview will be processed using the UCINET software version 6.699 on Windows devices.

Scoring for ten stakeholders is carried out in Excel format plus three stakeholders based on information from the resource persons, namely DITJEN SDA-KPUPR, BPLH, and INISIATOR in the form of tables which have 13 rows and 13 columns. The results from the data will copy in the Matrix Editor section at UCINET. The network of the 13 stakeholders is then described by NetDraw (Figure 3.1) to illustrate the pattern of the interrelationships. Betweenness and Degrees Centrality will use to analyze the network.
3.2.1. Degree Centrality. To find out the most connections (linkages) of an actor, UCINET conducts a Degree Centrality analysis that will produce Indegree and Outdegree. In this case, the relationship between actors shown in the value of Outdegree (the relationship that comes out to establish relations with other actors). At the same time, Indegree is the relationship that leads to actors from other actors in the network. Outdegree and Indegree Normality uses to assess the distribution spread out of data on the network.

Table 1. Actors with the highest Degree Centrality.

|        | Outdegree | Indegree |
|--------|-----------|----------|
| DCKTRP | 9,000     | 8,000    |
| DSDA   | 9,000     | 8,000    |
| DLH    | 8,000     | 7,000    |

Descriptive Statistics

|        | Mean  | Sum   | Maximum | Minimum |
|--------|-------|-------|---------|---------|
| Outdegree | 6,000 | 78,000| 9,000   | 4,000   |
| Indegree | 6,000 | 78,000| 8,000   | 4,000   |

Network Centralization (Outdegree) = 27.083%
Network Centralization (Indegree) = 18.056%

Based on the results of this analysis (Table 1), the highest value of Degree Centrality is in the DCKTRP and DSDA actors with Outdegree and Indegree values of 9,000 and 8,000. Outdegree value that is greater than Indegree and Outdegree Normality value that is greater than Indegree Normality indicates that in the analysis of the relationship, the cooperation coming out of DCKTRP and DSDA is higher than the incoming relationship.

Figure 2 illustrates two stakeholders who tried to communicate with nine actors in the network, and each of them was contacted in collaboration with eight other actors. The average value of Indegree and Outdegree actors in the network is 6,000. This value means that each stakeholder interacts with six other actors in this network with the value of Network Centralization Indegree and Outdegree of 18.056% and 27.083%.
The DCKTRP analysis value in occupying the highest Degree Centrality value is supported by informants from DSDA in in-depth interviews as follows:

“...We study first when it makes a polder. For example, this area is often flooded, then we examine it with a polder system. Locations in these areas may be congested, so we have to free up land, the first coordinate with DCKTRP then changes to Blue Open Space (BOS) or trace. So the process is long. We must first go to DCKTRP, we make a study first, after making the study we determine the extent, we determine where the money goes....”

The informant from BKAT-ESDM also mentioned the involvement of cooperation with DCKTRP and DSDA about groundwater conservation issues, as follows:

“...for water issues, we cooperate with all stakeholders in the groundwater sector for Jakarta, such as the DPE, often with DCKTRP there is joint coordination...”

The role of DCKTRP in the hydrological concept is mentioned implicitly by informants from DEPGUB-TRLH, through the role of one of the spatial instruments, which is the authority of DCKTRP, namely RDTR:

“....we already have in the spatial planning regulations, we have Zero Run Off, have many things. The way we collect water so that it might reduce the runoff....”

In the RDTR mentioned, one of the objectives of drainage infrastructure includes adding a BOS ratio of at least 5% and in receiving excess water when there is high rainfall through the optimization of GOS. An informant from DCKTRP in his interview citation stated that related to holding back the stormwater coordination with DSDA is the must:

“...If all this time, the average Polder is functioning to collect water, delays water, so that is indeed our coordination with DSDA...”

Excerpts from BAPPEDA’s statement about the GOS hydrological function, namely involvement in action plans to accelerate regional strategic activities, namely Taman Maju Bersama (TMB) development:

“....the concept of integration of GOS-BOS, I feel that we have only just done it recently. That the groundwater must be absorbed and stored as much as possible. However, related to land acquisition, this year already exists in F8KKSD..”
In Format 8 of the Regional Strategic Activity Column (F8KKSD), DCKTRP plays a role in the arrangement of the park while DSDA revitalization, planning, and structuring it. Both of them are involved in the preparation of the RTH Master Plan 2030. For DCKTRP linkages also mentioned by the informant from DLH in this case policy making to improve water reserves in GOS, which are as follows:

"...For those who have small land but there is a fixed obligation to make water catchment, for example, infiltration wells. We are more that way to increase water reserves; it is hoped there will be no pavement. If there is pavement, is it after 3 meters? Because what happens is allowed more is the basement model. This means that the function of the plant is how far it should be absorbed, then how far is it able to absorb water..."

An informant from DPHK stated that the linkage of DCKTRP in the implementation of GOS was in the adjustment of the trace (location determination) related to land acquisition.

3.2.2. Betweenness Centrality
In this analysis, we will get the value of Betweenness and nBetweenness (Normality Betweenness). Betweenness defines as an actor who controls information or has a role as a facilitator in disseminating information on this network.

|                | Betweenness | nBetweenness |
|----------------|-------------|--------------|
| DSDA           | 15,452      | 11,706       |
| DCKTRP         | 13,119      | 9,939        |
| DLH            | 12,753      | 9,661        |

Descriptive Statistics

|       | Mean | Sum  | Maximum | Minimum |
|-------|------|------|---------|---------|
| Mean  | 6,231| 81,000| 15,452  | 0,167   |
| Sum   | 4,720| 61,364| 11,706  | 0,126   |

Network Centralization Index = 7.57%

The Betweenness Centrality value of 7.57% indicates the lack of centrality that acts as a facilitator in the network. DSDA is a stakeholder who can be the highest facilitator to other actors who are not directly related, or other stakeholders can pass DSDA to be able to relate to other actors.
Based on Figure 4.5 and Table 4.12, DSDA is a facilitator for the most strategic stakeholders related to the hydrological function of Jakarta's GOS, although not as a single strategic actor. This is in accordance with one of DSDA's tasks[19] that is facilitating the maintenance, construction, and supervision of infiltration wells and providing technical recommendations related to soil conditions. Another thing that supports DSDA as the most strategic facilitator is organizing the revitalization and construction of water resources infrastructure with the concept of naturalization. DSDA, together with DCKTRP evaluating the development of the naturalized area.

DCKTRP as a potential facilitator in supporting the hydrology function of the Jakarta GOS because of assignment for 1) supervising infiltration wells in Jakarta's government buildings; 2) determining the location and adjusting the alignment in the revitalization or construction of water resources infrastructure with the concept of naturalization, and 3) reviewing and evaluating the development of the area to be naturalized. BAPPEDA, as a potential facilitator, further supports the GOS hydrology function through the establishment of an Action Plan for accelerating regional strategic activities, namely the development of the TMB and the GOS. BAPPEDA involved as a related stakeholder in land acquisition, planning, development, spatial planning, and increasing the number of plants with DPHK as the person in charge of activities. The TMB and RTH development also supports the DSDA work procedures, namely the management of clean water and its development, and establishes groundwater conservation zones in groundwater basins.

One of the roles of DLH[20] is related to the realization of implementation related to climate change mitigation is the green belt reforestation policy through the creation of a GOS so that it can act as a carbon binder. The other role[21] is joining the team that identifies and formulates problems related to water resources infrastructure in buildings and housing. DPHK plays a role in the construction and management of infiltration wells at the park and cemetery locations and related to naturalization activities, for the maintenance and management of natural resources infrastructure in the aspects of managing GOS, the budget burden is in the DPHK budget implementation document.

For stakeholders with the lowest intermediate position related to GOS hydrological functions, there are INITIATORS, while the second-lowest is BPLH. For the role of BPLH mediation based on a network interaction matrix within the DKI Jakarta Provincial Government, this actor has a significant intermediary role because it has a relationship with all other actors. However, when communicating
with the central government level, several stakeholders can relate directly to the central government actors, so it makes a decrease in the level of BPLH.

BKAT-ESDM is one of the potential alliances because of its duties and functions on the conservation of Jakarta's groundwater so that it has a close relationship with GOS. DPHK as a potential alliance because it has duties and functions in parks and forestry so that most of the GOS is under its supervision. KEMENLH is the highest level at the national scale in environmental management, which is a part of groundwater conservation through GOS. INITIATORS are an inherent part of an alliance because they can submit proposals for regional development.

**Table 3. Summary of Key Stakeholders in the Hydrological Function of RTH Jakarta.**

| Network          | Key Actors | Enabler     | Potential Alliance |
|------------------|------------|-------------|--------------------|
| Jakarta Capital City Government | DSDA       | BAPPEDA     | BKAT-ESDM          |
|                  | DCKTRP     | BAPPENAS    | DPHK               |
|                  | DLH        | ATR/BPN     | KEMENLH            |
|                  |            | DITJEN SDA-KPUPR | BPLH             |
|                  |            |             | INISIATOR          |

For non-human aspects involved in the hydrological function of Jakarta's GOS are as follows:

1. Law of the Republic of Indonesia No. 26/2007: Spatial Planning
2. Law of the Republic of Indonesia No. 17/2019 concerning Water Resources
3. Republic of Indonesia Government Regulation No. 43/2008 concerning Groundwater Enterprises
4. Regulation of the Minister of Home Affairs of the Republic of Indonesia No. 1/2007 concerning the Arrangement of Urban Green Open Spaces
5. Regulation of the Minister of Public Works of the Republic of Indonesia No. 5/2008 concerning Guidelines for Provision and Utilization of Green Open Space in Urban Areas
6. Provincial Regulation of the Special Capital Province of Jakarta No. 1/2012 concerning Spatial Planning for 2030
7. Provincial Regulation of the Special Capital Province of Jakarta No. 1/2014 concerning Detail Spatial Planning and Zoning Regulations
8. Regulation of the Governor of the Special Capital Province of Jakarta No. 162/2012 concerning the Direction, Policy, and Strategy of Water Resources Management
9. Regulation of the Governor of the Special Capital Province of Jakarta No. 20/2013 concerning Infiltration Wells
10. Regulation of the Governor of the Special Capital Province of Jakarta No. 31/2019 concerning Development and Revitalization of Water Resources Infrastructure Integrated with the Concept of Naturalization
11. Regulation of the Governor of the Special Capital Province of Jakarta No. 141/2019 concerning Development of Naturalization Areas for Rivers, Rivers, Reservoirs, Embungs and Situ
12. Decree of the Governor of the Special Capital Province of Jakarta No. 2388/2017 concerning the Coordination Team for the Control of Groundwater Utilization
13. Decree of the Governor of the Special Capital Province of Jakarta No. 279/2018 concerning the Integrated Supervision Team for the Supply of Infiltration Wells and Installation Wastewater Treatment And Land Water Utilization In Buildings And Housing
3.3. Identification of network interests

Several things require more intensive coordination regarding joint management for areas that have a GOS and BOS together. Some stakeholders are having a role in improving the hydrological function of Jakarta's GOS. DSDA has an essential role based on its duties plays a role in the managing and development of polder systems, controlling floods, managing and developing clean water, establishing groundwater conservation zones in Jakarta's groundwater basin, monitoring land subsidence and carrying out a land acquisition. These duties were supported by informants from DSDA in in-depth interviews as follows:

“... For DSDA, GOS is one of the reasons for the focus on raw water conservation in catchment wells.”
“... Because we are conserving hydrology for flood control so that it is sustainable...”
“...The assets are still DSDA assets, but only the absorption wells, the management. So the management is still DSDA if the land is still the owner of the GOS ...”
“......If we clash with the land for green or arguably a park, we try not to. Because we also do not want to cut down trees, right? Because also, the bureaucracy is difficult...”
“....Let's study first; we want to make Polder. For example, this area continues to flood, and we continue to examine, better with a polder system. Automatically if the area is dense, then we must free the land, first coordinate with DCKTRP, trace. So the process is long. We must go to DCKTRP, we make a study first, after making the study we determine the extent, we determine where the money goes....”

The statement of the DSDA informant was also supported by the DSDA joining the integrated supervision team in providing infiltration wells as well as the team in controlling groundwater utilization. Not only active to facilitate the procurement of infiltration wells but also with DCKTRP and DPHK supervise so that the presence of infiltration wells can run optimally.

Besides DSDA, DEPGUB-BTRLH said that in the implementation of the integration of GOS and BOS, sometimes more coordinated intensive are needed, with the following quotation:

“...this one area is DSDA land. Yes, it is not possible DSDA uses all, there must be edges. Then we say DSDA is not planting ... DPHK said, "we will plant later, we will use our budget; for example, buying trees planted on the assets of other parties." The assets are DSDA, then DSDA does not want either. Later, if the plants grow, we cannot dope, then make an MOU. In the end, make the governor's instructions...”

For obstacles that were conveyed by DEPGUB-BTRLH informants, the coordination between stakeholders is needed, so the implementation of GOS with BOS, which is the concept of naturalization, can be implemented. Jakarta's Government has tried to bridge this obstacle by stipulating that revitalization and infrastructure development related to the naturalization concept are being on the DSDA expenditure budget. When DCKTRP has to adjust trace, DPHK has a duty in the maintenance and management of water resources, including what aspects of GOS management. Water quality monitoring and waste management activities are in the DLH budget. BAPPEDA and BPLH assist monitoring in the implementation of revitalization and development.

Informants from the DPHK think that related to coordination with DSDA in the implementation of the integration of GOS and BOSs are as follows:

“...if for the big ones, they have consultations, if I am not mistaken, there are consultations that involve, but the form is a coordination meeting or something like that, and usually if for example, it is big, that is a special concern. it is usually rather intense...”

DPHK also stated that in the integration of GOS and BOS, there is also something that should do independently because the location is a DPHK's asset:
“So we from DPHK in building parks, at the most, there are observations but internally, not too deep. Well, before 2017, We were already aware of water, and we tried to implement Zero Run Off. At least if there is water in our land, we do not release it to other places, as much as possible like that. In the south area, that means much water, and our land is also mostly in contact with a body of water, river, or river, at the pond like that, fishing. We treat it as it was originally; for example, there used to be a pond; yes, we made a tree there. So there is a pond, yes, there is another pond, but the form is updated and added with other facilities…”

The existence of Blackbox in analyzing the GOS hydrological function is needed. Blackbox is another element of the subject that received by each stakeholder in the network. It also defined as the knowledge that has been embedded without any debate and questions. Based on the results of in-depth interviews conducted for the existence of a BlackBox on this network is the importance of the concept of integrating GOS with BOS in helping to minimize Jakarta floods.

4. Conclusion
For interaction patterns in the GOS hydrological function in Jakarta, it found that DSDA, DCKTRP, and DLH were key actors and BAPPEDA as a link. For Betweenness Centrality, it obtained the results of an analysis of 7.57%, which showed very weak centrality in this network, which acted as a facilitator. The obstacle found in the network is the lack of integrated coordination among stakeholders. Blackbox on this network is the importance of the concept of integrating GOS with BOS in helping minimize Jakarta floods.

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