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Actor-network theory approach for urban green spaces planning: Study in Jakarta Capital City, Indonesia

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Abstract

Urban Green Space (UGS) is an element of sustainability for urban areas. Rapid urbanization and population growth in Jakarta have led to UGS decline. Considering the many functions of UGS for urban sustainability explored in prior research, it is important to have a more in-depth analysis of stakeholder interaction to improve UGS planning and management. This study investigated the pattern of stakeholder interaction to draw institutional frameworks in formulating the UGS Master-Plan (UGS MP) in the DKI Jakarta Provincial Government (DJPG). This study conducted in-depth interviews with 24 informants from the DJPG, developers, academics, NGOs, and professionals. Actor-Network Theory (ANT) with UCINET network analysis software was utilized to map interactions networks between actors. Based on ANT's analysis, the key actors are the Governor, Forestry Agency (FA), and Spatial Planning Agency (SPA) of the DJPG. The 'betweenness' centrality in this network is 26.75 percent, indicating the weak centrality as a facilitator on the network. The facilitators must increase the role of their connections with other actors outside the local government so that the formulation of the UGS MP can be carried out properly. The results of this study can be used as input and recommendations to the Central Government and Local Governments in the formulation of the Master-Plan with the ANT approach.

Introduction

Urbanization has increased rapidly in Jakarta, causing changes in the urban landscape. The change in the urban landscape is the conversion of green land into built land in Jakarta (Setiowati et al., 2019). Urban parks play an essential role in improving the quality of city life and require a sustainable planning approach (Bahriny & Bell, 2020; Chiesura, 2004). Previous research on the Djakarta Master-Plan in 1965–1985 observed that green space areas were converted into residential and commercial areas (Nurbaya, 2015). The amount of UGS based on the Jakarta One Map is only 32,975,945,966 m^2 (5.1%) of the total land area. This research defined UGS as parks, urban forests, green belts, and other green open spaces accessible to the public and managed by local governments.

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Based on the Law of the Republic of Indonesia No. 26 of 2007 concerning Spatial Planning, the required proportion of UGS is to cover 30 percent of the total area, consisting of 20 percent public and 10 percent private. UGS in Jakarta in 2017 was 5.1 percent and is still far from the mandated target. The data on private UGS until the year 2021 in Jakarta is still inadequate; therefore, it is not comparable. Jakarta was instructed to prepare the UGS Master-Plan (UGS MP) based on the Regulation of the Province of Jakarta Capital Special Region No. 1 of 2008 concerning Regional Medium-Term Development Plan Year 2007–2012, but the plan is still uncompleted. The completed UGS MP is needed as a reference and guide for DJPG to achieve the mandated target.

Formulation of the UGS MP requires the involvement of stakeholders to add value to the legitimacy of the formulation of planning and as a component in sustainable development. The interaction pattern of stakeholder involvement needs to be identified to formulate the UGS MP to map the stakeholder interactions that can be used to illustrate the institutional framework. The absence of the completed UGS MP caused DJPG not to have guidance and a long-term plan that is applicable and measurable in achieving the target by 2030.

This study provides information from a general overview of UGS based on the historical planning regulation and the actors involved in UGS management for formulating the MP of Jakarta. This study also delivers the Government's input in the formulation of UGS MP based on the involvement of the related agencies and stakeholders' ANT analysis.

Literature Review

Urban Green Space (UGS) provides environmental services, ecology, social facilities, psychological benefits for society and human life (Chiesura, 2004). UGS is vital to sustainability (Choumert & Salanié, 2008) as it provides various ecosystem and social benefits and contribute to public health and the quality of urban life (Byrne & Sipe, 2021; Wolch et al., 2014). The amount of UGS in Jakarta can be additional information and reference for the DJPG in calculating the achievement of UGS and baseline. The latest regulation on UGS planning that had been issued is the DJPG-issued Regional Regulations Number 1 of 2014 concerning Detailed Spatial Planning and Zoning Regulations. In the regulation, based on the GIS analysis, the green plan stipulated decreased to 7,520.96 ha. Historical changes in regulation on the percentage and stipulated total planning area of UGS are shown in Table 1.

Based on previous studies, the reduction in green space in Jakarta from 2011 to 2018 was 342.40 ha (Setiowati et al., 2019). Changes in land use in Jabodetabek are predominantly caused by the conversion of land due to concentrated urban activities (Rustiadi et al., 2015). The conflict between city density and the provision of green space within cities will continue so that a balance is needed to ensure a fair quality of life for all citizens (Dallimer et al., 2011). The best practices of other cities that have succeeded in developing UGS in terms of quantity, quality, and distribution are needed as a reference in the formulation of UGS MP (Dormidontova & Belkin, 2020). The UGS MP is planned and implemented with input from the public to include their values and life patterns in the process. Thus, it is necessary to have an in-depth analysis of stakeholder interaction to improve UGS planning and management.

Actor-Network Theory (ANT) is a method to provide an understanding of how networks are formed, negotiated, consider how actors relate to each other, how actors register themselves with each other into the network, and how actors act as intermediaries by generating a relationship map between these actors; thus, the central actors in the network can be determined (Latour, 2013). This aims to find out the social interrelationships and material elements/actors related to each other that produce scientific knowledge through social processes (Rydin, 2012).

Table 1 Jakarta Spatial Planning (JSP) Regulation and Total UGS Area in 1965–2012

Regulation	UGS Area Percentage (%)	Total UGS Planning Area (ha)
Djakarta Master-Plan Year 1965–1985	37.20	24,315.04
Regional Regulation Number 4 the Year 1984 concerning Jakarta Spatial General Plan (RUTR) Year 1985–2005	29.92	19,556.61
Regional Regulation Number 6 the Year 1999 concerning the JSP Year 2010	13.94	9,111.60
City Government-issued Regional Regulations Number 1 of 2014 concerning Detailed Spatial Planning and Zoning Regulations	11.51	7,520.96

ANT concept is a network, interaction pattern, translation, key actor, intermediaries, and black box (Latour, 2007). Furthermore, Latour (2007) explains that a network is a dynamic group consisting of actors with the same perspective, and 'translation' is the way actors define certain subjects to join the network alliance. Rydin and Tate (2016) define a key actor as a determinant who connects, encourages other actors as allies to support a particular subject. 'Intermediaries' or facilitators are entities, can be human actors, organizations, agreements, documents, and materials that have a function to keep actors in the network (Latour, 2013). 'Blackbox' is defined as knowledge that is accepted by all actors and networks without question and debate (Latour, 2013). Institutional stakeholder interactions to describe actors and social networks in the planning process have been carried out in previous studies (Caniglia et al., 2016; Permana et al., 2018; Ratnayake et al., 2016; Ruming, 2008; Rydin, 2012).

The role of ANT in this study is to define key stakeholders in the formulation of the UGS MP and their interaction schemes with other actors, including those produced from the results of in-depth interviews and document reviews. The analysis of actor interaction consists of three stages, which are: (1) defining the actors involved in the formulation of the UGS MP, (2) identifying actors and their interactions in the actor-network, (3) analyzing strengths and weaknesses in the actor-network. This analysis produces a map of the interaction of the actors/stakeholders that illustrates the institutional framework in the preparation of UGS MP. This study applied ANT analysis to analyze the interaction of the stakeholders in the preparation of the UGS MP in Jakarta.

Methodology

Study Area

The Special Capital Region of Jakarta is one of the most highly urbanized and populated cities in Indonesia, and its population is expected to increase from 10.3 million in 2017 to 12.5 million by the year 2030, inhabiting an area of 662 km^2 (JSP 2030). As Figure 1 shows, the study area comprised five municipalities of Jakarta: South Jakarta, Central Jakarta, East Jakarta, North Jakarta, and West Jakarta. Kepulauan Seribu District is not discussed due to the limitation of collected data.

Analysis of Data

Data collection

The data were collected by conducting in-depth interviews representing various stakeholders and document reviews. This is to determine the level of interaction of the parties involved in the preparation of the UGS MP and to discover which key actor(s) have the most dominant interaction and influence the formulation of UGS MP.

The actors

Formulating UGS MP in Jakarta is a process of joint planning with stakeholders from public, private, and civil actors, navigating through local conditions, law, institutions, and spatial planning (Boonstra, 2016). The actors in this research were defined as the stakeholders involved in producing information, analysis, opinions, problems, and challenges in formulating the UGS MP. The questions asked during the interview included the definition of UGS, formulation of the MP, baseline, benefits of UGS, collaboration, and strategies for developing UGS. The process of participation between stakeholders can influence and control development and resources in decision-making (Rogers et al., 2008).

Figure 1 Map of Jakarta Province

The interviews were conducted representing different stakeholders: DJPG, developers, academics, NGOs, and professionals. The elements of DJPG consists of Deputy Governor of Spatial Planning and Environmental (SPE), Regional Development Planning Agency (RDPA), Forestry Agency (FA), Forestry Sub-Agency (FSA), Spatial Planning Agency (SPA), Environmental Agency (EA), Water Resources Agency (WRA), Public Works Agency (PWA), Food, Marine, and Agriculture Agency (FMAA), Spatial Planning and Environmental Bureau (SPEB), and Bureaucratic Reform and Organization Bureau (BROB).

Data analysis

The interaction process between the parties in preparing the UGS MP is analyzed using ANT. Stages of interaction analysis involving actors are carried out by identifying the actors involved in the formulation and grouping the interests or visions of the actor-network. After the actors are grouped, the actor-network interactions are identified to see the key actors, problems, liaisons, and the existence of black boxes. The UCINET is used to describe the network pattern of actors involved in preparing the formulation (Borgatti et al., 2002). In this model, the actor who is the most dominant or plays a significant role in the success of the formulation is determined by using a value of 0–1. A value of 0 indicates that the interaction between parties has no effect, while 1 indicates that the interaction between parties influences.

This study used the UCINET to illustrate the pattern of actor relation networks involved in formulating the UGS MP, as adopted from previous studies that used a similar method (K'Akumu, 2016; Rydin, 2012). UCINET was selected due to the simplicity of the displayed data code and the mapping of graphical networks using Net Draw (Frija et al., 2016). Network illustration using UCINET supports ANT analysis by providing the dynamics of relationships in the network. UCINET software calculates key actors from the analysis of 'betweenness' or the level of connection of other actors in the network.

Results and Discussion

Interaction of Actor-Network

The interviewees of the DJPG consisted of 19 informants from 10 agencies and have the most prominent aspect due to the main tasks and functions of the local government providing UGS public. Furthermore, DJPG's organizational structure based on Regional Regulation 5 of 2016 is shown in Figure 2. Actors from NGOs represented by Oxfam Indonesia, professionals represented by Indonesian Planner (IP) and Indonesian Landscape Architecture Association (ILAA), Developers are represented by Indonesian Real Estate. Academics are represented by Institut Sains dan Teknologi Nasional. Actors added to the ANT's analysis process are the Governor of Jakarta, Regional Asset Management Agency (RAMA), Financial Management Agency (FMA), Jakarta Regional People's Representative Council (JRPRC), and Audit Board of the Republic of Indonesia (ABORI). The addition of 5 actors due to the results of prior in-depth interviews resulted in information that these actors influenced the formulation of the MP.

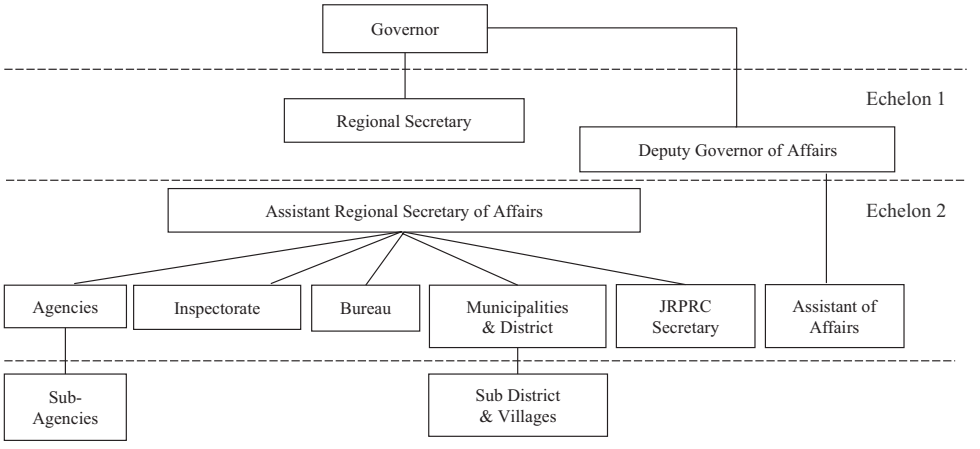

Figure 2 DJPG organizational structure

Based on audit result of Performance Assessments on the effectiveness of the implementation of City Spatial Planning at the SPA and other relevant agencies in the Fiscal Year 2015 and 2016 Semester 1, ABORI gave recommendations to the City Parks and Cemeteries Agency (now FA) to prepare the UGS MP and suggested to prepare it even though it is still at the macro level. ABORI asserted that the structuring of the FA is to facilitate the planning of the distribution of park construction. The inspection related to the achievement of this green space target is that DJPG is required to provide 20 percent UGS public whose distribution is depicted in the spatial map pattern in the JSP 2030 and Detailed Spatial Planning and Zoning Regulation.

Based on the data gathered from the interview, it was decided that the number of actors to be analyzed was 20 actors. After completing the identification of the actors, the next step is to identify the interaction of the actor-network. The initial action is to define the main actors and describe their interactions with other actors, including knowledge and information sharing and decision making that is justified from in-depth interviews and literature studies. The interaction is defined by explaining that certain actors contribute to sharing and providing information and consider the decisions of other actors in the process. The process of mapping could generate some of the actors' potentials. After the mapping phase, extensive and prolonged discussions were needed to develop self-organizing new collectives (Boelens & Coppens, 2015). The narrative statements become qualitative data, which are then scored to obtain quantitative data to visualize the connection between actors. The framework of this study is illustrated in Figure 3.

After completing the scoring, the binary dataset was inputted into the UCINET for analysis. The network analysis is performed to show the centrality of Degree Centrality and 'betweenness' Centrality. Interaction and communication in the network of 20 actors are visualized as the network pattern, which aims to describe the connectedness between actors and shows the interaction between one actor and another. Actors who contribute to the translation phase can connect their interests with other actors and create an enrollment of actor-network (Alagic et al., 2017).

The UCINET software is operated to carry out the Degree Centrality analysis to determine the actor with the most connections. This analysis will produce the value of InDegree and OutDegree. The higher the InDegree value of an actor indicates that every actor is trying to connect to that specific actor. The higher the OutDegree value indicates that the actor is trying to connect with other actors in the network.

Three actors had the highest Outdegree and InDegree centrality in the network, namely, the Governor, FA, and RDPA. The Governor, FA, and RDPA who have high out-degree can drive others aware of their views, or in other words, become the most influential actors. The average value of OutDegree and InDegree of actors in this network was 5.400. This shows that each actor interacts on average for 5 actors in the network. Centrality network as a whole is quite strong, where Network Centralization OutDegree was 53.186 percent and Network Centralization InDegree was 64.266 percent (shown in Table 2), indicating there is a substantial amount of centralization with the positional rather unequally distributed.

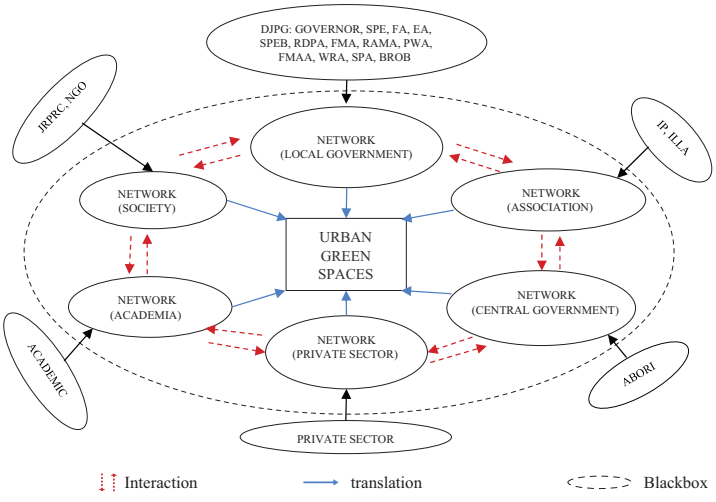

Figure 3 The research framework adapted from Rydin and Tate (2016), Latour (2007)

Table 2 Degree Centrality of the Top 3 Actors

Actors	OutDegree	InDegree
Governor	15.000	17.000
Forestry Agency (FA)	13.000	14.000
Regional Planning Development Agency (RDPA)	13.000	11.000
Descriptive Statistics	**OutDegree**	**InDegree**
Mean	5.400	5.400
Sum	108.000	108.000
Minimum	1.000	0.000
Maximum	15.000	17.000
Network Centralization (Outdegree) = 53.186%		
Network Centralization (Indegree) = 64.266%		

The Governor tries to connect with 17 other actors in the network. The InDegree value indicates other actors in the network are trying to connect with the Governor, FA, and RDPA. The formed network maps presented several nodes based on their connection. The connection of the network was based on the connectivity Degree Centrality and the size of the node was determined based on in-degree centrality, as seen in Figure 4.

Focusing on human actors and institutions, the actor interaction network map in Figure 4 shows the three most strategic stakeholders as key actors are Governor, FA, and RDPA. The Governor has a central position in terms of policymakers to other stakeholders in the network. The Governor also gave straightforward directives to the FA. RDPA, as the development planning agency in Jakarta, facilitates other agencies through regular coordination meetings.

Figure 3 shows that the Governor is the central actor in the formulation of the UGS MP network with FA and RDPA. In 2012–2014, the Governor was Joko Widodo, and after Joko Widodo took office as President of the Republic of Indonesia, the governor's position was taken by Ahok. Preceding Ahok, the Acting Governor was filled by Sumarsono from the Ministry of Home Affairs. Furthermore, Ahok was succeeded by Djarot Syaiful, and in 2017 a governor election was held. Anies Baswedan was elected for the 2017–2022 period as the incumbent.

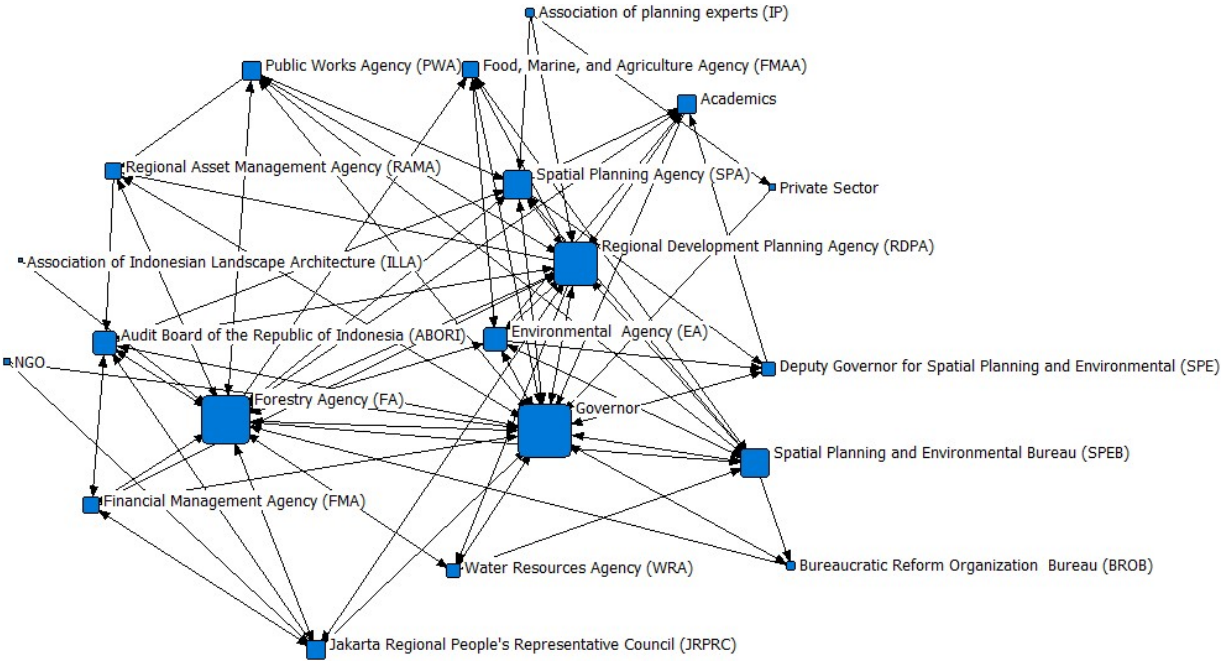

Figure 4 Network Interaction Degree Centrality

Each Governor has a particular vision and mission towards priority or strategic programs on UGS. The research results indicate that the main factor in UGS management in Jakarta is yet optimal due to political factors. It also shows the lack of involvement of the parties in UGS management from the planning stage to the implementation. There have been governor changes five times in five years, affecting the UGS management. The finding by Rydin (2012) was that political factors influence heterogeneous networks.

The 'Betweenness' Centrality analysis was used to determine the facilitator between actors in the network. It demonstrates how far the actor can control information among other actors and actors who facilitate or liaise with other actors in the network. The Governor is the actor to convey information to other actors not directly connected to him. The 'betweenness' Centrality Index was 26.75 percent indicating the weak centrality as a facilitator in the network (displayed in Table 3). From the network perspective, individual actors emerge from their relationships with other people (Hanneman & Riddle, 2005). The connections can be constructed from this network without the help of intermediaries; hence not many 'facilitators'.

Three actors have the highest centrality 'betweenness' and 'nbetweenness' in the network: the Governor, FA, and RDPA (shown in Figure 5). In this network, there are structural constraints because not many strengths are formed, so the distribution of information between actors is not wide due to the lack of facilitators.

Table 3 'Betweenness' Centrality of the Top 3 Actors

Actors	'Betweenness'	'nBetweenness'
Governor	96.917	28.338
Forestry Agency (FA)	47.817	13.981
Regional Planning Development Agency (RDPA)	27.883	8.153
Descriptive Statistics	**'Betweenness'**	**'nBetweenness'**
Mean	10.000	2.924
Sum	200.000	58.480
Minimum	0.000	0.000
Maximum	96.917	28.338
Betweenness Centrality = Network Centralization Index = 26.75%		

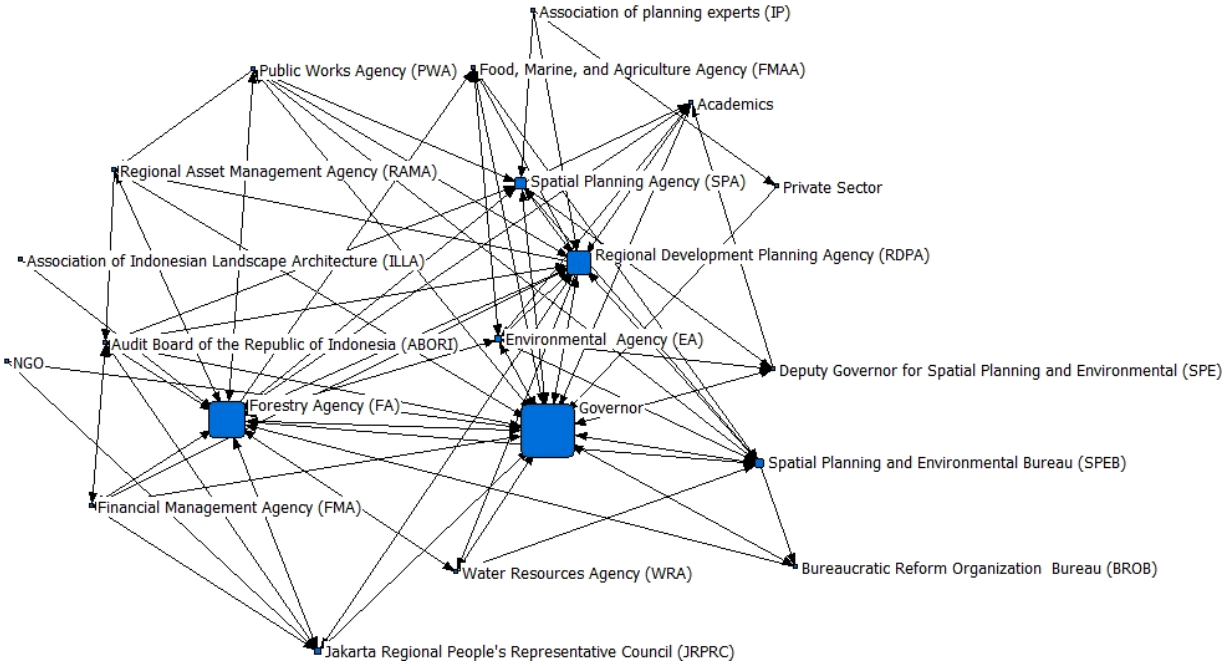

Figure 5 Network Interaction Betweenness Centrality

The study results have indicated that the RDPA is a strategic -but not the only- actor. RDPA is involved collegially with other actors, especially with the FA. The results also indicate the Governor's vital role as a central actor in directing and coordinating the other actors. In addition to RDPA, SPEB, SPA, ABORI, Academia, and JRPRC act as enablers. SPEB has a function as a coordinator between DJPG's internal and external institutions. The results of the ABORI audit on the Performance Assessment of the SPA's effectiveness in implementing the city spatial planning in 2015 and Semester 1 2016 as a rationale for preparing UGS MP include the road map for achieving the UGS target in Jakarta.The WRA, PWA, FMAA, EA, RAMA, and private sectors as developers as potential alliances in the formulation of the UGS MP. These actors have assets or vacant lands in Jakarta that are potential to be transformed to UGS after coordinating with FA. Table 4 shows the summarized list of stakeholders' potential Assets or Land to be Transformed into UGS.

The potential alliances with other actors are specified by their roles. The Academics have functions in consulting services, research publications, and professional advisory assistance. The EA has become a potential alliance because of its role in calculating carbon absorption from the forestry sector in green house gasses inventory. The JRPRC has a function in the budgeting of UGS programs. The non-human aspect is Law of the Republic of Indonesia No. 26 of 2007, regional regulations of Jakarta, and audit results from ABORI, which become a reference for the formulation of the UGS MP.

There are differences of opinion among informants related to the agency in DJPG that should prepare the UGS MP. Based on the interview results, the informants perceived the three agencies as the key actors in preparing and formulating UGS MP: RDPA, FA, and SPA. RDPA is considered essential in preparing the UGS MP because of its function to plan and budget to reach the targeted UGS area and having the authority to coordinate with other regional agencies in various sectors. However, the informants from RDPA and EA have different views. Their opinion is that the regional agency that should formulate the UGS MP is the FA due to its principal role in managing UGS in Jakarta.

RDPA acknowledges that other agencies are involved only as supporters in preparing the UGS MP. However, some informants previously presumed that FA was qualified to prepare the UGS MP. Still, the informants from the FA had different opinions. Their opinion is that RDPA and SPA should formulate UGS MP for their capability in spatial planning. Differences in views between institutions caused the UGS MP, to not yet be realized. Therefore, it is recommended that BROB conduct an institutional evaluation for the appointment of the appropriate institution in the formulation of it. The final stage is analyzing the existence of a black box. It was concluded that the black box in this network is the determination of the baseline needed as a basis for formulating and the importance of realizing the UGS MP in Jakarta.

Conclusion and Recommendation

This research proved that mapping stakeholders' actors for UGS planning and policy-making is necessary to comprehend sustainable urban development appropriately. ANT analysis in this research shows how planning policy is important in defining the relationship between city planners and all authorities. This research defined three key actors: Governor, FA, and RDPA as the facilitator. The Governor is the central actor in directing and coordinating the actors subordinate to him and other actors. The 'betweenness' centrality in this network is 26.75 percent, indicating the weak centrality as a facilitator on the network. Furthermore, the heterogeneous network of actors is influenced by political factors in Jakarta. The facilitator in this actor-network, RDPA, must improve and support its function as an agency with a role in regional planning and coordinating agencies through periodic discussion meetings in preparing the UGS MP.

Table 4 Stakeholder's potential assets or land to be transformed into UGS

Institutions	Types of Assets/Lands	Description
WRA	Reservoirs, settlements, protected zones	Protected zones to UGS
PWA	The working area along the road	Highest potential in the green belt
FMAA	Agricultural land	Monitoring paddy fields
RAMA	Vacant lands owned by DJPG	Management of DJPG's asset
Private Sectors	Owned land	Regulations stated in the permit for space utilization.

The problematization on this network is the different views among actors related to agencies that should formulate the UGS MP. Furthermore, the network interactions were shaped only in the internal DJPG, and interactions cross-boundary with outside actors are not so strong. The partnership for all actors has more roles in promoting and executing the plan. The government is the regulator and controller, and the other actors are the enabler. The determination of the UGS baseline is a black box that all the actors have been accepted to achieve the target. The DJPG should increase collaboration with all stakeholders to achieve the target. The stakeholders in the formulation of UGS MP are presented in Table 5.

This study has limitations on the selection of informants that does not involve the Governor, Central Government Ministries/Agencies, JRPRC, communities, and local governments around Jakarta Province. Further research can be carried out involving other stakeholders to develop UGS across administrative boundaries due to the function of UGS in ecosystem services and urban sustainability. Nevertheless, the ANT approach can be implemented in a social network mapping study using nodes (actors) and edges (relations) with UCINET to describe actors and social networks in the planning process and policymakers.

Conflict of Interest

The author s declare that there is no conflict of interest.

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Table 5 Actors in the formulation of the UGS MP

No.	Actors	Roles
1	DJPG	
	Governor	Key actor having a central position in terms of policymakers to other stakeholders in the network
	SPE	Assisting the Governor in organizing DJPG as the Capital City
	FA	Key actor as formulating UGS MP, development, and maintenance activities of UGS
	RDPA	Facilitating other agencies and program preparation in development planning and UGS maintenance
	SPA	Key actor to the provision of UGS maps and city plan maps
	SPEB	Coordinator between DJPG's internal and external institutions
	BROB	Conduct an institutional evaluation for the appropriate institution
	EA	Calculating carbon absorption from UGS in Green House Gasses inventory
	WRA	Program of activities in blue open spaces that function as UGS
	PWA	Green belt in UGS development
	FMAA	Monitoring paddy fields in agriculture programs
	RAMA	Management of DJPG's asset to UGS
	FMA	Budgeting development and maintenance activities of UGS
2	Private Sectors	Provision of private UGS
3	Academics	Consulting services, research publications, and professional advisory assistance in the environmental and social sciences
4	Society	
	NGO	Elementary and being a community companion and criticizing the government.
	JRPRC	Budgeting of UGS programs and approval of local regulations on UGS
5	Central Government	
	ABORI	Supervision of the budget and performance of UGS programs and activities
6	Association	
	IP	An organization as a forum for urban and regional planning experts
	ILAA	An organization as forum for landscape architect experts

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