



ANALYSIS OF THE INSTITUTIONS ROLE IN SUSTAINABLE DOMESTIC WASTEWATER MANAGEMENT IN JAKARTA

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Abstract

Currently, the Jakarta water is suffering from a high level of pollution, both the groundwater or the river. This is mainly caused by domestic wastewater disposal that has not been properly controlled. Efforts to develop domestic wastewater management are inadequate. Infrastructure development is very slow, the community participation and care, the wastewater management competencies and capacities are all very low. For this reason, it is necessary to increase the role of domestic wastewater management operators and regulators, to accelerate the construction of domestic wastewater treatment infrastructure, improve the participation and care of the community, and to improve the competence and capacity of domestic wastewater management service managers. The purpose of this study was to determine the role of the operators and regulators in the development of domestic wastewater management in DKI Jakarta. To achieve this goal, this study was conducted using the method of interpretive structural modeling (ISM) as a method for analyzing the interrelationships between institutions in the framework of developing domestic wastewater management. The result of this study shows that the key institutions that could accelerate the wastewater infrastructure development are the Coordinating Ministry of Economic Affairs, National Development Planning Agency, and the Ministry of Public Works and Public Housing. The key institutions in enhancing the participation and care of the community are the Water Resources Office, the Environmental Office and the regional owned company Managing DKI Jakarta Waste Water. The key institutions related to improving the competence and capacity of domestic wastewater service managers are the Ministry of Public Works and Public Housing.

Keywords: Domestic Wastewater, Institution, Interpretive Structural Modeling

I. INTRODUCTION

The level of water pollution in major cities in Indonesia, especially in Jakarta, has shown an increasing trend. The cause of this water pollution is the result of anthropogenic activities, such as industries that dispose of their waste directly into water bodies, both to reservoirs, lakes, channels, and the sea. In addition, the factor that is not less

significant is the presence of domestic wastewater discharges coming from households directly to the river or into the land uncontrollably. This condition is made worse by the low level of public awareness to protect the environment.

Domestic wastewater management or sanitation is a basic human need whose main goal is to separate human waste from residential areas

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to prevent the onset of disease (Flores, Buckley, & Fenner, 2009). Efforts to develop centralized domestic wastewater management to overcome water pollution in Jakarta has been started since 1972, by drafting a Waste Water Management Master Plan sponsored by the United Nations Development Program (UNDP) and the World Health Organization (WHO), but to date, its development is still very slow.

Therefore, several studies have been conducted for development. The latest study was conducted in 2012, through collaboration between the Japan International Cooperation Agency (JICA), the Directorate General of Human Settlements of the Ministry of Public Works, DKI Jakarta Provincial Government and DKI Jakarta Wastewater Treatment Company (PD PAL Jaya), to review the Water Management Master Plan in DKI Jakarta.

In the Wastewater Management Master Plan Review in DKI Jakarta conducted by JICA (2012), it was identified that only 1.26% of the people had received wastewater services through a piping system with a relatively better technology, 25.00% the community treats their wastewater through an individual wastewater treatment plant (IPAL), 64.03% used a conventional septic tanks to absorb it directly to the ground and 9.71% of the people in slum areas dispose of their domestic wastewater directly into the river.

The centralized sewerage system or domestic wastewater management service in Jakarta which is currently managed by PD PAL Jaya, the coverage ratio is still very small, when compared to the population of Jakarta, and the rest dispose of its domestic waste to water bodies, to the river, reservoirs, lakes, the sea or directly into the ground through septic tanks without adequate treatment.

This condition is very far behind compared to cities in other Asian countries. Based on data released by the Asian Development Bank (ADB) (2004), several major cities in Asia, almost all of its population can be served by a modern sewerage system of domestic wastewater treatment, such as Hong Kong, Osaka and Singapore which have reached 100%, Seoul 98%, Chengdu 85%, Kuala Lumpur 80%, Shanghai 68% and Delhi which reached 60%. The very limited system to manage domestic wastewater in Jakarta have resulted in high levels of water pollution, both the ground and surface water.

Research conducted by WHO shows that poor domestic wastewater management conditions cause 85% to 90% of diarrheal diseases in developing countries (Annette Prüss-Üstün, Kay, Fewtrell, & Bartram, 2004, p. 2) and each year contributes to death 1,5 million children under the age of 5 (A. Prüss-Üstün & Corvalán, 2006, p. 34). Several studies related to domestic wastewater management have

been carried out and can provide an overview and be a reference.

1. Said (2006, p. 169) in his study on domestic wastewater management in DKI Jakarta stated that domestic wastewater treatment is a requirement for various permits related to the construction of residential and building areas.
2. Nur'arif (2008, p. 141) in a case study in the city of Praya, Central Lombok Regency of the management of domestic wastewater concluded that domestic wastewater management institutions had not carried out their main tasks and functions in accordance with the provisions, resulting in frequent overlapping activities between one agency to another.
3. In a study of the strategy of domestic wastewater management with community-based environmental scale sanitation systems in the city of Batu, East Java, Nurhidayat (2010, p. 169) concluded that the management of domestic wastewater is not optimal because there is no organizing institution handling the wastewater.
4. Fatnasari & Hermana (2010, p. 7) in their study on domestic wastewater management strategies for the settlements along the Surabaya river's banks, concludes that there is the need to establish technical institutions for domestic wastewater management, counseling, and training for community participation in the residential wastewater management.
5. In a case study entitled the "Analisis MDS Untuk Keberlanjutan Pengelolaan Air Lintas Wilayah" in DKI Jakarta, Bakeri, P., Riani, & Sutjahjo (2012, p. 22), concludes that there are five dimensions of the level of sustainability, namely economic, legal and institutional, infrastructure, and technology, social, and ecological in the provision of clean water in Jakarta
6. Setiawati, Notodarmojo, Soewondo, Effendi, & Otok (2013, p. 690) examined infrastructure development strategies for sustainable waste-water systems by using SEM method (Setiabudi and Tebet Districts Case Study, South Jakarta), concludes that the aspects that have a positive and significant influence on the sustainability of domestic wastewater management are institutions, environment, technology, economic/financial and socio-cultural selection.
7. Afandi (2013, p. 102) study on Community-Based Communal Domestic Wastewater Management in Probolinggo City, recommends maximizing the coverage of wastewater services and improve the function of local

- institutions through the implementation of monitoring and maintenance of facilities as planned, and increased personnel capacity.
8. Yuliani, Oktawan, & Hadiwidodo (2013, p. 4) in the study of domestic wastewater management in Semarang Tengah sub-district, East Semarang, Gayamsari, and Semarang City, concludes that there was poor coordination of institutions involved in wastewater management.
 9. Hafidh, Kartika, & Farahdiba (2016, p. 52) in their study related to the sustainability of the community-based domestic wastewater treatment plant, Gunung Kidul, Yogyakarta, concludes the importance of community participation and independence in the maintenance and management of processing installation facilities and the communal wastewater infrastructure.
 10. Study on the policies and strategies of domestic wastewater management in Indonesia by Yudo & Said (2017, p. 72) concludes that the main problems in domestic wastewater management in Indonesia are, among others, the weak institution which oversees managing the domestic wastewater in the regions

Domestic wastewater generally consists of black water and gray water. Blackwater consists of a mixture of stool, urine, toilet paper and water (Knerr, Rechenburg, Kistemann, & Schmitt, 2011, p. 1247). Gray water is non-industrial waste produced from domestic processes such as dishes and clothes washing, and bathing, and comprise of 55%-75% of domestic wastewater (Shaikh, Sameer, & Younus, 2015, p. 167). According to Iskandar, Mudikdjo, Sanim, & Saefulhakim (2010, p. 24), household wastewater management is divided into two, namely feces and kitchen wastewater, bathing, and washing.

While in accordance with the Regulation of the Governor of the Province of DKI Jakarta Number 41 of 2016 on the Master Plan for the Development of Domestic Wastewater Management Infrastructure and Facilities, the definition of wastewater is water that was produced as the result of production process activities and other businesses that are not reused. Domestic Wastewater is wastewater produced by household activities, housing, flats, apartments, offices, hospitals, malls, markets, supermarkets, hotels, industries, and schools in the form of gray water or black water.

In this regulation, gray water is defined as non-toilet waste water from the kitchen (dishwasher), clothes washing (from the washing machine sewer) and bath water (not from the toilet), while black water is defined as wastewater from the toilet which

contains human waste. So that based on the above provisions, in other words that domestic wastewater can be said as water that comes from the remaining activities of the production process and other businesses that are not reused which come from household activities, housing, flats, apartments, offices, hospitals, malls, markets, supermarkets, hotels, industries, schools both in the form of non-toilet wastewater coming from the kitchen (sink), clothes washing (from the washing machine) and bath water (not from the toilet) or toilet wastewater which contains human waste.

Based on the Regulation of the Minister of Environment of the Republic of Indonesia Number: P.68/Menlhk/Setjen/Kum.1/8/2016 on the Quality Standard of Wastewater, wastewater is defined as residual water from a result of a business and/or activity, while the domestic wastewater is wastewater from the daily human life activities related to water use. In other words, domestic wastewater can also be said as residual water from business and/or activity that originates from the activities of human daily life related to water use.

The Law of the Republic of Indonesia Number 32 of 2009 on the Protection and Management of the Environment, defines that sustainable development is a conscious and planned effort that integrates environmental, social and economic aspects into a development strategy to ensure the integrity of the environment and safety, capability, welfare, and the quality of life of present and future generations.

The concept of institutions or agencies has viewed as formal and informal organizations. Uphof (1992) and Fowler (1992) in Suradisastra (2008, p. 83) stated that an institution may take the form of an organization or vice versa. Institutions may take the form of institutions in government, political parties, businesses, and others. In addition, institutions can also be in the form of rules and regulations, customs, social manners, and others.

In this case, the domestic wastewater management institution is an institution that has the duties and functions as a regulator, operator or the beneficiary, from the Ministry and Central Government Institutions, the Regional Government Work Unit, business entities engaged in wastewater treatment, and the community. Regulatory institutions are institutions that oversee formulating policy regulations, carrying out development planning, carrying out the physical development of infrastructure and conducting monitoring and supervision. Operator institutions are institutions that provide services to domestic wastewater treatment both locally and centrally. While the beneficiary is the recipient community of domestic wastewater services.

The sustainability of wastewater management is predominantly and significantly influenced by (1) ecology or the environment, which is related to pollution of the water sources, efficient use of raw materials, and minimizing wastewater, (2) economic and financial, related to investment costs, maintenance and operational costs and regional development (3) social and cultural development, which is related to willingness to pay (WTP), local capacity, community acceptance, and suitability of local culture, (4) technology, which is related to system resilience, availability of spare parts, operational ease, and adaptability, and (5) institutions, which are related to regulations and sanctions for wastewater management, as well as regulations and sanctions for environmental protection (Setiawati et al., 2013, p. 690).

From the ecological aspect, it can be seen from the high pollution of groundwater and surface water because most of the people of Jakarta dispose of their domestic wastewater directly into the soil and into water bodies in rivers, channels, lakes, and reservoirs. The government has not been able to provide facilities for centralized wastewater treatment facilities adequately, the service coverage is very limited and too slow to overcome this condition. The above conditions will, of course, cause adverse health effects for the people of Jakarta who are still using groundwater sources to meet their clean water needs. The development of domestic wastewater treatment facilities has problems in financing sources and schemes related to investment costs and maintenance and operational costs. Funding sources and schemes cannot yet be established and agreed upon, given the number of costs required and the different interests between the Central Government and the Provincial Government of DKI Jakarta.

The readiness of the community to be able to accept the concept of domestic wastewater treatment which, in reality, means they would pay the cost of connecting the installation and pay for services or the community's WTP are not yet there. Regarding social aspects, efforts to develop domestic wastewater treatment facilities are also constrained by the provision of land for the WWTP infrastructure development. Other social aspects are lack of environmental protection knowledge that cause uncontrolled domestic wastewater disposal and the polluter pays principle is not well understood.

Based on the technology aspect, the government of DKI Jakarta Province through PD PAL Jaya uses simple domestic wastewater treatment technology and the results are not reliable, as such, a new environmentally friendly technology needs to be selected. Furthermore, concerning

institutional aspects, the domestic wastewater management in Jakarta is still not optimal, due to overlapping tasks and functions of the managing institutions. Regulatory institutions are also acting as the operators or vice versa, as such, that their performance cannot be measured properly and when problems occur, they would not accept the responsibility.

PD PAL Jaya which should act as an operator in treating domestic wastewater, especially in the Setiabudi area is also acting as a regulator. While the Water Resources Office (Dinas Sumber Daya Air) or the Environmental Office (Dinas Lingkungan Hidup) which is supposed to be a regulator, is currently the operator of the domestic wastewater treatment outside the Setiabudi area. In addition, the law enforcement against environmental violations that dispose of domestic wastewater so that it contaminates groundwater and surface water that have not been applied consistently.

Based on the above explanation, the development of domestic wastewater management systems in DKI Jakarta needs to be done holistically by considering all aspects of sustainability, namely ecological, economic, social, technological and institutional to overcome the problems of slow development of domestic wastewater treatment infrastructure, low participation and public awareness of wastewater management, as well as lack of capacity of domestic wastewater service managers.

Currently, there is no study on domestic wastewater management, especially those related to domestic wastewater management institutions in DKI Jakarta. For this reason, it is necessary to conduct this study on the role of sustainable domestic wastewater service management institutions in DKI Jakarta to find out the institutions that play a role in accelerating the development of domestic wastewater treatment infrastructure, increasing the participation and care of the community towards wastewater management, and increasing the capacity of the wastewater services management institutions and as reference in decision making. This is very important because, without the ability of the wastewater management (regulator and operator) to control the sustainability of domestic wastewater management in DKI Jakarta, any other aspects would not be able to perform well.

II. METHOD

The study used interpretive structural modeling (ISM) and was conducted in Jakarta in January - June 2018. ISM is used to analyze complex situations and solve complex problems and can be used at various levels of abstraction from conceptual

understanding to develop modeling issues that are useful for detailed design and development of action plans. ISM is an inclusive method, so it does not concentrate on rejecting or eliminating ideas. ISM uses the idea of pairwise analysis to transform complex problems and involves many ideas into a structured relationship model that is easier to understand. The use of ISM allows people from all aspects to interact, learn, and analyze problems. ISM technique provides a basis for analysis on programs where the information produced will be useful in formulating policies and planning models. According to Eriyatno (2013, p. 99), one of the elements that can be analyzed with ISM is the institutions involved in implementing the program

The use of ISM in this study was carried out based on good results from several studies related to institutions with the ISM method, including: (1) Kholil, Eriyatno, & Sutjahyo (2008, p. 31) on the development of institutional models for municipal solid waste management in South Jakarta, (2) Maflahah (2010, p. 87) on the preparation of the institutional system model for taro industry development, (3) Astuti, Marimin, Poerwanto, Machfud, & Arkeman (2010, p. 99) on the needs and institutional structure of the mangosteen fruit supply chain, (4) Sianipar (2012, p. 8) in determining the elements of actors in the development of a system for the production of coffee farmers and coffee agro-industry and (5) Sambali, Yulianda, Bengen, & Kamal (2014, p. 105) carried out an institutional analysis of the management of a thousand island marine national parks.

Data collection was obtained by a survey through filling out questionnaires and interviewing experts, both practitioners and scientists, who were selected based on the criteria of formal or self-taught education competencies as well as scientific or empirical experiences (Marimin, 2017, p. 41). Hora (2009, p. 3) states that the number of experts who are adequate and have high precision is 3 (three) to 6 (six) or 7 (seven) people, as such, the experts in this study are 7 (seven) people consisting of 2 (two) people from the planner of urban facilities and the environment of the DKI Jakarta Provincial Government, 1 (one) environmental expert from the Higher Education, 1 (one) person from the wastewater treatment business entity, 1 (one) environmental observer from the community, 1 (one) urban expert from professional organizations and 1 (one) urban expert from the Regional Research Council of DKI Jakarta Province.

III. RESULTS AND DISCUSSION

Based on the discussions and identification process, the institutions that are closely related to domestic wastewater management in DKI Jakarta are, 1) from the central government: the Coordinating Ministry for Economic Affairs, the National Development Planning Agency and the Ministry of Public Works and Public Housing; 2) From the regional government: Regional Development Planning Agency, Water Resources Service and Environment Agency; 3) Private/Business entity: PD PAL Jaya, 4) Community elements, as depicted in Table 1.

Table 1.
Domestic Wastewater Management Institutions

Code	Institution
A1	Coordinating Ministry for Economic Affairs
A2	National Development Planning Agency (Bappenas)
A3	Minister For Public Works and Public Housings
A4	Regional Development Planning Agency (Bappeda)
A5	Water Resources Office
A6	Environmental services
A7	Regional Company Managing DKI Jakarta Waste Water (PD PAL Jaya)
A8	Community

Then based on the interviews and questionnaires conducted by experts, the opinions are expressed by the symbols V, A, X, O in the SSIM matrix, with the conditions:

- V if the institution (i) plays a role more than the institution (j).
- A if the institution (j) plays a role more than the institution (i).
- X if the institutions (j) and institutions (i) have the same role.
- O if the institutions (j) and institutions (i) equally have no role.

A. Acceleration of Infrastructure Development

To accelerate the construction of domestic wastewater treatment infrastructure in DKI Jakarta, expert opinions were generated as well as the SSIM matrix presented in Table 2.

Further, the data were arranged in an SSIM matrix that uses the symbols V, A, X, O, that show a conceptual relationship, and then compile the

reachability matrix (RM) by replacing the symbols V, A, X, O with 1 and 0, then by using the transitivity rule. revise the SSIM matrix so that it becomes a closed matrix as presented in Table 3. Based on the RM matrix, eight institutions can be described in hierarchical form and divided into five levels as presented in Figure 1.

The description of the relationship between the driving power and dependence of the institutions related to efforts to accelerate infrastructure development can be seen in Figure 3.

Figure 2 shows that the key institution in the effort to accelerate the construction of wastewater treatment infrastructure in DKI Jakarta is the Coordinating Ministry for Economic Affairs, Bappenas, and the Ministry of Public Works and Public Housing. This is in line with Hidayat (2012, p. 9) who said that in the development of

infrastructure for regional autonomy, the role of the Central Government is still high.

As a confirmation of this fact, the Committee for the Acceleration of Provision of Priority Infrastructure (KPPIP) in the framework of accelerating the provision of priority infrastructure was established through Presidential Regulation Number 75 of 2014 on the Acceleration of the Provision of Priority Infrastructure. KPPIP is chaired

Table 2.
Structural Self Interaction Matrix (SSIM) of the Role of the Institutions for the Acceleration of Infrastructure Construction

Institutions Code	A1	A2	A3	A4	A5	A6	A7	A8
A1	-	X	X	V	V	V	V	V
A2		-	X	X	V	V	V	V
A3			-	X	V	V	V	V
A4				-	V	V	V	V
A5					-	V	X	V
A6						-	A	V
A7							-	V
A8								-

Table 3.
Reachability Matrix (RM) of the Role of Institutions in the Acceleration of Infrastructure Construction

Institution Code	A1	A2	A3	A4	A5	A6	A7	A8	Driven Power	Ranking
A1	1	1	1	1	1	1	1	1	8	1
A2	1	1	1	1	1	1	1	1	8	1
A3	1	1	1	1	1	1	1	1	8	1
A4	0	1	1	1	1	1	1	1	7	2
A5	0	0	0	0	1	1	1	1	4	3
A6	0	0	0	0	0	1	0	1	2	4
A7	0	0	0	0	1	1	1	1	4	3
A8	0	0	0	0	0	0	0	1	1	5
Dependence	3	4	4	4	6	7	6	8		
Hierarchy	5	4	4	4	3	2	3	1		

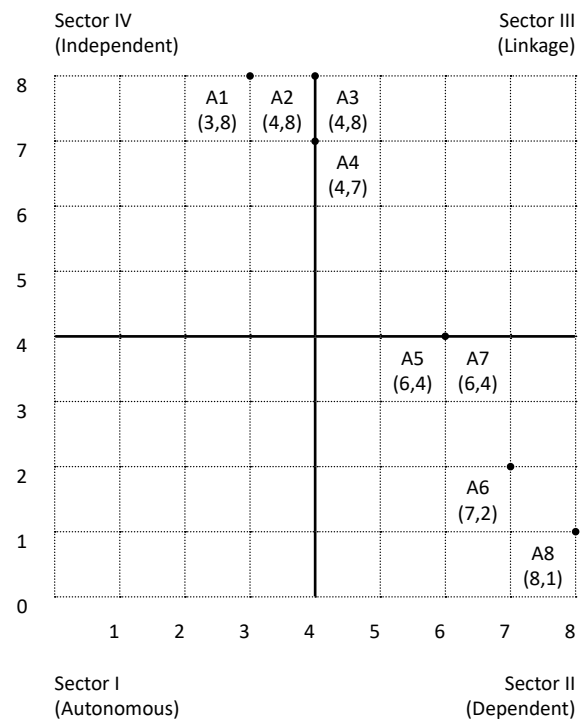


Figure 1. Driving Power (DP) and Dependence (D) of the Role of Institutions in the Acceleration of Infrastructure Construction

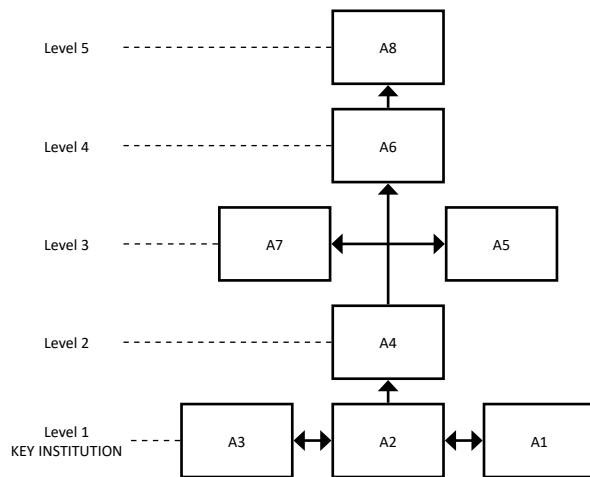


Figure 2. Diagram of the Hierarchical Structure of the Role of Institutions in the Acceleration of Infrastructure Construction

by the Coordinating Minister for Economic Affairs, and one of its members is the Head of Bappenas. KPPIP as a coordination unit in decision making is the point of contact to encourage coordination for remove the bottleneck in the National Strategic Projects and Priority Projects, including the development of the Jakarta Sewerage System Project which has also been included as a potential project in the Public Private Partnership (PPP) Plan in Indonesia Infrastructure Project 2015 published by Ministry of National Development Planning/ National Development Planning Agency (2015, p. 132).

Although the Coordinating Ministry of Economic Affairs is in Sector IV (independent), while Bappenas and the Ministry of Public Works and Public Housing, and Bappeda are between Sector IV and Sector III (linkage), as shown in Figure 1, the four institutions can still said to have a strong influence and low dependence (strong driver-weak dependent variables), so that it has the power to move other institutions in ensuring the acceleration of the construction of domestic wastewater treatment infrastructure in DKI Jakarta.

The Water Resources Office and PD PAL Jaya, which are located between Sector III (linkage) and Sector II (dependent), have a tendency to be carefully monitored because they are not stable (strong driver-strongly dependent variables), so that every effort and feedback made by these two institutions will have an influence on the success of the program to accelerate the development of domestic wastewater treatment infrastructure in DKI Jakarta. While the Environmental Office and the Community in Sector II (dependent) have a weak influence and high dependency (weak driver-strongly dependent), their nature is more dependent

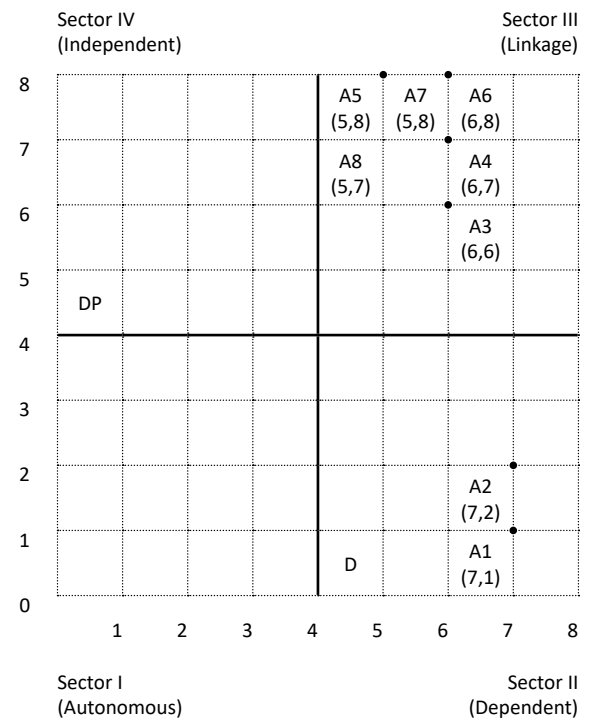


Figure 3. Driving Power (DP) and Dependence (D) of the Role of Institutions in Increasing the Community Participation and Care

on other institutions so that they are less able to contribute to the acceleration of the construction of domestic wastewater treatment infrastructure in DKI Jakarta.

B. Efforts to Improve the Community Participation and Care

In the effort to increase public participation and care for domestic wastewater management in DKI Jakarta, expert opinions were generated as well as the SSIM matrix presented in Table 4.

Table 4. Structural Self Interaction Matrix (SSIM) of the Role of Institutions in Increasing the Community Participation and Care

Institution Code	A1	A2	A3	A4	A5	A6	A7	A8
A1	-	O	A	A	A	A	A	A
A2		-	A	X	A	A	A	A
A3			-	X	X	X	A	A
A4				-	A	X	X	V
A5					-	X	X	X
A6						-	X	X
A7							-	X
A8								-

Table 5.
Reachability Matrix (RM) of the Role of Institutions in Increasing the Community Participation and Care

Institution Code	A1	A2	A3	A4	A5	A6	A7	A8	Driven Power	Ranking
A1	1	0	0	0	0	0	0	0	1	5
A2	0	1	0	1	0	0	0	0	2	4
A3	1	1	1	1	1	1	0	0	6	3
A4	1	1	1	1	0	1	1	0	7	2
A5	1	1	1	1	1	1	1	1	8	1
A6	1	1	1	1	1	1	1	1	8	1
A7	1	1	1	1	1	1	1	1	8	1
A8	1	1	1	0	1	1	1	1	7	2
Dependence	7	7	6	6	5	6	5	5		
Hierarchy	1	1	2	2	3	2	3	4		

The data were arranged in an SSIM matrix that uses the symbols V, A, X, O, that show a conceptual relationship, and then compile the reachability matrix (RM) by replacing the symbols V, A, X, O with 1 and 0, then by using the transitivity rule. revise the SSIM matrix so that it becomes a closed matrix as presented in Table 5.

The description of the relationship between the driving power and dependence of the institutions related to efforts to increase the public participation and care for domestic wastewater management can be seen in Figure 4.

Figure 4 explains that key institutions in efforts to increase community participation and care for wastewater management in DKI Jakarta are the Water Resources Office, the Environmental

Office, and PD PAL Jaya. The results of the analysis show that the institution should not only focus on physical development. This is in line with research conducted by Kurniawan (2013, p. 506) which states that regulatory institutions and facilitators of wastewater management, Bappeda, Environment Agency, and Public Works Agency, are still focused on the construction of WWTPs.

Besides that according to the Governor Regulation Number 272 of 2016 on the Organization and Work Procedure of the Water Resources Office, the duties and functions of the Water Resources Office are 1) coordinating with the community in the framework of implementing wastewater treatment management; 2) carry out technical assistance for wastewater treatment plants carried out by the community; 3) carry out cooperation with the community in the framework of the construction, maintenance and maintenance of infrastructure for wastewater management.

The Governor Regulation Number 284 of 2016 on The Organization and Work Procedure of the Environmental Office, stated that the duties and functions of the Environmental Office are 1) carrying out coaching and developing community participation with relevant agencies and partners in environmental management; 2) carry out counseling on the environment to the community; 3) community development to participate in environmental maintenance; 4) carrying out training activities for environmental management cadres; 5) fostering and empowering people to improve environmentally friendly areas; 6) developing, forming, fostering and developing environmental care community forums.

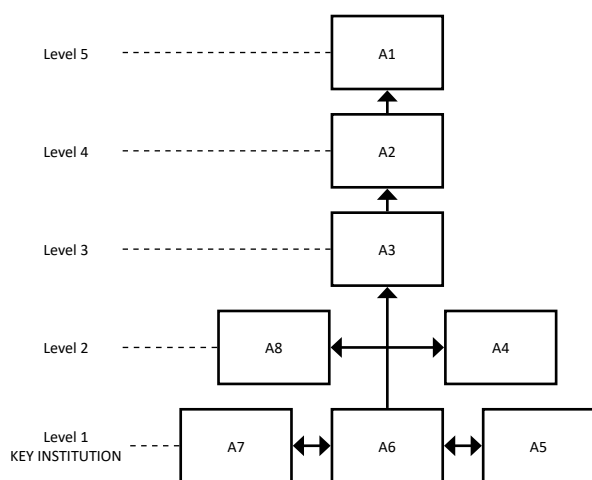


Figure 4. Diagram of the Hierarchical Structure of the Role of Institutions in Increasing the Community Participation and Care

Table 6.
Structural Self Interaction Matrix (SSIM) of the Institution Role in Increasing the Capacity or the Management

Institution Code	A1	A2	A3	A4	A5	A6	A7	A8
A1	-	O	A	A	A	A	A	O
A2		-	X	X	A	A	A	X
A3			-	X	V	V	V	V
A4				-	X	X	V	X
A5					-	X	X	X
A6						-	X	X
A7							-	V
A8								-

The Governor's Regulation Number 273 of 2014 on the Organization and Work Procedures of the Regional Company for the Management of DKI Jakarta's Wastewater, stated that the tasks and functions of PD PAL Jaya is the provision of counseling to the community regarding the regional government's plans in the construction of waste pipelines and its management.

The three key institutions located in Sector III (linkage) as illustrated in Figure 3, together with the Ministry of Public Works and Public Housing, Bappeda, and the Community, need to be carefully monitored, because the relationship between the institutions is not stable (strong driver -strongly dependent variables), so that every effort and feedback made by these six institutions will have an effect on the success of the program to increase community participation and care.

While the Coordinating Ministry of Economic Affairs and Bappenas in Sector II (dependent) have a weak influence and high dependence (weak driver-strongly dependent), their nature depends more on other institutions so that they are less able to contribute to the improvement of community participation and care towards the wastewater management in DKI Jakarta. As for the RM matrix, eight institutions can be described as hierarchical and divided into five levels as presented in Figure 4.

C. Efforts to Improve the Management Capacity

In the effort to increase the capacity of domestic wastewater service managers in DKI Jakarta, expert opinions are generated as well as the SSIM matrix presented in Table 6.

The data were arranged in an SSIM matrix that uses the symbols V, A, X, O, that show a conceptual relationship, and then compile the reachability matrix (RM) by replacing the symbols V, A, X, O with 1 and 0, then by using the transitivity rule. revise the SSIM matrix so that it becomes a closed matrix as presented in Table 6. Based on the RM matrix, the eight institutions can be described in hierarchical form and divided into six levels as presented in Figure 1. The description of the relationship between the driving power and dependence of the institutions related to efforts to improve the management capacity can be seen in Figure 6.

Figure 6 shows that the Ministry of Public Works and Public Housing are in Sector IV (independent), so this institution has a strong influence and low dependency (strong driver-weak dependent variables), it has the power to move other

Table 7.
Reachability Matrix (RM) of the Institution Role in Increasing the Capacity or the Management

Institution Code	A1	A2	A3	A4	A5	A6	A7	A8	Driven Power	Ranking
A1	1	0	0	0	0	0	0	0	1	4
A2	0	1	1	1	0	0	0	1	4	1
A3	1	1	1	1	1	1	1	1	8	1
A4	1	1	1	1	1	1	1	1	8	2
A5	1	1	0	1	1	1	1	1	7	2
A6	1	1	0	1	1	1	1	1	7	3
A7	1	1	0	0	1	1	1	1	6	3
A8	0	1	0	1	1	1	0	1	5	4
Dependence	6	7	3	6	6	6	5	7		
Hierarchy	2	1	4	2	2	2	3	1		

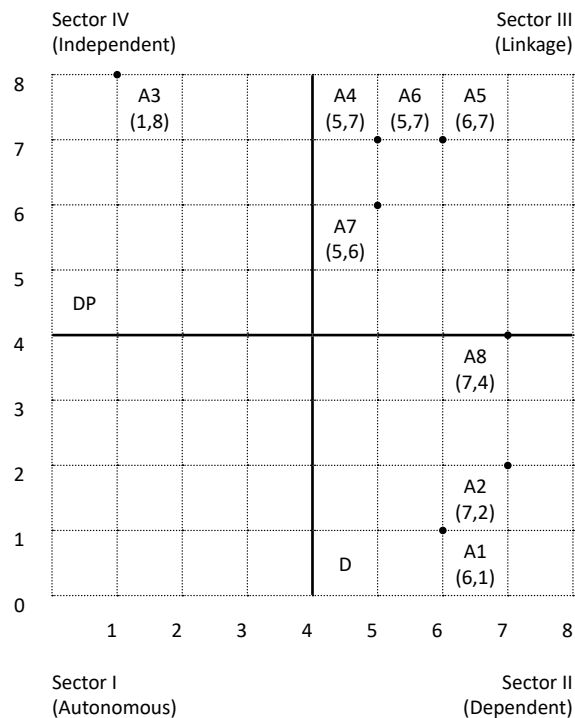


Figure 5. Driving Power (DP) and Dependence (D) of the Institution Role in Increasing the Management Capacity

institutions in increasing the capacity of managers of DKI Jakarta domestic wastewater services.

While the Bappeda, the Water Resources Office, the Environmental Office and PD PAL Jaya in Sector III (Linkage), as well as the Community that is between Sector III (Linkage) and Sector II (dependent) need to be watched carefully and monitored, because the relationship between institutions is not stable

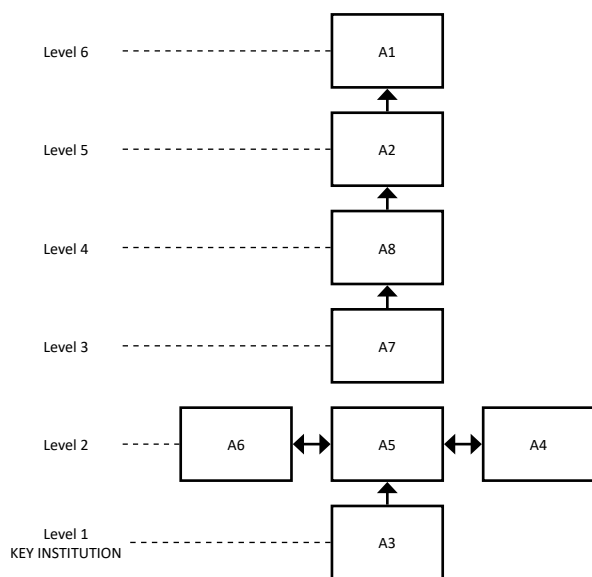


Figure 6. Diagram of the Hierarchical Structure of the Role of Institutions in Increasing the Capacity of Managers

(strong driver-strongly dependent variables), so that every effort and feedback made by these six institutions will have an effect on the success of the capacity building program for domestic wastewater service management institutions in DKI Jakarta.

Nur'arif (2008, p. 132) in his study stated that one of the recommended strategies in wastewater management is to increase institutional capacity in performing their main tasks and duties since the domestic wastewater management institutions have not implemented it and often overlaps their activities with another institution.

Figure 6 shows that the key institutions in the effort to increase the capacity of domestic wastewater service managers in DKI Jakarta are the Ministry of Public Works and Public Housing. This is in line with the Regulation of the Minister of Public Works and Public Housing Number 15/PRT/M/2015 which stated that one of the duties and functions of the Ministry of Public Works and Public Housing in the field of wastewater is the facilitation and empowerment of institutions and the development of human resources in the field of implementation development of wastewater management systems.

The Coordinating Ministry for Economic Affairs and Bappenas in Sector II (dependent) have a weak influence and high dependency (weak driver-strongly dependent), more dependent on other institutions so that they are less able to contribute to increasing the capacity of domestic wastewater service management institutions in DKI Jakarta.

IV. CONCLUSION

In an effort to develop domestic wastewater management in DKI Jakarta, it is our conclusion that the institutions that play a role in (1) accelerating the construction of domestic wastewater treatment infrastructure, are the Coordinating Ministry of Economic Affairs, the National Development Planning Agency, and the Ministry of Public Works and Public Housing; (2) enhancing the participation and care of the community, is the Water Resources Office, the Environmental Office, and PD PAL; (3) increasing competence and capacity, both regulators and operators of domestic wastewater services are the Ministry of Public Works and Public Housing.

To accelerate infrastructure development for more intensive wastewater treatment, considering the large budget requirements for the construction of wastewater treatment infrastructure and the very limited ability of the DKI Jakarta Regional Budget, while the authority to access loans and cooperation between the government and business entities for infrastructure development are at the central government, it is recommended that the DKI

Jakarta Provincial Government coordinates with the Central Government through (1) the Coordinating Ministry of Economic Affairs, in particular, the Committee for Accelerating the Provision of Priority Infrastructure; (2) National Development Planning Agency, in the preparation of long, medium and annual development plans; and (3) Ministry of Public Works and Public Housing to increase competence and capacity, both regulators and management operators.

In addition, the implementation of the duties and functions of the Water Resources Office, the Environmental Office and PD PAL needs to be improved, and not only to focus on physical development, but also to provide environmental education to increase community participation and care.

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