The essential aspect in sewerage regulation in Indonesia

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Abstract. Several cities in Indonesia have the sewerage local regulation such as Banjarmasin, Bantul, Surakarta and Denpasar. Meanwhile, The National Government have guideline in composing domestic sewerage regulation. Each city have their own characteristic and issues that need to be carried out by the local regulation. By using SWOT analysis, this study tries to figure out several aspect that need to be included in the local regulation. International references from developed and developing countries like Japan, Phillipines, Malaysia and Thailand were also used as benchmark without neglecting the local conditions of cities in Indonesia. Several crucial aspect of local regulation are institutional authority, composition on-site and off-site system, tariff, evaluation and monitoring, as well as punishment and rewards. Both tariff and evaluation aspects need to be narrowed down into specific regulations. Keywords: domestic sewerage, local regulation, oversead benchmark, SWOT

1. Introduction
Of all sewerage components, regulation is one of most fundamental aspects since all the implementations will rely on it. However, many studies discuss the technical components compared to the conventional methods, activated sludge, heavy metal treatments, as well as biological processes using algae [1]. Other studies consider social, economic, and environmental components in assessing sustainable technology for urban sewage sludge treatment [2]. There are also specific studies about the management of domestic sewage sludge disposal [3]. In Indonesia, the central authority of sewerage management is in the hand of Ministry of Public Works and Housing (MPWH). Under Directorate of Sanitation Development (PPLP), there is a guidance of composing local sewerage regulation [4]. The scheme can be seen in Figure 1.

1. Academic Script Composing
2. Composing Local Regulation Draft
3. Harmonization, composing, consolidation and conception
4. Approval final draft of local regulation

Figure 1. Indonesia sewerage regulation scheme [4].
Several cities that have a sewerage regulation are Banjarmasin City, Klungkung Regency, Tangerang City, and Bantul [5], [6], [7], [8]. Nevertheless, some of those regulation needs to be updated since the development of the city and regency will bring in different conditions which then alters the sewerage management, both technically and non-technically. In fact, some of these towns make an advancement by having their regulation of particular aspects such as tariff scheme, retribution [6], and regular desludging [7]. In contrary, some cities are still on the progress of composing local regulation concerning sewerage management just like Jakarta.

Devising a local law takes a lot of time indeed since the process of enactment has to go through many steps. Thus, it needs to be simplified. This study is intended to act as a simplification attempt of the necessary aspects of a local sewerage regulation.

2. Research Method
In this study, we try to define the actual condition including the issues and obstacles in each city by using best practices of local regulation in Indonesia. SWOT analysis is a method used to scrutinize the strategic planning. It takes strength, weakness, opportunity, and threat into account of a problem framework so that the best way to implement the strategy can be identified. The internal factors that will offer the potentials to tackle the issue are considered as strengths. The internal factors that will probably become additional problems are weaknesses. The external factors that can serve as subsidiary solutions are opportunities. The external factors that may aggravate the problem and weaknesses are threats. In here, we can find each point of SWOT analysis. The followings are several criteria that need to be considered in using this method:
1) Relevance to the local condition
2) The sewerage system
3) Public awareness

As a reference, Japan seems to be the most suitable developed country. Having relatively similar state with Indonesia, Malaysia, Thailand, and Philippines are set to be the benchmarks. The regulation aspects that are examined by using SWOT analysis and benchmarking are the institutional authority, composition (sharing) of the on-site and off-site system, tariff, evaluation and monitoring, as well as rewards and punishment.

3. Results and Discussion
As seen in Table 1 below, the comparisons of each aspect by considering several criteria mentioned before are listed for its strengths, weaknesses, opportunities, and threats.

Local government systems in many cities in Indonesia are no different except for the special regions such as Aceh and Yogyakarta. Those systems will affect the institutional authority, whereas a particular institution is required in the future for sewerage management, either in the form of public services or local enterprises e.g. the one in Denpasar (BLUPAL) and Jakarta (PD. PAL Jaya). For short term plan, water resources department will be modified, and smaller unit specially intended for wastewater management will be added. Compositions of the on-site (decentralized) and off-site (centralized) systems are often set aside in the local regulation, whereas it will determine the other aspects since many technologies can be used as an alternative treatment for the on-site system [9]. In contrary to business and tidy residential section, a dense area with a complicated geographic condition is more likely to be provided by an on-site system. A city or district with an economically diverse structure will apply a different plan compared to the economically homogenous one. The tariff scheme will need a specific regulation addressing the number or coefficient matter. The evaluation and monitoring aspect implicates the effluent criteria and one’s expertise in standardization. This aspect also needs a particular regulation such as a domestic wastewater standard. Thus, the effluent quality will not exceed the requirements. Lastly, reward and punishment as an inseparable aspect of the law enforcement can be directly mentioned in the local regulation.

In general, a sewerage system can be either centralized or decentralized. Decentralized here can consist of either a single system or many [10]. The common type in Indonesia is the communal and ITP (Individual Treatment Plant) units. A sewerage system is usually devised gradually in the fifth year period of mid-term planning RPJMD. In many cities, due to the rapid development led by the
population growth, the centralized wastewater systems exceed the limit of their capacities [11]. Hence, it will notably affect the composition of the on-site and off-site system. The remained criteria, the public awareness (willingness to pay), is less affected by the regulation aspects because the government can carry out a socialization or other approaches, even though it needs lots of efforts and takes time. This criterion has an impact on the on-site and off-site composition since a broader public involvement is required in a decentralized system [12].

### Table 1. SWOT analysis for sewerage regulation aspect.

| Criteria                                      | Aspect            | Strengths                        | Weaknesses                                      | Opportunities                  | Threats                                                                 |
|-----------------------------------------------|-------------------|----------------------------------|-------------------------------------------------|--------------------------------|-------------------------------------------------------------------------|
| Relevant with local condition (social, economy and geographic) | Institution Authority | Clearly define the coverage area | Need government capacities improvement          | Requirement one particular institution | • Irrelevant with other aspect
• Need alteration in government bodies |
| On-site and Off-site system Composition       | Institution Authority | Clearly define type of treatment | Need wide area of Water Treatment Plant (WTP) for Off-site/ decentralized system | Zero in on public necessity and local characteristic | Require new technology treatment |
| Tariff                                        | Institution Authority | Subsidize construction, operational and maintenance cost | Require law enforcement | Need other specific regulation | Low willingness to pay |
| Tariff                                        | Institution Authority | Improve effluent quality         | Need government capacities improvement          | Need other specific regulation on standard effluent | Low result and implementation of evaluation and monitoring |
| Tariff                                        | Institution Authority | Well regulated                   | Willingness to accept by public is low          | Increase public awareness      | Reluctant to do house connection |
| Sewerage system                              | Institution Authority | Define the coverage area         | Lack of public participative                    | Transfer technology           | Rely on one specific type of wastewater treatment |
| On-site and Off-site system Composition       | Institution Authority | Zero in on technical condition   | Low law enforcement for communal and ITP system | Need other specific regulation | • Dominancy of off-site system
• Lack of coverage in on-site system for dense area |
| Tariff                                        | Institution Authority | Influence to specific tariff     | Need public awareness increasing                | Need other specific regulation in tariff scheme | • Tend to refuse by public
• Become obstacle for sewerage construction |
| Evaluation and Monitoring                     | Institution Authority | Define the system of monitoring  | low disciplinary of monitoring in communal system | Need monitoring standardization | Low control in ITP |
| Criteria                     | Aspect                                      | Strengths                        | Weaknesses                        | Opportunities                        | Threats                                         |
|------------------------------|---------------------------------------------|-----------------------------------|-----------------------------------|--------------------------------------|------------------------------------------------|
| Rewards and Punishment       | Increase public awareness                    | Low law enforcement               | Additional funding for operational cost | Extra monitoring for ITP              |
| Public awareness (Willingness to pay) | Define the service system                   | Lowered sense of belonging        | Combined with other retribution, e.g. water, electricity, or solid waste charge | Increase the public wariness |
| Institution Authority        |                                             |                                   |                                   |                                      |                                                 |
| Off-site system Composition  | Increase sense of belonging, if on-site dominated | Lowered sense of belonging, if off-site dominated | People are willing to pay with specified tariff | People reluctant or even refuse to pay |
| Tariff                       | Subsidize system from ITP to communal system | Lower revenue from communal system | Get higher tariff for ITP          | There is no revenue communal system    |
| Evaluation and Monitoring    | Increase public awareness                    | Does not make a deterrent effect   | Increase the awareness to meet the standard | No effect to public                   |
| Rewards and Punishment       | Increase public awareness                    | Burdening public                  | Public feel included              | No effect to public                   |

Table 2 provides the benchmarking using the best practices in several Asian countries. Japan is one of leading countries in sewerage management in Asia starting from 2,200 years ago using a domestic wastewater treatment under Johkasou Law as the on-site system. In 1990’s, Japan provided a technological transfer of field-constructed Johkasou for Indonesia. Manila has implemented an effective and efficient sewerage management by separating sewer and combining sewer-drainage systems. This application is feasible for Manila, considering its decent public capability and willingness to pay. The implemented strategy is by upgrading communal septic tanks (CST) into package-sewage treatment plants (STP). Another way is by using a lift station that delivers wastewater into larger, centralized sewage treatment plant. Meanwhile, the sewer and drainage systems are combined by constructing interceptors (collector pipes) in the drainage toward the STP.

Previously in 1950’s, Malaysia emphasized more on primary treatments, i.e. latrine and septic tanks. Nowadays, IWK (Indah Water Consortium) is more focused on addressing diverse types and dimensions of sewerage to improve the operation and maintenance. The characteristics of sewerage system in Malaysia is that the regulator, as well as the operation and maintenance, are provided by one door namely National Water Services Commission (SPAN). The integration of water and wastewater services enables the law enforcement and eases the implementation of the regulation. It can be seen by the large increment of houses connected from 5% to 70% in 2010. Bangkok’s sewerage master plan had been drafted using centralized wastewater treatment since 1968. It shifted afterward in 1990’s into communal wastewater treatment plants. The government began to improve public awareness through information campaigns in educational programs as well as to expand the human resources capacity.
Table 2. Overseas best practice as benchmarking of sewerage management.

| Country             | Characteristic (coverage area) | Institution Authority | On-site and Off-site system Composition | Aspect                                      | Tariff                          | Evaluation and Monitoring                                                                 | Rewards and Punishment                                      |
|---------------------|--------------------------------|-----------------------|-----------------------------------------|--------------------------------------------|---------------------------------|-------------------------------------------------------------------------------------------|-------------------------------------------------------------|
| Japan               | 65%                            | There is clear and firm authority distribution between national government and city | Communal system refer to Jokashou law. There are several area that service by on-site system and dominated by off-site system | Firm tariff collection and calculation based on water consumption | ● By management in registration private sector (plumber, engineer, factory) ● Obligation in operator to do regular effluent monitoring. | Penalty ≤ 50,000 JPY for particular violation                                           |
| Manila, Philippines | 10%                            | Metropolitan Manila Development Authority (MMDA) | Combined sewer for not doable area for seperate system | Progressive Tariff with environmental and sewerage charge | Follow domestic wastewater effluent standard | Fines of 10,000 – 200,000 Php for every day of violation;                                |
| Kuala Lumpur, Malaysia | 68.8%                        | On the hand of IWK | Shifting from Individual Septic Tank (IST) to Communal septic tank (CST) | Flat national tariff with regulated and non-regulated business service | Program Certification for facilities and human resources | Penalty called as “Sewerage Control funds”                                               |
| Bangkok, Thailand   | 21%                            | Department of Drainage and Sewerage, Bangkok Metropolitan Administration (BMA) | Dominated by sewerage system (cluster WWTP) | Using ‘polluter-pay-principle’ and ‘service-pay-principle’ | ● On progress program Certification for facilities and human resources ● Enforcement of effluent standards | Implementation of wastewater discharge fee                                               |

4. Conclusion
This paper discusses the local sewerage regulation in general by emphasizing that implementing an appropriate wastewater management is fundamental. There are several crucial aspects of local regulation that need to be considered, particularly concerning the fact that each city in Indonesia has distinct characteristics and issues in implementing the wastewater management. Those aspects are the institutional authority, composition of the on-site and off-site system, tariff, evaluation and monitoring, also punishment and rewards. Both tariff and evaluation aspects need to be narrowed down into specific regulations.

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