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GOVERNMENT SUPPORT TOWARDS COMMUNITY TO WASTEWATER MANAGEMENT IN URBAN SLUM AREA (CASE STUDY: METROPOLITAN BANDUNG AREA)

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Abstract: Sanitation is one of the development aspects which are mankind basic necessity. Government support plays an important role in santitation achievement. One of sanitation development policy in Indonesia refers to community needs (demand driven) rather than achieving technical target (supply driven). The development pattern has positioned community to play a major role in development process and become an active participant in facility planning, construction, utilization and maintenance. This research is intended to explore importance factor for community in sanitation management. Research location is in Greater Bandung Area which is West Java Province capital area. In the area without government intervention, among ten requested importance factors, the financial factor becomes a major importance factor that had to be improved, nevertheless community participation, environmental and social impacts factors are satisfied important factors. On the contrary, in area with government intervention there are other factors appear than those mentioned factors which are institution and technology.This indicates government socialization and empowerment effort has opened community perception that sanitation management needs legitimate institution and suitable alternative technology.

Keywords: government, community, sanitation, slum area

INTRODUCTION

The majority of urban households and businesses in Indonesia use septic tanks for wastewater disposal, and the use of water-flush toiletsis common. About 14 percent of urban dwellers still practice open defecation (Aus Aid, 2013). Indonesia Statistic Bureau (BPS) data stated that proper sanitation achievement is increasing from 51,19% in 2009 to 60,31% in 2013, while Millennium Development Goals (MDGs) target stated that 62,41% proper sanitation in Indonesia (RPJMN, 2010/2014) has been updated to 100% in 2019 (RPJMN, 2014/2019). In West Java Province, which has the largest population in Indonesia, sanitation service in 2013 is 64% and in 2015 is aimed to reach 70% (RPJMD, 2013/2018).This coverage is significantly lower than in otherEast Asian countries despite Indonesia having experiencedsignificant economic growth in recent years, surpassing manyof its neighboring countries.

Development Policy

Government support contributes in santitation achievement and as for the challenges towards sanitation are low political priority, low allocated budget, low human resources and lack of readiness in implementation. Beginning in 2000, the central government, coordinatedby BAPPENAS,embarked on a series of initiatives to reformwater supply and sanitation sector policies. Thesere forms were aligned with decentralization which devolvedresponsibility for

sanitation to the local government.Indonesian government effort and policy is confirmed by initiatinga National Program for Human Settlement Sanitation Development Acceleration (PPSP). In this scheme, development acceleration will concern to sanitation including wastewater management. The following achieved establishment of the Acceleration of Urban Sanitation DevelopmentProgram (PPSP) to assist local governments incomprehensive citywide sanitation planning through thepreparation of City Sanitation Strategies (SSK). As of mid-2012, 240 cities and regencies have prepared SSKs, and 330of the 496 local governments in Indonesia are expected tocomplete them by 2014.

Inclusion in the 2010-2014 Medium Term Development Plan of sanitation targets: (a) Indonesia to be 100 percent Open Defecation Free; (b) 10 percent of the total population to be using off –site wastewater management systems; and (c) 90 percent of the population to have improved on-site or shared facilities. Both on-site and off-site system refers to the government's strategy to encounter the challeges in sanitation.As on site system improvement, decentralization system then become one alternative in domestic wastewater management to accelerate covering service which manage wastewater close to the source (Wilderer and Schreff, 2000). Development pattern is conducted by involving various stakeholder, community as users in particular, focusing active community participation to initiate and to take responsibility for constructing sanitation facility, empowering community and dedicated to low income inhabitants (Dayal et al., 2000).Government Regulation No.23/2014 stated that community participation should be encourage to help the Government's development programme. The West Java Provincial Government also stated about the importance of community participation in their local policy known as "Jabar Masagi". Essentially community based decentralization system is both technical and economically appropriate for low income society (Paterson et al, 2007).Technical government implemented system is per group decentralization or communal instead of centralized system. A total of approximately 1700 decentralized wastewatertreatment systems (DEWATS) constructed countrywidewith another 4,000 DEWATS systems planned to be implemented by 2015. On the other hand, centralized sewerage systems planned for an additional five cities such that 32 million people or 15 percent of the population in 16 cities will be covered by centralized sewerage systems (Aus Aid, 2013).

Institution

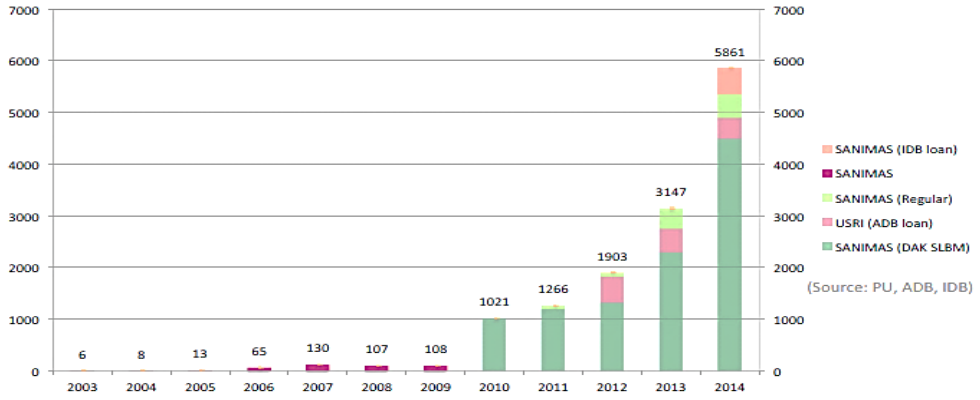
Well managed institution is required to execute abovementioned programs. Cooperation among sectors both technical and non technical sectors are then realized in sanitation development particularly in institutional aspect (Mara et al, 2010). In Uganda for example, water and sanitation are managed by central government inter department covering ministry of education, health, water and environment (Isunju et al, 2011). In Indonesia, BAPPENAS initiate working groups for water and sanitation (Pokja AMPL) then since 2007 focusing on sanitation through sanitation development technical team (TTPS) that involve nine ministries/institutions incorporated in Pokja AMPL, which are Ministry of Home Affair, Ministry of Health, Ministry of Public Works, Ministry of Housing, Ministry of Finance, Ministry of Industry, Ministry of Environment and Central Statistic Bureau. This team is also created in both provincial and city/regency government.The Association of Cities and Districts Concerned aboutSanitation in

Indonesia (AKKOPSI, established in 2011) nowcomprises over 200 cities. Members of AKKOPSI have committedto allocating at least 2 percentof their budget tosanitation in the future.

Financial

Related to financial policy aspect, low political priority and institutional capacity create less government attention to invest in sanitation than in other sectors (Cumming, 2008). Increasing financial support since 2003 as shown in Tabel 1, moreover in significant amount after regional autonomous era, both national (APBN) and provincial/local (APBD) budget, sanitation still has less allocated budget than water (WSP, 2009). Low allocated budget, below 2% in average, leads to useless sanitation facilities due to small operational and maintenance budget (WSP, 2009).

Table 1.Financial Support in Sanitation



Sustainable Sanitation Facility

Wastewater treatment system is integrated off-site and on-site system also involving legal, finance, institution and administration waste water infrastructure system (Permen PU, 2013). Table 2 shows often used sanitation facilities in Indonesia.

Table 2. Categories of Sanitation Facility di Indonesia

Category	On-site System	Hybrid : Community Based	Off-site System
Sub-division	- Communal - Individual	- Communal Septic Tank - Communal wastewater treatment unit - MCK++	- Medium: Decentralization - Centralized
Water flow	Not required	Required for flushing	Required for flushing
Transport system	No piping system	Area piping system	Conventional piping system/

Category	On-site System	Hybrid : Community Based	Off-site System
			sanitary/simple
Treatment system	Collected in septic tank	Septic Tank/ABR+filter. MCK++: digester+ABR+filter	Anaerobic, aerobic or lagoon system
Final disposal	Fecal Sludge Treatment Facility(IPLT)		Fecal sludge treatment in wastewater treatment facility (IPAL)
Note: MCK : MandiCuciKakus, *ABR : Anaerobic Buffled Reactor*			

Source: ADB & WB, 2013

Individual sanitation provision in slum area is unfeasible due to high density and poverty (Schouten andMathenge, 2010), also for centralized sewerage system because of high cost, large water consumption and irregular housing pattern shall complicate piping network. In urban slum area the only feasible system is communal on-site system which is appropriate for limited land (Katukiza et al, 2012). This communal system or septic system is commonly used for individual house or also known as decentralized wastewater treatment system (DEWATS) that technically and economically possible for low income inhabitants (BORDA,1998; Paterson et al, 2007; Libralato et al, 2012).This system is appropriate for area without direct connection to centralized wastewater piping system, essentially used to handle black and grey water naturally in septic tank and disposal field. Decentralization management system needs intensive attention from professional experts and researchers considering its water consumption, pollution control, water recycling and also cost efficient and effectiveness (Butler and Mac-Cormick, 1996).

According to Mara et al (2007), the utilization stages in sustainable sanitation are community health, operation and maintenance capability, environmental sustainable and proper institution. Sanitation is close related with fecal management and treatment (Parkinson et al, 2008) that means management institution is emphasized. Carden et al (2009) define sustainability is accuracy in maintenance and long term system sustainability. Bracken et al (2004) conclude that sustainable sanitation system shall result human health protection, minimize environmental degradation or declining natural resources. This system is technical, economical and socially acceptable.

Sustainable sanitation from technology aspect standpoint is environmental and locally sustainable with contribute to health improvement and environmental protection also technically accepted by user (Darrow, 1993). Operational sustainable technology is a facility to remove pathogen materials from wastewater, protecting groundwater, least cost implementation, operation and maintenance also functional without high quality materials (Howard et al, 2003).

Summary for determining factors in community based sanitation development are shown in Table 3 below.

Table 3. Sustainability Determining Factors

No	Determining Factor	Defenition
1.	Institution	Institutional role in sanitation development both for government and community
2.	Regulation	Regulation role in sanitation management
3.	Financial	Financial support for sanitation handling
4.	Community Involvement	Community involvement in sanitation management
5.	Technology	Applicated technology type and performance
6.	Private sector role	Private sector involvement in sanitation management
7.	Culture	Attention to cultural role including local wisdom
8.	Gender	Housewife role in sanitation management
9.	Social Impact	Attention to social impact including community social life (religion, behavior, trust)
10.	Environmental Impact	Attention to surrounding environmental impact

Community Participation

Participation is community voluntary attitude to help out development program successfully instead of people mobilization process (Bryant et al, 1987). Since community takes over bigger responsibility, the participation wills succeed even more (Wellington, 2009). In terms of development, UN defines participation as active and meaningful involvement from inhabitants in various levels, which are:

1. Decision making process to stimulate community purposes and resource allocation to achieve them;
2. Program implementation and voluntary conduct projects;
3. Program or project result utilization.

Essentially, sanitation system needs to adjust with community requirements instead of community adaptating with sanitation system(DellstromRosenquist, 2005). Four important main factors are (Schouten andMathenge, 2010):

1. Field situation, each location will have different case;
2. Financial, affordable by community in both construction and operation and maintenance;
3. Technology, simple operation and maintenance also environmentally safe; Participation, main role in implementation.

METHODOLOGY

This research design is conclusive descriptive refer to explaining one or more characteristic of structured and specific variables both for secondary data and observation result to help out decide, evaluate and provide the best optionto solve problem. Quantitative analysis shall be used (Firdaus, 2012). Research purpose is to identify determining factors for sustainable sanitation in urban slum area.

This research is conducted in to different handling locations/areas that result to different respondent understanding, Location 1 is slum area without government program while Location 2 is slum area with government program (SANIMAS/SLBM). Research is conducted by questionnaire distribution to communities in both locations, those results then compared and analyzed to obtain conclusion.

Location 1

Research location is Greater Bandung Area urban slum area. This location is selected based on several planning documents which are City/Regency Spatial Plan (RTRW) and Environmental Health Risk Assessment (EHRA) study.Selection criteria will refer to:

1. Population density. Ideal population density is 75 people/Ha (WHO, 2010), this research is focused in district and villagewith density over 75 person/Ha.
2. Stated as slum area in RTRW or other documents.
3. Prone Sanitation Area, according to Environmental Health Risk Assessment (EHRA) study which conducted by City/Regency by series of activities in Urban Sanitation Acceleration Development Program (PPSP) to describe sanitation condition.
4. Urban area characteristic.

Research Location 1 is described in following Table 4.

Table 4.Research Location 1

Bandung City	Cimahi City	West Bandung Regency	Bandung Regency
1.Kel. Sekejati 2.Kel. Braga 3.Kel. Andir 4.Kel. Cigondewah	1. Kel. Cigugur Tengah 2. Kel. Leuwigajah 3. Kel. Melong 4. Kel. Cibeureum	1.Kel. Padalarang 2.Kel. Ngamprah	1. Kel. DayeuhKolot 2. Kel. Rancaekek

Location 2

Research is conducted to community based sanitation development program granted areas in Bandung Metropolitan particularly in urban area, commonly known as SANIMAS and SLBM. From entire 69 locations, there is 47 locations situated in urban area.

Continuous Systems Research (Field)

Continuous system research starting from July 2014 through December 2014 with details of a field survey (May 9, 2014), sampling baseline (July 3, 2014 and August 11, 2014), installation trial of the plant net (7 and October 11, 2014), continuous system research in Cikacembang River (November 2014), extraction of metals in Industrial Hygiene Laboratory, Environmental Engineering Institute of Technology Bandung (ITB) (November and December 2014), and testingof heavy metal by using Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES) in laboratory Service Center for Basic Science, University of Padjadjaran (PPBS-UNPAD) (March, 2015). Equipment used in the continuous system is anet of 2 x 1 x 1.5 m with a mesh size of 5 mm, bamboo, tarpaulin size of 3 x 4 m, 250 ml plastic bottles, plastic zip, shovels, buckets, cool box , blue ice, cameras, DO meter, pH meter and conductivity meter. Water hyacinth (*Eichhornia crassipes*), which is used in a continuous system from Ciparay areas which has a large and small size with an averagewet weight of each size is 71.78 and 24.29 grams. Research continuous system was carried out for 4 weeks, but it will only be explained for 1 week to compare with the batch system. Sampling (water and plants) done on days 0, 3, 5, and 7.

With reference to the SNI 6989.57-2008 water sampling in all the points were done in 0.5 x depth of the surface due to river discharge an average of less than 5 m^3/sec. Samples of water and then put in a plastic bottle of HDPE (High Density Polyethylene) measuring 250 mL. Water hyacinth (*Eichhornia crassipes*)samples were taken by 2 pieces large and small, and put them in a zip plastic. Samples were stored in a cool box to keep cool at 4 ° C.

Batch Systems Research (Laboratory)

Batch systems research and metal extraction were done at the Laboratory of Industrial Hygiene, Environmental Engineering Institute of Technology (ITB) in November and December 2014, and the measurement of the concentration of metals using the tool Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES) was done in laboratory Service Center for Basic Science University Padjadjaran (PPBS-UNPAD) in March 2015. The object of the research is the water hyacinth (*Eichhornia crassipes*) obtained from rice fields in the area of Ciparaywhich has smaller size than in continuous systems with an average wet weight of 13.47 grams. The equipment used in batch systems research are glass beaker 50 ml, 250 ml Erlenmeyer flasks, flasks of 50 ml and 25 ml, funnel glass, watch glass, spatula, analytical balance, an electric stove, a water bath (water bath), refrigerator, oven, vaporizer cup, plastic zip, glass bottles, plastic bottles of 30 ml and 60 ml, papers, camera, and filter paper whatmann number 42 with a diameter of 90 mm. Materials used in batch systems research were HNO_3, HNO_3 10%, concentrated HCl, concentrated H_2SO_4, H_2O_2 10%, and aquabidest.During the research, plants were stored in racks in the aquatic laboratorywhich provided by the artificial lighting system (TL

lamps 40 W, light intensity 900-1200 lux) to replace the function of sunlight. Sampling (water and plants) was done on days 0, 3, 5, and 7.

Extraction of heavy metals in water is based on Standard Methods, 5th edition (2001) following the research conducted by Nurfitri (2010) is by concentrating the 250 mL water sample with 10 ml of HNO_3. Subsequently, the sample was heated to less than 50 mL volume. After that, the sample was diluted with distilled water until reaching the volume of 50 mL. Based on Amalia research (2012), extraction of heavy metals in plants is based on SNI-06-2464-1991 were weighed wet weight of the whole plant samples using an analytical balance. After that, the sample was separated between the leaves and roots. Further samples were chopped and mashed. The sample was then dried in an oven at 105°C for 2 hours. The oven wasused for the research is Precision Oven Economy models. Furthermore, the dry weight of the sample was weighed. Aquaregia (mixture of HCl: HNO_3 with a ratio of 3: 1) of 10 ml for every 1 gram dry weight of the sample is then given to the sample. Samples were heated in a water bath Boekel series models 020 070 1494RS-2 during a day and night. The sample then was filtered and diluted up to 50 mL volume.

Testing and Data Analysis

Testing of content of metals in water samples first of all was done by extracting the metal content in the water and plants. The content of metals in the samples were analyzed using Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES) brand Agilent Technologies type 700. ICP is a common tool used to detect various kinds of metals in the different samples. The main principle in determining element ICP is the injection of fluid and then element atomization, this technique is based on the spontaneous emission of photons from atoms and ions that have excitation in radio frequencies (Hou and Jones, 2000). The data obtained should be converted to the suitability of the data by the weight of samples using **Equation 1** until **Equation 6**.

$$\text{Concentration of heavy metals in water}\left(\frac{\text{mg}}{\text{kg}}\right) = \frac{\text{ICP Result (ppm) x 50 mL}}{\text{250 mL}} \quad \textbf{(Equation1)}$$

$$\text{Concentration of heavy metals in the roots}\left(\frac{\text{mg}}{\text{kg}}\right) = \frac{\text{ICPResult (ppm) x 25 m}}{\text{Weight of dry sample (g)}} \quad \textbf{(Equation2)}$$

$$\text{The concentration of heavy metals in the shoots}\left(\frac{\text{mg}}{\text{kg}}\right) = \frac{\text{ICP Result(ppm) x 25 m}}{\text{Weight of dry sample (g}} \quad \textbf{(Equation3)}$$

$$\text{Efficiency of metal reduction} = \left(\frac{\text{Co}-\text{Cx}}{\text{Co}}\right) \text{ x } 100\% \quad \textbf{(Equation4)}$$

Where Co = Concentration of metal on day 0

Cx = metal concentrations on day 7

Bioconcentration factor (BCF) can be determined using the following equation (Soemirat, 2005):

(Equation5)

$$\text{BCF (L/kg)} = \frac{\text{concentration of metals in plants } \left(\frac{\text{mg}}{\text{kg}}\right)}{\text{concentration of metals in water } \left(\frac{\text{mg}}{\text{L}}\right)}$$

RESULTS AND DISCUSSION

Sanitation Facility

Housing profile in Bandung City slum area is mostly owned or inhabited, but often rented as well. Inhabited house generally have private toilets while rented house use shared toilets (WSUP, 2011).Schematic on-site wastewater treatment system in Indonesia is shown on Figure 1.

Although slum area communities have private toilet, the quality should be observed further as shown in below Figure 2, but the quality of facility is doubtful. TheMinistry of Health issued the good sanitation criteria which are no water and soil pollution, bugs free, odorless, used safely and comfortable, easy to clean and paying attention to aesthetics. Toilets facility and materials are also important, for instance the wall and floor. Good floor should be dark, well isolated to avoid cockroach and other small insects, easy to clean and dry, good slope and non slippery. While the wall should be light, soundproof, isolated, having door and aesthetics.

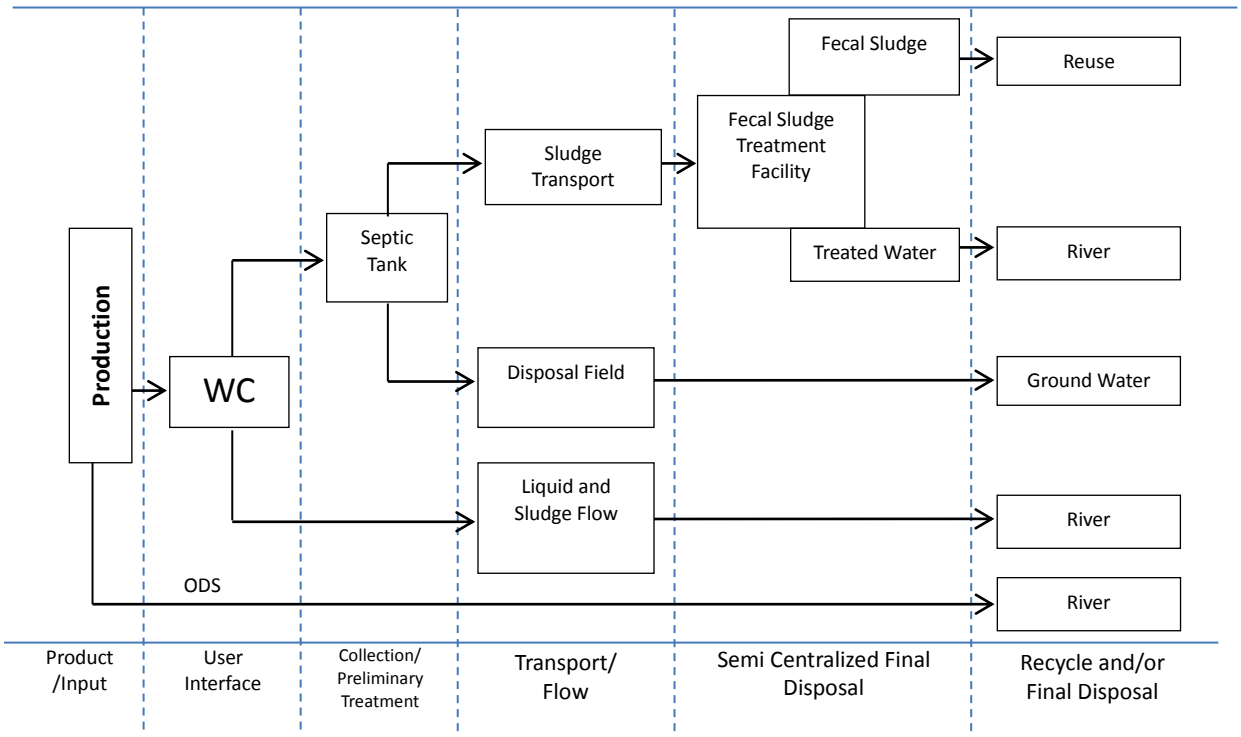


Figure1. Schematic On-site Domestic Wastewater Flow System

The same figure also explain fecal sludge collection facility that using septic tank for only 45-57%. Similar with the toilets, septic tank collection and treatment quality is also doubtful. Other inhabitants flow the sludge directly to the river or through open channel network then to the river without prior treatment as shown in above Figure 1. This network should be modified to a better piping network that equipped with communal treatment facility.

Available private toilets in each house signify that required technology is communal distribution and treatment. Hence government attempts to involve in providing sanitation facility particularly community based or decentralized communal treatment system.

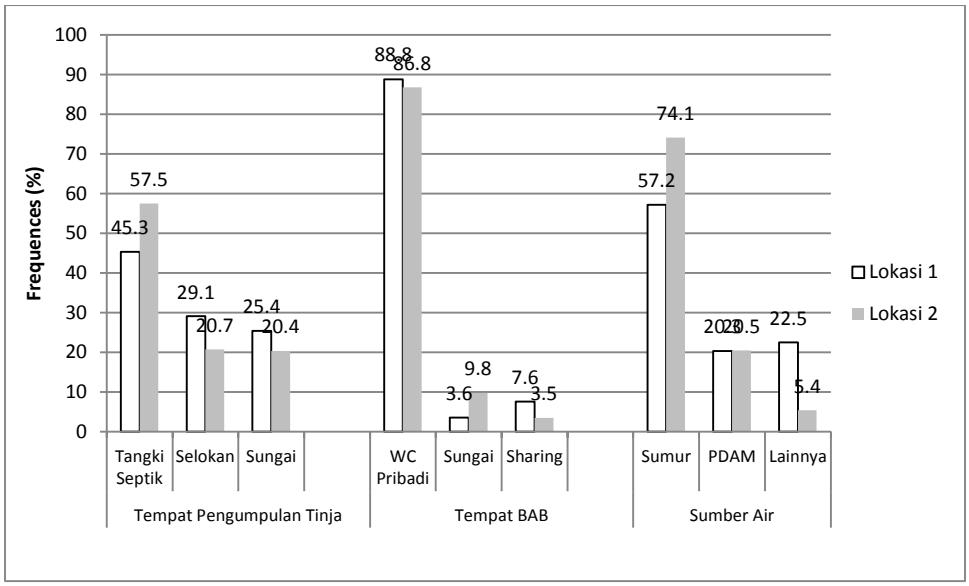


Figure 2.Sanitation Facility and Water Source Illustration

Importance Factors for Development Success and Sustainable

As explained above, Indonesian government efforts to achieve sanitation service target are implemented through decentralization system to the community that means sanitation management is conducted by the community while government acts as a facilitator. However, community readiness to implement this concept needs further study especially for the required factors. Next discussion isidentification results for sanitation management importance factors in urban slum area. The keywords are development achievement and sustainable.

Importance factors identification results in Location 1 and 2 are shown in following Table 5. There are different survey results to 10 importance factors in sanitation management in both locations. Importance considered factors in both locations are finance, community involvement, social and environmental impacts, however in Location 2 (supported by government program) other factors show up which are technology and institution.

Table 5. Importance Factors Comparison in Location 1 and 2

Quadrant	Research Result Stage 1	Research Result Stage 2
Quadrant I (important factor, not satisfied yet)	V3. Cost	V3. Cost V5. Technology
Quadrant II (important factor, satisfied)	V4. Community Involvement V9. Social Impact V10. Environmental Impact	V1. Institution V4. Community Involvement V9. Social Impact V10. Environmental Impact
Quadrant III (unimportant factor, not satisfied)	V1. Institution V2. Regulation V5. Technology V6. Private Sector	V2. Regulation V6. Private Sector V7. Cultural Role V8. Gender Role
Quadrant IV (unimportant factors, satisfied)	V7. Cultural Role V8. Gender Role	

Note:
Stage 1: Location without government program
Stage 2: Location with government program

Financial factor that comes up in both locations reflects community characteristic in slum area. As discussed above, inhabitants income in slum area generally below regional minimum wage (UMR), consequently main necessity shall be more prioritized than sanitation which least financed by any available fund. Government financial supports are much expected by community as no support experienced yet.

Technology factor arise in Location 2 which illustrate government intervention result through community empowerment in sanitation development. Previous community understanding that domestic wastewater should be disposed or treated by septic tank only, has improved by understand that technology have important role in sanitation management.

Institution as managers working place has important role in decentralization system, this factor arise in Location 2 as a result from government program to prepare community in sanitation management particularly for well structured community organization. Community has understood that by their limited time and power, a well coordinated group/institution is required to achieve success and sustainable developed facility.

Social and environmental impact and community involvement factors are considered as important factors in both locations. It means that community has understood basically that well managed sanitation is required to avoid negative social and environmental impacts. Community has involved in sanitation management in both locations, either individual in Location 1 or group involvement in Location 2.

CONCLUSION

Based on survey result, analyzed data and discussion, could be concluded that sanitation facilities are dominated by private toilets both in slum areas with and without government program. This means community has a role to provide their defecation facility independently by any available condition. Septic tank is used by part of inhabitants while other directly flows to the nature. However septic tank maintenance still poor, therefore the quality should be improved by communal or shared septic tank which is suitable to slum area physical and social condition.

Community understanding to sanitation is relatively good, particularly by government program that involve the community, starting from preparation, plan, construction and maintenance stage. Generated positive impact is increasing community understanding in sanitation management including the importance of institution and technology in addition to financial, community involvement, social and environmental impact.

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