



Sustaining Community-Scale Sanitation Services: Co-management by Local Government and Low-Income Communities in Indonesia

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Ensuring sustainability of sanitation infrastructure assets and services over the long-term is crucial for achieving safe sanitation for all. Co-management is an emerging approach that balances state and citizen responsibility for services, with applicability to community-scale (or decentralized) sanitation systems in a city-wide context. In Indonesia more than 30,000 of these systems are typically managed solely by communities, however, due to challenges in technical, social and financial aspects, commonly fall to disrepair. This paper presents qualitative research comprising document review, interviews and co-design workshops with local government and community management groups that developed a model for co-management of community-scale systems. The co-management model articulated four minimum responsibilities for local government: monitoring and corrective action; provision of technical and institutional support to community groups; formalization of fee collection; and funding of large costs for rehabilitation and expansion. This model was developed and tested in two case study locations, and through this process, was deemed appropriate, acceptable and feasible for both local government and community management groups. Related changes to Indonesia's national program guidelines were also identified to clearly articulate local government's role. The agreed co-management approach aligns with the human right to sanitation by supporting local governments fulfill their legal mandate for services, promotes professionalized sustainable management arrangements, ensuring community-scale systems can contribute effectively to future citywide solutions.

Keywords: co-management, sanitation, sustainability, local government, institutional arrangements

INTRODUCTION

Providing sanitation services at city-scale is expected to require a combination of different system types, including on-site, decentralized and off-site centralized treatment. To ensure sustainable services into the future, each system type requires an accompanying effective management approach. This article is focused on community-scale systems (also known as decentralized or

small-scale systems), and experience of their large-scale implementation in Indonesia in low-income areas. Community-scale systems have also been implemented elsewhere at scale, including in India (Ulrich, 2018) and Egypt (Reymond et al., 2018), and are considered an important component in city-wide sanitation solutions (BMGF, 2017; Lüthi and Sankara Narayan, 2018; Reymond et al., 2018; and Larsen et al., 2013). Existing literature promoting decentralized solutions in the citywide context largely focuses on the technical aspects (Lüthi et al., 2011; Willetts et al., 2013b; Bright-Davies and Luthi, 2015; Capodaglio, 2017) or economic aspects (Retamal et al., 2011; Willetts et al., 2013a), whereas this paper deals with the institutional aspects, building on a small number of studies examining the latter (Etnier et al., 2005; Willetts et al., 2007; Mitchell et al., 2008; and Reymond et al., 2018).

The Government of Indonesia (GoI) has made significant investments in community-scale sanitation (also known as SANIMAS) over the last 10 years with at least 20,000 systems built as part government and donor urban sanitation programs (Mitchell et al., 2016). These systems can include communal toilet and bathing blocks, simplified sewer systems serving up to 200 households or mixed systems combining these. Wastewater treatment is typically with Anaerobic Baffle Reactors (ABR), both cast-in-situ and prefabricated, and may also include chambers of anaerobic filter or discharge to a constructed wetland or other secondary treatment process. Based on current estimates, there were expected to be almost 30,000 systems by the end of 2017. The medium-term development plan (RPJMN) targets 100% access to sanitation by 2019, of which community-scale systems are proposed to contribute 7.5% of sanitation coverage, the same proportion as centralised sewerage systems, with the remainder covered by on-site systems.

In Indonesia, local government has a legal mandate to provide access to sanitation as a 'basic, mandatory and concurrent affair' based on local regulations introduced in 2014 (Al'Afghani et al., 2015). However, to date there are varied institutional arrangements for managing urban sanitation, with different local government departments, water and wastewater utilities responsible for all or parts of sanitation services depending on the city (Eales et al., 2013). Community-scale wastewater systems (known as SANIMAS systems), to date, have been funded under a model that promotes community responsibility for ongoing service delivery. A community group is formed to implement each system (known as a *Kelompok Swadaya Masyarakat* – KSM) and another group to operate and maintain it (known as a *Kelompok Pemanfaat dan Pemeliharaan KPP*). Since in reality these groups are often merged, and the commonly used term is KSM, in this paper we refer to the relevant community management group as KSM only.

Weak or unsuitable organization models and institutional arrangements have been blamed for poor performance and failures of decentralized systems installed worldwide (Brown and Farrelly, 2009; Mitchell et al., 2010; Kiparsky et al., 2016; Larsen et al., 2016). The institutional arrangements which prescribe sole community responsibility for ongoing service delivery in Indonesia have been found to be unsustainable, particularly financially (Eales et al., 2013; Mitchell et al., 2015). The problems

identified in these reports included: systems not operating at capacity, on average utilizing less than half of their design capacity; approximately 80% of systems had not been desludged; only 60% of community groups collected any fees, and those fees collected were insufficient to cover needs; many tasks allocated to KSM were beyond their financial or technical capacity; and most KSM were not legal entities and land ownership for the community-scale wastewater systems was typically insecure. While effluent data from Eales et al. (2013) indicated acceptable performance, effluent quality appeared to be decreasing with increasing scale-up, and Mitchell et al. (2015) confirmed that there was limited data on the status or performance of systems, with effluent quality testing only available for 2% of systems.

Given these challenges, this research sought to examine the feasibility of a co-management approach, in which responsibilities for on-going management of the community-scale wastewater systems would be shared between local government and communities. The proposed co-management approach was based on the recommendations of the previous research (Eales et al., 2013; Mitchell et al., 2016) that there was a need for greater local government involvement to effectively sustain services. As such, the research sought to define appropriate roles suitable for local government and communities to jointly manage community-scale systems in the long-term.

MATERIALS AND METHODS

This research employed document review, semi-structured interviews and facilitated co-design workshops in 2016–2018. Two city case studies were employed. This methodological choice took into account that case studies provide opportunity to investigate a contemporary phenomenon (in this case management of community-scale wastewater) within its real life context, acknowledging that the phenomenon is not distinct from the context, and the contextual details are also important and must be analyzed (Yin, 2003). The two selected case study locations were Kota Bogor, West Java and Kabupaten Bantaeng, South Sulawesi. These locations were selected based on local governments' willingness and interest to change and extend their roles to support the effective ongoing operation and management of community-scale systems. In each location, the technology employed was anaerobic baffled reactors, serving 10–120 households in Bogor and 30–50 households in Bantaeng (average four people per household). These comprised a mix of communal toilets, shared septic tanks and decentralized sewer systems.

The research addressed three research questions, the first focused on developing and articulating what "co-management" might look like in practice, the second focused on the case studies the city level, and the third addressing the national level with regards to program implementation guidelines for community-scale sanitation in Indonesia.

The conceptualization of a co-management approach answered the question: What balance of responsibilities should be sought between local government and communities in sustainably managing community-scale sanitation services,

including which minimum responsibilities should be taken on by local government?

At the city level the research investigated: What enablers and constraints are revealed when local government increase responsibility for community scale sanitation in two case study areas (Kota Bogor and Kabupaten Bantaeng)? Including three sub-questions:

- (i) To what extent are proposed minimum responsibilities for local government appropriate, acceptable and feasible in terms of improving sustainability of community-scale sanitation services?
- (ii) How could the institutional arrangements be modified to increase local government responsibility for community-scale sanitation in the case study locations? What should be the role of different actors [e.g., relevant local agency or work unity, cross-agency working group (*Pokja sanitasi*)]?
- (iii) How do national implementation approaches and regulations shape the way local government could take on the proposed minimum responsibilities?

At the national level, the research investigated: What revisions to the national program guidelines would clarify local government responsibility and guide all stakeholders on the options and implementation of a co-management approach?

Document review comprised drawing on literature on governance and management of community-scale systems in Indonesia and elsewhere, as well as detailed review of the Indonesian national program guidelines for community-scale sanitation (Technical Guidelines SANIMAS Regular and Appendix (*Petunjuk Teknis SANIMAS Regular dan Lampiran*) 2016; and Implementation Guidelines for Special Allocation Fund (DAK) Infrastructure Sector Sub Sector Sanitation (*Petunjuk Pelaksanaan Dana Alokasi Khusus (DAK) Bidang Infracstruktur Sub Bidang Sanitasi*) 2016.

Semi-structured interviews were undertaken with 17 government and community stakeholders in Bantaeng and 12 government and community stakeholders in Bogor. The interview guide covered key areas of community and government proposed responsibility for community-scale systems under a co-management model and was designed to test perceptions and reactions to the proposed arrangements.

A co-design and a follow-up workshop were undertaken in each case study location. This research approach valued engagement by relevant stakeholders in the research process, with an intent to prompt changes in their thinking through their involvement in the research, and to ensure the research was relevant to their work. Co-design is an emerging discipline that proactively brings together actors to address a particular issue or problem (Blomkamp, 2018). In Bantaeng the initial workshop was attended by 25 participants (7 women, 18 men) and included the following organizations: planning agency, public works agency, technical work unity for wastewater management,¹ health agency, environment agency, water utility, two KSM and AKSANSI (National association of KSM) and a representative

¹Unit Pelaksana Teknis Dinas - Pengelolaan Air Limbah (UPTD-PAL) is the Technical Implementation Service Unit - Wastewater Management.

of a sanitation development cooperation program. The follow-up workshop was attended by eight members of the sanitation working group. In Bogor, the workshop was attended by 20 participants (11 women, 9 men) including planning agency, public works agency, waste management unit, environment agency, water utility, city development group, AKSANSI and a representative of a sanitation development cooperation program. The follow-up workshop was attended by nine members of the sanitation working group. The participatory methods drew on Mitchell and Ross (2016) and the work of Rosenqvist (2018) and focused on how responsibilities could be partitioned between different actors and designing scenarios for how roles and relationships could be shifted and changed.

The qualitative research approach described above has the advantage of providing in-depth analysis for the two cases including specific details that illustrate the co-management concept. A limitation of the study is its scope, in covering only two case study locations and limited numbers of research participants due to the qualitative approach. The careful selection of research participants based on relevance of their role to the research topic serves to mitigate this concern.

RESULTS

The findings of this research are presented in three sections, addressing the three key research questions in sequence.

Conceptualizing a Co-management Approach

Previous research recommended greater local government involvement in the management and governance of community-scale systems (Eales et al., 2013; Mitchell et al., 2016). However, it was recognized that the community plays an important role, and community empowerment remains a strong national government norm in Indonesia. Therefore, a co-management approach was proposed that comprised the KSM managing daily operation, with local government supporting the KSM in more complex tasks. Following the document review and co-design workshop four minimum responsibilities were identified for local government alongside related community roles (see **Table 1**). These minimum responsibilities are elaborated and justified in the sections below.

TABLE 1 | Co-management approach to community scale sanitation.

Community operate	Local government support
Within community capacity: 1. Day-to-day operation and maintenance (regular cleaning, removing rubbish, unblocking pipes etc.) 2. Collect user fees and fund regular costs (e.g. pay operator) 3. Request support	Proposed minimum responsibilities: 1. Monitor and maintain records and plan corrective action 2. Provide technical and social support to community management group 3. Formalise process of fee setting and collection 4. Fund major costs (rehabilitation, extension, retrofitting)

Monitor and Maintain Records and Plan Corrective Action

Local government responsibility to monitor services constitutes an integral part of their legal mandate to ensure ongoing services. The proposed task includes monitoring and maintaining records of all community-scale systems, including technical assessment of performance and damage, as well as the institutional and financial status of KSM, and to inform KSM of any immediate concerns and share data with relevant local government department (e.g., health or public works) and ensure corrective follow-up actions. Previous research found that limited monitoring occurs (Mitchell et al., 2016). The system operation and the institutional and financial status of KSM are not formally monitored by local government, only informally through AKSANSI (Mitchell et al., 2016).

Monitoring needs to consider different information needs. First, at the strategic level, there is a need for city or national scale monitoring to understand the status and performance of the systems with respect to city-wide sanitation planning and development, and to determine the extent to which community-scale systems are a cost-effective, appropriate way to achieve city and national-level sanitation strategies. Such information could be compiled at local level and then integrated with national strategic monitoring through the national database NAWASIS.² Second, at the tactical level (or management level) there is a need for monitoring of technical, institutional and financial status of systems. Monitoring should be ongoing (i.e., annually) and should inform the sanitation department of priorities for investment and planning. The responsibility for tactical level monitoring is already allocated to local government in the national guidelines. However, the lead actor to consolidate data and share the findings is often unclear and current monitoring, if it occurs, focuses only on the effluent quality. Lastly, at the operational level there is a need for KSM's daily and weekly monitoring of the system operations to inform immediate needs and maintenance or make requests for additional support.

Provide Technical and Social Support to KSM

There is significant need for local governments to proactively provide KSM with technical and institutional support post-construction for operation, maintenance and management. Previous research (Eales et al., 2013) found that one-third of systems did not have an active management group, most did not collect user fees and over half the operators surveyed were working without cash payment. While these systems were built with an effort to enable community empowerment, instead, several communities reported that the system becomes a burden due to malfunctioning, and that there was a missing line of communication or assistance from local government (Rosenqvist, 2018).

The specific activities that KSM found challenging included both technical and non-technical activities (Mitchell et al., 2016). Technical challenges included: monitoring of effluent;

major repairs and rehabilitation; retrofitting unused facilities (community toilets and unconnected simplified sewerage systems; conducting biogas maintenance; monthly de-scumming and desludging every 2–4 years. Non-technical challenges included: collecting user fees; managing the accounting books; reporting and managing bank accounts; paying operators, planning and budgeting for recurrent or major/unexpected costs; sourcing supplementary income; ensuring operator is active and has legitimacy in community; and educating households about the benefits of the system to encourage them to connect or increase their willingness to pay.

Formalize Fee Setting and Collection

The approach to community-scale sanitation in Indonesia requires that households commit to paying a monthly fee for operation and maintenance to be collected and managed by the KSM. The amount and method of collection are left to the community to define. In shifting to a more professionalized service, it is important to formalize fee setting and collection, as this provides authority and legitimacy for KSM in this domain, and as a consequence, enable sustainable financing of operational costs. Although during system development a given community commits to paying the ongoing costs as part of the initial selection criteria, previous research found that more than a quarter of community sanitation centers have no regular income at all, and over half of simplified sewer systems rely solely on ad hoc collections as necessary (Eales et al., 2013) and that fee collection is the most common challenge for KSM (Mitchell et al., 2016).

This research revealed that these challenges related to fee collection are due to four main reasons. First, a lack of perceived need, particularly for community sewer systems, since the operator is typically not paid and major costs such as desludging or maintenance are not planned for. Second, lack of legitimacy for wastewater fees. According to the national program guidelines the fees were “*iuran*” which is a voluntary contribution rather than a ‘tariff’ or ‘retribution’ which are regulated payments. Nor are sanitation fees set at village or sub-village levels, whereas this is done for other community service fees (i.e., security or waste collection). Third, there is a lack of authority to collect fees in the case that the allocated collector is the operator, or someone not linked to the community power system (community/neighborhood group, RW/RT) who typically collect other community service fees. Lastly, there is low willingness to pay – with education and empowerment activities with the wider community typically only undertaken pre-construction, the understanding of the benefits of the system is lost over time, resulting in low commitment to pay.

Fund Major Costs

A minimum local government responsibility to fund major costs that are greater than community financial capacity is a way to ensure that major repairs and rehabilitation take place in a timely manner, and that additional connections and retrofitting can be undertaken. This role is strongly needed as most KSM are not able to collect sufficient fees to cover routine operational costs, let alone the major and significant costs which need to be met for successful operation. Nor are KSM capable of planning and

²NAWASIS or the National Water Supply and Sanitation Information Service is an internet-based data center being developed to monitor the development of water and sanitation sector in Indonesia www.nawasis.info.

budgeting for such costs (Mitchell et al., 2016). Full life-cycle costs (Abey Suriya et al., 2015) for sustainable operation of community-scale sanitation systems include:

- **Capital investment:** initial investment cost for infrastructure.
- **Routine operation:** such as the operator's salary, costs of cleaning materials and equipment, electricity and water costs for communal toilet facilities, etc.
- **Minor repairs:** small maintenance costs such as unclogging the system, desludging, fixing pumps, desludging (every 4,5 years).
- **Major costs:** Larger repairs such as main pipe or outlet repairs, rehabilitation from major damage, system expansion and new connections or retrofitting (i.e., converting a community toilet to a simplified sewerage system with household connections).

Given regular collection of adequate user fees, the KSM should be able to recover the routine operational costs and minor repair costs. However, the major costs described above are unlikely to be funded, even with improved fee collection. In addition, to date there has been limited guidance on available options for KSM to request financial support from local government.

A key issue arising in relation to financing large costs is asset ownership. Legitimate expenditure for local governments relies on either government ownership of the asset (and the related land) with registration of the asset on the local government asset register, or, payment of a grant (hibah) to a legal entity (Al'Afghani et al., 2019). As currently few KSM are legal entities, this raises issues that require further resolution by sector stakeholders and are discussed in the two case studies below.

Findings in Bantaeng

Kabupaten Bantaeng is a Regency in south Sulawesi located on the coast, with a population of 185,581 and a population density of 469 people/km² (Badan Pusat Statistik [BPS], 2019). Bantaeng undertook a city sanitation planning process in 2013, 2014, which was further expanded in 2016 with a more comprehensive poverty, health and sanitation survey, and set targets for reducing open defecation, increasing toilet connections to existing community-scale systems and building new ones. At the time of this research, 68% of Bantaeng households used septic tanks, 10% used community-scale systems (communal toilets or simplified sewerage systems) and 22% practiced open defecation.

At the time of this research, there were 22 community-scale systems built since 2010, with the majority in recent years, and including 16 simplified sewerage systems, 1 communal toilet and four mixed (communal toilet and simplified sewerage) systems. Based on an expected design capacity of 50hh/system, approximately 4,400 people could be served by these systems which equates to 2.5% of the city population. However, this study confirmed that utilization was approximately 66% or 2,444 people.

Sanitation was managed by a local wastewater work unit (UPTD-PAL- *Unit Pelaksana Teknis Dinas (UPTD) Pengelolaan Air Limbah (PAL)*) established in 2014 under the public works

(PU) department. At the time of research, it consisted of one technical staff, one support staff, four truck operators and two treatment plant operators. Based on a local regulation (3/2015 PU decree- *PU Decree 3/2015 on UPTD-PAL position description "Keputusan kepala dinas pekerjaan umum dan kimpreswil Nomor 03 Tahun 2015"*), UPTD-PAL was responsible for the operation of the planned centralized wastewater treatment system, treatment for special community apartments and sludge treatment, and although the responsibility for community-scale systems was not clearly defined, there was one specific position allocated for a patron or "guide" for community-scale facilities and community participation management, with that role vacant at the time of this research.

The proposed four minimum local government responsibilities were discussed in interviews, the co-management workshop and follow-up workshop with the Pokja Sanitasi, with the findings presented below.

Monitor and Maintain Records and Plan Corrective Action

Prior to this research there was limited data on the technical status of community-scale sanitation systems and no data on KSM institutional or financial status. While effluent monitoring was conducted by the environmental agency (BAPPEDALDA) the available data was not for all sites, infrequent and only monitored environmental parameters that do not indicate treatment performance. Both the health department (DINKES) and Bappedalda monitored groundwater quality, however, this information was not shared with other departments or consolidated with other data to inform sanitation improvements.

The planning agency (Bappedda) suggested that investment should follow planning and planning requires data and were supportive of an increased focus on monitoring. Additional drivers for monitoring identified by participants included: the need for data on the status of sanitation in order to receive national funding to provide on-site sanitation, to improve river and sea water quality, and to improve planning for system repairs. Following the workshop, the city had already taken steps to improve monitoring, specifically for the community-scale systems. UPTD-PAL accompanied AKSANSI to conduct monitoring of the technical, institutional and financial status of the existing systems in 2016. Bappedda was also in the process of conducting city-wide sanitation status and health surveys and proposed to add this data to their poverty database.

To improve monitoring and corrective action, it was agreed that clarity of responsibilities was needed across agencies. A proposition was made that PU lead and coordinate ongoing monitoring and data collection for community-scale systems, as they are the agency responsible for sanitation and with the authority able to fund improvements. The PU decree (3/2015) allocates responsibility to UPTD-PAL for wastewater monitoring, however, they did not yet have a laboratory so Bappedalda would continue to support. Monitoring was agreed to include both technical and social aspects and would require additional resources for the UPTD-PAL (or to outsource some tasks to a locally registered unit of AKSANSI or other provider) and

support from the *Pokja Sanitasi* to enable coordination and appropriate sharing of data and responses across agencies.

Technical and Social Support

As a part of this research, AKSANSI and UPTD-PAL reviewed all 22 community-scale systems and found various technical problems, with eight systems damaged, and problems with main sewer pipes and backflow. Utilization was only at 66% of the system capacity across the 22 systems, and of those households utilizing the systems, only a quarter had connected both their toilet and their greywater, which the systems are designed for. Surprisingly, most had not connected their toilet and did not realize this was the intended purpose of the community-scale sanitation system. Despite the relatively recent development of the systems, 38% of the 21 systems monitored did not have an active KSM and 33% did not have an active operator (see **Figure 1**). While UPTD-PAL had provided some technical support for major repairs to three systems, there was no ongoing technical or social support for KSMs, and KSM members reported that they did not know where to go if they required support.

To develop a way forward for local government to provide a strengthened support role to KSM, research participants identified a number of key directions, and took action on several of these between the co-management workshop and the follow-up workshop six months later. Local regulations and plans already allocated a key role to UPTD-PAL in the form of the local wastewater decree³ and the UPTD-PAL Roadmap, covering their upcoming planning, mentioned annual institutional strengthening of KSM. It was suggested that improvements could be made to the social support to KSM by leveraging from existing sub-district/village healthy city programs and placing greater responsibility on sub-district leaders. In addition, following the co-management workshop, a coordination meeting with sub-districts had been held and DINKES (health agency) had started build capacity amongst its health center staff (*Puskesmas*) to address existing misperceptions and promote greater acceptance of blackwater connections to community-scale systems, not just greywater. Another identified strategy was to provide rewards for high performing KSMs as a means to recognize good management. Finally, the UPTD-PAL agreed to provide additional technical support to the KSM by directly paying four operators to oversee the operation of all systems in Bantaeng, covering approximately five systems each.

Setting the User Fee and Authority for Collection

AKSANSI's monitoring in 2016 revealed that only 33% of KSM (7 systems) had set a user fee (**Figure 2**). The other KSM reported that either: they didn't know a fee was expected, did not think it was necessary, assumed the community would not pay so didn't set one, or thought the area was too poor to pay. Only 14% (3 locations) collected user fees and of these only one provided a salary to the operator (**Figure 1**) while one other provided cigarettes for work done. The collected monthly fees

were between IDR 3,000 and 5,000/month (US\$0.18–0.31, see **Figure 2**). This equates to 0.2–0.4% of the average monthly household expenditure in urban areas of South Sulawesi in 2016 (Badan Pusat Statistik [BPS], 2016), and while it is low in relation to operational expenses, it is similar to the US\$0.31/month tariff applied in other Indonesian cities (Eales et al., 2013).

Interviews with four operators as a part of this research indicated that many wished to be paid but were also likely to continue their work unpaid out of a sense of obligation and personal responsibility for the systems: “*feel I have to make a contribution to my community and keeping it clean*” and “*I am not the allocated operator but I realize that if there is no money then no one else will work. Since the community trusted me to be head of KSM, I feel responsible to maintain the system*”. The operators also reported that they are not always supported by the community/neighborhood group (RT/RW) which is why sub-district support was deemed important. Regulations regarding the user fee and its use are also necessary to support KSM treasurers, as one noted that there is an expectation that any saved money will be made available for emergency community expenses rather than saved for major repairs or desludging.

Through the co-management workshop, it was agreed that the formalization of fees and KSM responsibility for collection through a sub-district level decree (Surat Keputusan, SK) rather than through a higher Kabupaten regulation, was appropriate. Discussions had started with sub-district/village regarding their roles in supporting KSM and the management of communal scale systems, and plans were made for providing training in financial management to KSM.

Major Costs

This research investigated and found three areas in which the KSM required financial support for major costs. These included: (i) increasing the number of household connections due to systems operating at only 66% of design capacity; (ii) connection of blackwater (from toilet) since 65% of households connect only greywater (from shower, washing); and (iii) major maintenance efforts to fix damage to main pipes or treatment and issues that had already been identified in 2016 (see **Figure 3**). In addition, the research identified one system that was not in use and another that had very low usage.

To date, local government has already provided funding for some major costs. For example, they funded major repairs including IDR 50 million (USD 3,700) in 2015 to build an outlet chamber to reduce backflow from the river, and IDR 75 million (USD 5,700) in 2016 to repair a subsided inlet pipe, resurface the treatment plant, install grease traps and build 17 new household connections. This research found there was uncertainty within some local governments about the legality of funding community-scale sanitation systems if they were not on their asset register, however, in Kabupaten Bantaeng, the local government was able to legitimately fund these repairs since the majority of systems were funded through a direct allocation fund, and for most capital budget (*belanja modal*) expenditure had been used and assets kept on the local government asset register rather than being handed over to community.

³2015 Bupati decree about domestic wastewater No 37/2015.

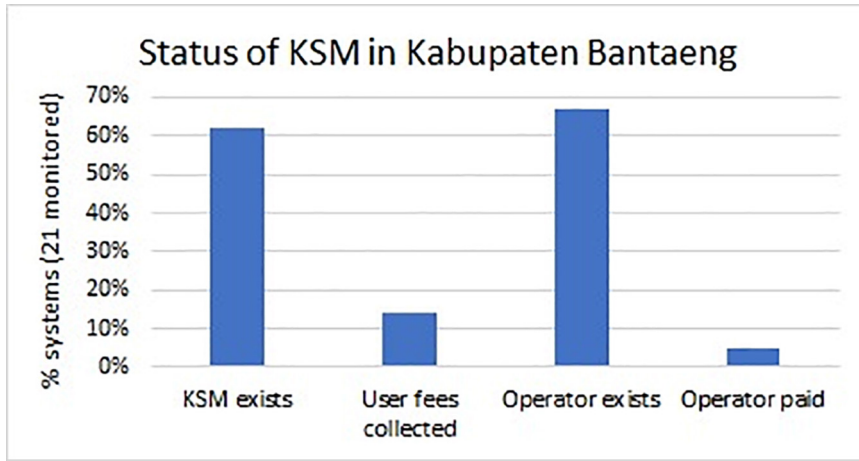


FIGURE 1 | Management status based on review of community-scale systems.

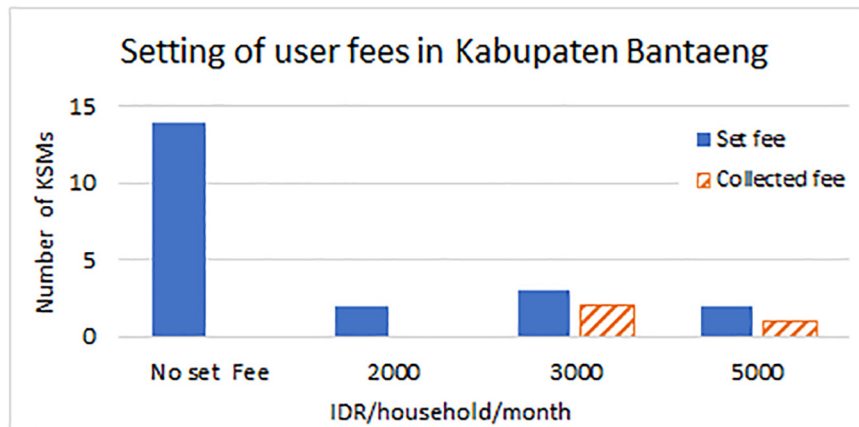


FIGURE 2 | Setting of user fees in Kabupaten Bantaeng.

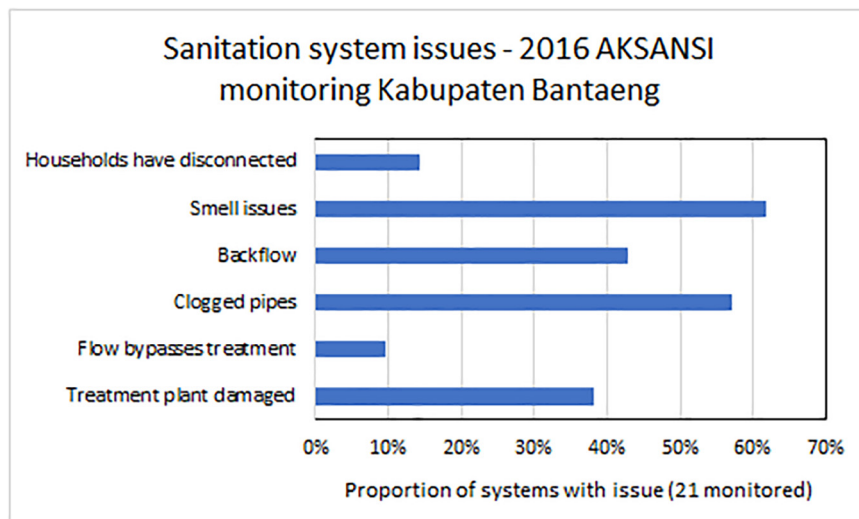


FIGURE 3 | System issues and damages in Kabupaten Bantaeng (AKSANSI monitoring 2016).

For 2017 PU had planned for and requested IDR 90 million (USD 6,900) for maintenance, additional connections and monitoring of existing systems. Based on AKSANSI monitoring and the results provided during this research, they specified the locations for support, with an intention in future to develop clear criteria for support requests. For the systems not on the local government asset register, PU were interested to investigate ways to financially support these systems or have them formally handed from community-ownership to local government ownership.

Findings in Bogor

Kota Bogor is a city in West Java with a population of just over 1 million (2017) and a population density of 9,359/km² (Badan Pusat Statistik [BPS], 2018). Kota Bogor completed their city sanitation strategy (SSK) in 2011 and at the time of this research were investing in extending centralized sewerage in some areas. A new wastewater local government decree (*Perda*) was in the approval process intended for all scales of sanitation was under development.

Sanitation in Kota Bogor was predominantly on-site (71%), although many households' toilets discharged directly to the river (22%) and open defecation still occurred (4%) (Bogor, 2014). A centralized wastewater treatment plant was built in 1997 for 600 households but only 393 were connected. Fifty-two community-scale sanitation systems were built from 2007 to 2014 serving over 8,000 people (1% of the population). A further 40 systems were proposed to be built in 2016 and 83 in 2017.

Institutional responsibilities were spread across different agencies and also lay directly with communities. Wasbangkim (the department of building and housing supervision, WBK) was assigned responsibility for community-scale sanitation systems in 2015. Prior to this the wastewater technical implementation unit UPTD-PAL (under the cleaning department, DKP) were responsible as they also managed the centralized sewerage system and fecal sludge. The Healthy City Forum (*Forum Kota Sehat*, FKS) was established in 2007 and it supported the implementation of communal scale systems, while an AKSANSI branch was established in 2013 to support the KSM in the operation phase. A draft local regulation allocated responsibility for community-scale sanitation to the community (*masayarakat*), however, several participants in this research also suggested that the UPTD-PAL should potentially also take on the role of supporting community-scale sanitation.

Monitor and Maintain Records and Plan Corrective Action

With 52 existing community-scale systems and many additional planned systems for 2016 and 2017, the total comprises over 170 systems which would require monitoring. Due to this large number, a systematic way of assessing issues and prioritizing and planning major maintenance, rehabilitation and expansion investment was needed. Existing responsibility for these systems has been dispersed and ad hoc, with the environment agency (BPLHD) monitoring effluent annually and the local health agency (Dinkes) monitoring water quality. WBK had conducted a one-off technical assessment of all systems. AKSANSI had also undertaken preliminary monitoring of technical and institutional

dimensions. Data was typically not shared and not available to inform decisions.

Over recent years Kota Bogor had initiated action in the domain of monitoring, including formally shifting responsibility for the monitoring from the community to local government in a new local regulation. During this research, one local government participant confirmed that: "*Data entry would be centralized with one agency and we and will continue discussing at Pokja saniatsi. We will also make a city mayor regulation (Perwali) to specify the roles for monitoring*" such that information from WBK, AKSANSI and BPLHD could be consolidated, and transparent decisions made about which systems should then receive support.

Technical and Social Support to KSM

An investigation conducted as part of this research identified a number of institutional issues: 13% of systems monitored did not have an operator, 44% did not have a user fee, only one system has been desludged and 19% systems had issues with wastewater flow. Similarly, the Wasbangkim assessment report included reports of blocked and damaged pipes, and damaged superstructure or treatment systems.

Technical support to KSM was particularly necessary for desludging, as many systems were likely to soon require emptying. However, access was difficult to many systems due to steep terrain, narrow access lanes and long distances from main roads suitable for the emptying trucks. The small carts provided through awards or grants to some KSM were unsuitable in some locations because they were too big for alleys or, due to their small volumes and short hose lengths, would require complex arrangements to empty the systems. Through the research process it was decided that the UPTD-PAL would support desludging, however, the technical solutions remained unclear for steep areas.

Social support was also required, with reports that many KSM were dissolving and neighborhood leaders then became tasked with managing the community-scale systems. AKSANSI was active and provided some social support to KSMs but did this voluntarily without recompense and did not have the authority to enforce KSM activity, unlike government institutions.

Local government has attempted to incentivise better functioning of KSM and since 2014 the local government has presented Sanitation Awards for KSM with the aim of recognizing KSMs, motivating good operations and maintenance, and raising awareness in the community about the need to maintain systems. Wasbangkim also conducted one-off empowerment workshops for KSM in 2016. Through this research further roles were also defined, in particular to allocate primary responsibility for social and institutional support to the relevant subdistricts (*Kelurahan*).

At the co-management and follow-up workshops, it was also proposed that budget funds should be allocated for both supporting technical issues and for empowerment of KSM, including instilling a sense of responsibility, operations training, and setting and collecting tariffs. However, at the time of this research, grants could not be provided on an ongoing basis, and only to legal entities, whereas none of the KSM in Bogor were legal entities.

Setting User Fee and Authority for Collection

Fees are needed to cover daily costs including operator fees, maintenance equipment, electricity and water charges for communal toilets. The existing fee collection was low and justified increased attention to this area by local government. Monitoring revealed that 44% of systems do not have a set user fee, and those that do charge IDR 1,000–25,000 (0.08–1.9 USD) per household per month, with an average of IDR 2,400 (USD 0.18) per household per month (see **Figure 4**). These tariffs equate to 0.1–2.2% of the average monthly household expenditure for urban areas of West Java in 2016 (Badan Pusat Statistik [BPS], 2016). This is lower than national target for affordability of 4% for water supply, however, as these systems often serve low income populations the affordability of the connected community should be considered. Data was not collected on whether the KSM are collecting the fees, or on the percentage of households paying. Co-management workshop participants noted that fees are insufficient to cover costs and the monitoring showed only 13 of 52 KSMs pay the operator a salary (see **Figure 4**).

Barriers to fee collection included the perception from households that sanitation was a free service and they did not see the need to pay, while some KSM acknowledge the households are low income and do not think they can afford a fee. Very few KSMs were saving money to pay for the intermittent expenses of desludging and minor repairs, therefore such often did not occur or the KSM leadership or operator paid.

During co-management and follow-up workshops, the *Pokja Sanitasi* agreed that a user fee should be paid for communal scale systems, so long as that fee were affordable for low income households. It was agreed that the neighborhood group and sub-district should be engaged to support the formalization of *iuran* (contribution) or else that a local regulation should include the possibility of a tariff or *retribusi* (which have a different status to *iuran*) to support institutionally based fee collection. In a scenario where the UPTD-PAL would be made responsible for community-scale systems, this agency could support formalized fee collection, as is undertaken for centralized sewerage.

Major Costs

The feasibility study commissioned by Wasbangkim identified a number of technical issues, with 12 systems requiring priority improvements due to damage and idle capacity. This included five systems which needed replacement due to severely damaged treatment plants or issues with the inlet or outlet pipes, and requests for expansions. These repairs and expansions were beyond community ability to fund. During co-management workshops participants recognized that the users of community-scale sanitation systems are typically low income and local government should be responsible for paying for these major expenses.

To date, the Wasbangkim had funded eight systems for rehabilitation or optimization in 2016 and requested a similar amount for 2017. Improvements supported by local government funding to date included the following: repaired the communal toilet roof and added a room for community use, repaired the main pipe that was not previously flowing; repaired and painted a communal toilet building and built another level for community use; created a new well water supply and fixed some manholes; provided a new water supply; and increased the size of the inlet pipe, built a new water supply and added a washing area at a communal toilet. The latter system also required desludging but it was inaccessible with current equipment.

A proposed local regulation for wastewater allocated sole responsibility to the community for financing the operation and maintenance of community-scale systems. However, this regulation also noted that funds could be “sourced from *iuran* or other legitimate sources” which could include government sources, but there was no requirement for local government to provide funds, a matter which was left to further discussion subsequent to this research.

One complication regarding funding major costs was the asset ownership status. The national guidelines implied that assets were to be handed over to communities, and indeed in many cases the relevant land was owned by the community. However, this situation precludes local government legitimately

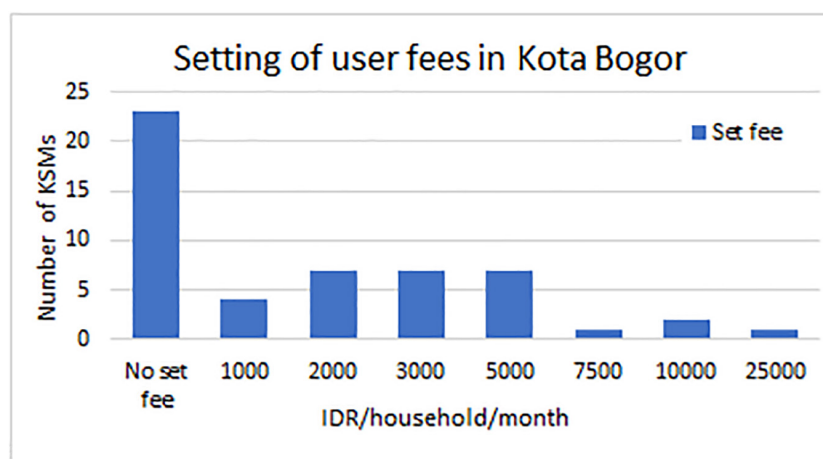


FIGURE 4 | Setting of user fees in Kota Bogor.

funding maintenance, rehabilitation or repair of these systems from the local government capital maintenance budget, since they would not appear on the local government asset register. Hence the possibility of handing assets back to local government was discussed, as was the potential for KSM to become legal entities such that KSM could instead receive funds from local government for repairing sanitation systems.

During the co-management and follow-up workshop, the *Pokja sanitasi* also suggested that the Wasbangkim should develop a standard operating procedure for the local government funding of rehabilitation and expansion. This would ensure strategic investment and the planning of funding, improve equity and provide an incentive for KSM to improve their institutional functioning.

Review of National Program Guidelines

Recent updates to the National Guidelines had moved from allocating full responsibility with the community, to assigning at least some responsibilities to local government. However, these roles were not always well defined. Our review therefore focused on how the Guidelines could more explicitly support and articulate a co-management approach in which community and government are both responsible for different aspects of management and governance. The review covered three elements: (i) allocation of responsibilities to community and to local government (ii) post-construction financing and (iii) asset ownership and KSM legal status. These represent areas where decisions made in the implementation phase directly affect subsequent local government and community roles in service delivery. The review focused on two different programs (with different funding arrangements between national and local level). Firstly, Sanimas DAK (70% of systems built in 2015), a funding mechanism whereby local government directly receives a grant and itself chooses how to invest. Secondly, Sanimas Regular (10% of systems built in 2015), a nationally run program in which provincial level representation of the Ministry of Public Works provided support to communities and local governments play a lesser role. The latter program was reported by local governments to inappropriately by-pass their own planning processes due to the direct engagement with communities, compounding the issue of their low sense of ownership and responsibility for the systems.

Review of the *allocation of responsibilities* in the Guidelines revealed that success and sustainability were described as dependent only on community roles rather than on both community and local government. The Guidelines allocated responsibilities to community that, based on previous research, are beyond their capacity while local government roles were not fully clarified. The focus on building capacity of the community organization was stronger for the Regular program compared with DAK program. Overall, the national guidelines were based on a norm to support 'community empowerment' to create ownership of the community-scale sanitation systems. For example, "*Management of infrastructure and facilities can run well if [it is] realized with a real working plan and contributions (funding) from beneficiaries as [a form of] self-reliance for sustainability. This is done to foster a sense of belonging*". (Regular guidelines Article 6.2). This vision of

empowerment is unfortunately not realized, as roles allocated to community are beyond their capacity. The Guidelines include numerous activities that are allocated to the KSM. These include: prepare the operation and maintenance plan; operate and maintain the sanitation facilities; conduct or organize desludging; conduct effluent monitoring; monitor and record damage and plan repairs; perform repairs or rehabilitate; develop, expand or increase the quality of service and number of house connections; conduct behavior change campaigns; set and collect user fees; manage and report finances. As demonstrated through previous research and the case studies in Bantaeng and Bogor, it is not realistic that communities fulfill these responsibilities, and hence the suggestion for co-management discussed in this paper. In places, the Guidelines do mention some of the proposed minimum local government responsibilities, specifically monitoring, extension and major repairs, however, these mentions are vague and it was not clear whether such roles were intended to be optional or obligatory.

Review of post-construction financing showed that the Guidelines need to provide clearer guidance on how to calculate a cost-recovery tariff that fits with the prescribed community role. The expectation of communities to collect and manage fees described in the Guidelines was likely exceed community capacity, particularly in terms of book-keeping, reporting and seeking additional financial sources. Lastly, whilst the Regular Guidelines mentioned the local government role in financing large costs such as rehabilitation and replication, the DAK Guidelines did not. In general, it was not made clear if this local government role was obligatory or optional, nor which budget line items could legitimately be used or how the initial budget mechanism used to fund the system directly affected this.

A review of asset ownership and legal status revealed that the Guidelines had omissions regarding the key elements that affect asset ownership – namely land ownership, land transfer and KSM legal status. Handover processes described in both Regular and DAK Guidelines were vague, and only include the handover from KSM to KPP, and were unlikely to be legally binding. Finally, and most importantly, the Guidelines did not make clear if or how local governments could register assets on their asset registers. It is important to ensure this is an option, since expenditure analysis makes clear that for local government to easily fund large costs (rehabilitation, extension and retrofitting) they must own the asset.

DISCUSSION

The discussion below is on three areas to situate the proposed co-management approach for community-scale sanitation systems in the wider framework of sanitation service delivery in a city-wide context. These areas include reference to the human right to sanitation and how co-management might provide a stepping stone towards the expected roles of government in enabling services, the requirement for professionalized service delivery to secure on-going city-wide services across different scales of technology and management, and finally, links to wider governance context

of decentralization that is prevalent throughout many low and middle income countries.

Firstly, the co-management approach described in this paper aligns well with the internationally recognized human right to sanitation (de Albuquerque, 2010) as well as national legislation in Indonesia that gives local government legal responsibility for sanitation as a basic, concurrent, mandatory affair. The resolutions made by the UN General Assembly and the UN Human Rights Council impose obligations on governments to respect, protect, and fulfill right to sanitation services that are safe, sufficient, accessible, affordable, and acceptable to everyone. As a part of this, governments are expected to use the *maximum resources* to take *progressive, incremental steps* towards realizing the human right to sanitation. Monitoring, the first of the minimum responsibilities proposed for local governments in this paper, is directly in line with expectations under the human rights, such that governments are able to assess and demonstrate to both their citizens and the global community the extent to which the rights are being met in their country, and also to inform decisions on planning and resource allocation (de Albuquerque, 2014). In addition, in circumstances where non-state service providers such as a community management group are involved, a key obligation of the state is to regulate through setting standards, establishing accountability mechanisms, and ensuring that grievance mechanisms are in place (de Albuquerque, 2010). Such responsibilities move beyond the proposed approach described in this paper but could form a future trajectory once better functioning sanitation systems were achieved through the proposed approach as a starting point. For instance, an area not tackled in this paper is questions of where responsibility would lie, for instance, in the case of a significant irregular discharge of sludge, or effluent discharge high in contaminants, due to poor or incorrect operation. Such accountabilities must ultimately be defined and operationalised as part of a robust co-management arrangement. Finally, in the contexts of the rights, particular attention should be paid to the equity of service provision across a city. With the community-scale sanitation program, at least in Indonesia, targeting low-income communities, there is a risk that these systems become a greater financial responsibility or time burden on users as compared with other scales of sanitation infrastructure and services.

A second area worth raising is the value of de-coupling the scale of management from the scale of technology in the provision of city-wide services. In Indonesia the scale of service for the community-scale systems described in this paper has to date directly dictated the management model, also assumed to need to operate at community scale. However, it is possible to provide centralized management across multiple community-scale systems, and which can provide economies of scale. In particular, for local governments to fulfill the proposed co-management minimum responsibilities, this will require relevant human resource capacity, financial capacity and skills, ideally housed within a central purpose-built work unit. This is true for the technologies employed in the cases described in this research (small gravity sewer networks

connected to an anaerobic baffled reactor) and is even more true if more complex technologies were to be utilized. This would also ensure professionals can be specifically trained and retrained which addresses the issue of the lack of trained operators found to be a major reason for malfunctioning of small plants in a study in Egypt (Reymond et al., 2018). Such units dedicated to wastewater are an emerging institution within some local governments in Indonesia, particularly in cities where sewerage networks exist, but are not yet common (IndII, 2011). Equally, there could be potential to combine responsibilities with those of water utilities (PDAM), since some functions such as fee collection, are already well-established in such entities (Rosenqvist, 2018). Other countries are also looking to the potential roles of private sector to overcome the human resources bottleneck of utilities responsible for services (Reymond et al., 2018). Regardless of the particular chosen arrangement, the key objective should be a critical mass of suitably skilled professionals who can provide professionalized management, since sanitation, as well as being a human right, is also a public good, and without safely managed services, public health will be compromised (WHO, 2018).

Thirdly, in highly decentralized governance contexts such as Indonesia, wider policy and legal support for co-management arrangements need to be secured for co-management models to be feasible and achievable, including with respect to lines of accountability. Such policy and legal support reflect the areas described in this paper concerning public financial management and funding flows from central to local level, as well as rules and regulations pertaining to relevant asset and land ownership (Al'Afghani et al., 2019). As demonstrated in this study, the way in which funding is transferred from national to local level can significantly impact the outcomes, resulting in negative impacts if local government engagement is bypassed. Conversely, other studies have shown how carefully designed performance-based financing can instead incentivise improved institutional functions and arrangements at local government level (Willetts and Howard, 2017, IndII). A conducive environment for local government leadership, authority, capacity and management of sanitation requires national programs funding sanitation to pro-actively incentivise such roles in local governments (Chong et al., 2016; Abeysuriya et al., 2019), rather than on the contrary, as described in this paper, to potentially undermine this possibility or create barriers for such roles to be assumed. Specifically, in relation to supporting citywide inclusive sanitation services and based on this study, local government should be involved in all city sanitation planning and implementation, both for their buy-in and to ensure the asset is under their ownership. Ultimately the lines of accountability need to rest with local government responsible to ensure these services. Systems financed by donors or national government should coordinate and involve local governments if systems are to be included in citywide management arrangements. More broadly, development of a coherent policy, planning, financing and implementation approach across national and local level emerge as key factors in supporting effective

institutional arrangements for community-scale sanitation in a citywide context.

CONCLUSION

Decentralized sanitation services are often promoted as an important component of citywide sanitation, the lessons learned from the scaling up of community-scale sanitation systems in Indonesia can provide valuable insights to implementation and governance. This paper described how responsibility for managing community-scale systems could be fulfilled through a co-management approach by local government and low-income communities in Indonesia, with local government assuming four proposed minimum responsibilities. Two case study cities demonstrated that these proposed minimum responsibilities were appropriate, acceptable and feasible for local governments. These minimum responsibilities included for monitoring, technical and social support to community management groups, funding large costs and supporting formalization of fees and fee collection. Such an approach would be aligned with the human right to sanitation, support improved equity and professionalization in the provision of sanitation services, and provide a viable component of a wider city-wide service delivery approach.

DATA AVAILABILITY STATEMENT

The datasets generated for this study will not be made publicly available as the datasets include named respondents and participants and this would contravene the research ethics approval. Requests to access the dataset can be directed to the corresponding author.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by University of Technology Sydney. The participants provided their verbal informed consent to participate in this study, documented by the researchers.

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AUTHOR CONTRIBUTIONS

JW and FM were involved in all stages of the research from conceptualization to implementation, analysis and writing. JW led the authorship of this manuscript, drawing on secondary material that was prepared jointly by JW and FM with some inputs from MA'A. MA'A was involved in research conceptualization and components of the research related to legal and institutional arrangements, particularly for budgeting and financing. FM supported the monitoring reviews undertaken of the community-scale systems in both locations and analyzed this data. All authors have reviewed and agreed on the final manuscript.

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Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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