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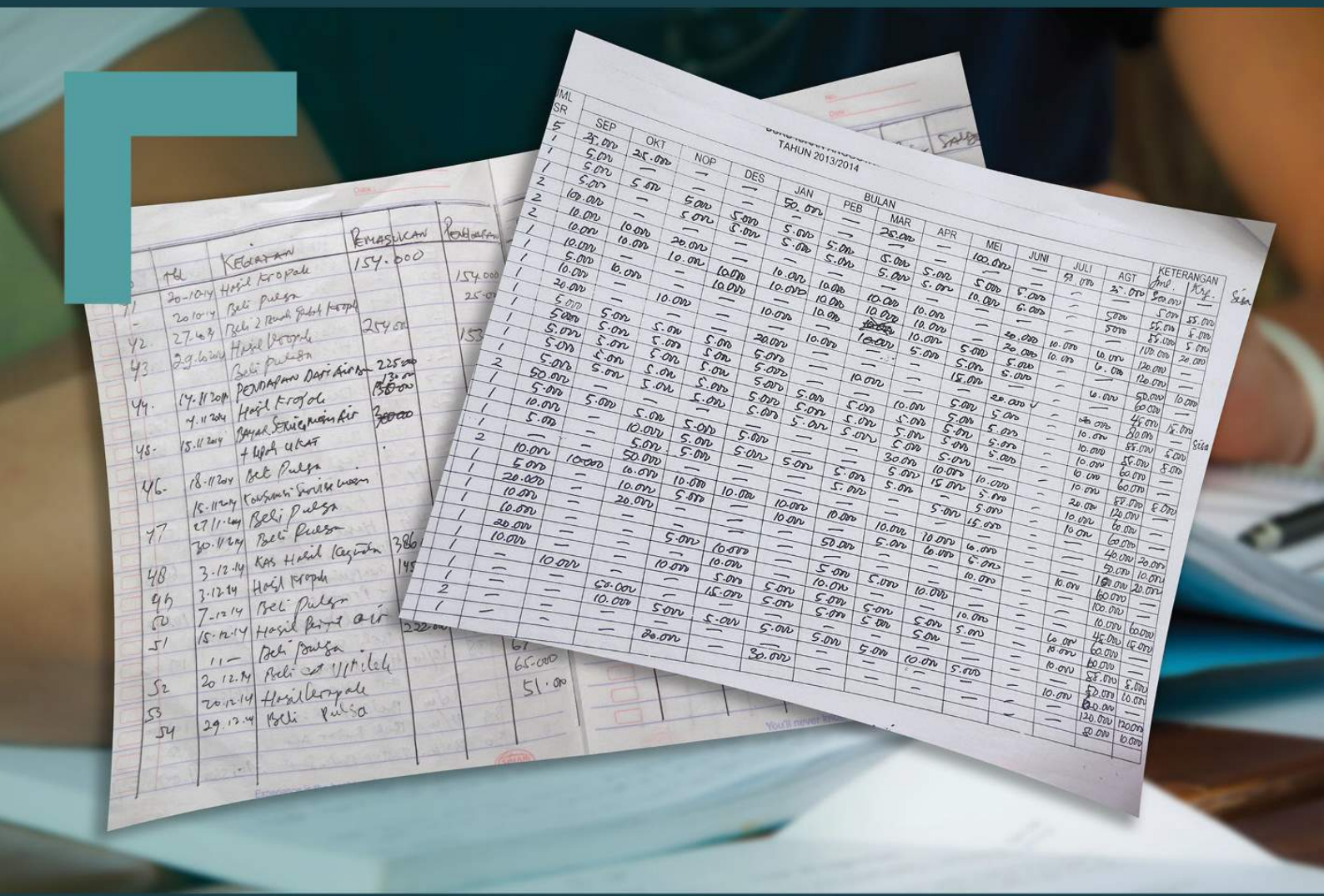
RESEARCH REPORT

Effective governance for the successful long-term operation of local scale wastewater systems

A review and comparative analysis of indicative service costs for different sanitation service scales in Indonesia

SYNTHESIS AND RECOMMENDATIONS



COMMUNITY SANITATION GOVERNANCE

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'Community Sanitation Governance' is a joint research project led by the Institute for Sustainable Futures (ISF) at the University of Technology, Sydney, which investigates effective governance for successful long-term operation of community scale wastewater systems in Indonesia. Effective governance refers to the financial, stakeholder, organizational, regulatory, and technical support necessary for successful, long-term service delivery. The research is undertaken in collaboration with BORDA Germany, the Overseas Development Institute (ODI), AKSANSI (Association for Community Based Sanitation Organisations in Indonesia) and the Center for Policy Regulation and Governance at Universitas Ibn Khaldun Bogor (UIKB). The research has been funded through a research grant under the Australian Development Research Awards Scheme (ADRAS), an Australian Aid initiative.

ABOUT THE AUTHORS

The Institute for Sustainable Futures (ISF) was established by the University of Technology Sydney (UTS) to work with industry, government and the community to develop sustainable futures through research and consultancy. ISF's mission is to create change toward sustainable futures that protect and enhance the environment, human well-being and social equity. We seek to adopt an inter-disciplinary approach to our work and engage our partner organisations in a collaborative process that emphasises strategic decision-making. Our projects foster lasting change and we aim to build independent capacity in our clients by passing on knowledge and skills. We focus on innovation and our research often extends sustainability practice and contributes to current thinking.

CITATION

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DISCLAIMER

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Project background

Our starting point for this project is: Effluent management in dense, low-income urban areas in Indonesia is challenging. Local (community) scale systems offer an affordable way to manage the public health and environmental hazards of untreated wastewater in urban areas. However, in order to operate in the long-term, these systems need effective governance, defined as (Ross et al, 2014):

Functioning technology: Ensuring the physical system delivers the service	**Sustainable financing:** Sufficient ongoing revenue to cover all short and long-term operational cost elements	**Effective management:** Accountable and equitable administration and decision making system	**Sustaining demand:** Maintaining effective community demand for the service over time

Finding pathways towards effective governance is especially timely. Reviews of local scale systems in Indonesia found that effective governance is difficult to achieve and the service does not always last as planned (Eales et al. 2013). In addition, connection numbers are as low as half of what was planned (Mitchell et al. 2015). Nonetheless, the Government of Indonesia has committed to local scale wastewater systems as a key component of its commitment to provide 100% of its citizens with access to sanitation. To date, about 13,600 of these systems have been funded for installation, and as many as 100,000 more are needed to meet current targets for access (Mitchell et al. 2015).

In response to this situation, the Institute for Sustainable Futures (ISF) at the University of Technology Sydney (UTS) developed a three-year transdisciplinary action research project that seeks to improve the long-term governance of local scale wastewater services in Indonesia.

This project is a research partnership with the Indonesian Ministry of National Development Planning (BAPPENAS), and is conducted in collaboration with AKSANSI (Association of community based organisations for sanitation), Bremen Overseas Research and Development Association (BORDA) Germany, Center for Regulation Policy and Governance at Universitas Ibn Khaldun Bogor and the UK Overseas Development Institute (ODI). A Project Advisory Group (with members from seven Ministries and six international donors) provides guidance and validation for the research. The 2014-2016 study is supported by the Australian Development Research Awards Scheme (ADRAS).

The four enquiry areas for this project are:

Performance monitoring: What is the volume and quality of data for local scale system performance? How are systems performing?	**Legal arrangements**: What are the legal and informal arrangements for local scale system governance, and what are the implications for O&M?	**Scale and distribution of costs:** For a range of sanitation service delivery models, what are the scale and distributions of costs; and what are the implications?
Management partnerships: What are the range of structures and institutional arrangements that could deliver the responsibilities for managing local scale systems?		

This document is an output of the cost enquiry. It investigates the value and distribution of costs for centralized and community (local) scale sanitation service provision in Indonesia.

Executive Summary

Equitable cost distribution in the delivery of cost-effective sanitation services is an important aspect of effective governance. This comparative analysis of community (local) scale sanitation managed by communities with centralised sanitation managed by local government in Indonesia sheds light on the distribution of costs (both time costs and financial costs) in building infrastructure and delivering services.

Collecting actual cost information is difficult. In our financial and economic work in this project and elsewhere over the past 15 years, expenditure records are sparse and incomplete, and generally fail to include information about the boundaries of reporting – what is included and excluded in reported numbers, although critical, is often unclear. A statistically significant and comprehensively representative set of figures remains elusive. What is possible is the integration and analysis of distinct sets of diverse practice-based experiences and professional estimates.

Findings from our cost review point to the need for substantial reviews of current funding models, to improve distributional equity and efficiency of investment.

- On a per household basis, government pays significantly more public funds to build and operate centralised systems than to build and operate community managed local scale systems.
- Communities receiving local scale systems make significant contributions of assets (land) and voluntary time during construction. Voluntary time in construction is substantial (1 -5 person-years), and potentially significant, especially for the economically vulnerable. These contributions are not asked of communities receiving centralised services.
- In the operational phase, the types of services provided on a voluntary basis by community-based management groups (KSM) with responsibility for community scale sanitation systems are similar to, albeit simple versions of, those provided by the paid, professionalised workforce with responsibility for centralised technologies (finances and invoicing, procurement, technology maintenance, human resourcing, etc).
- Operational financial costs for local scale systems are significantly lower than for centralised systems because a large amount of time is volunteered in operation and management activities, particularly by communities with communal toilet/bathing/laundry facilities (MCK). This time is seldom recompensed.
- Monetising the voluntary services provided by communities and community-based management groups (KSMs) to support MCKs makes per-household operational costs for these community scale systems roughly equivalent to reported per-household operational costs (staff and consumables/equipment) for centralised services.
- Communities generally struggle to collect fees and to set tariffs at cost-recovery rates to cover routine operations and carry out intermittent maintenance such as desludging and repairs.
- For both local scale and centralised services, revenues from tariffs are generally insufficient to cover operation costs. Revenue shortfalls for centralised scale systems appear to be covered by public funds, while for local scale systems, the shortfalls appear to be either not met or met by individuals within the community.

Recommendations

Setting tariffs that ensure affordability is complex and highly contextual (Human Rights Council 2015). The insights presented here are based on a small data set representing mostly MCK systems. Communities served by SSS systems have lower costs, and SSS systems are increasingly prevalent. The potential for a cost-recovery tariff emerged at the completion of this study. Therefore a wise next step would be to undertake a study in a number of locations across Indonesia to identify the real, full, costs for SSS and MCK/SSS combined systems, to provide a meaningful basis for setting locally feasible tariffs.

In addition, national Government has a role to play in creating the policy drivers for implementing measures to improve equity and efficiency of current funding models. Recommended measures include:

- Enabling public funds to be provided to support local scale operations through Local Government funding e.g., for intermittent maintenance and asset renewal expenditures;
- Facilitating alternative service delivery models for local scale systems that are financially viable without ongoing need of voluntary time contributions; and
- Enabling, authorizing, and formalising the collection of fees and setting of household tariffs that are equitable across all scales of services and adequate for recovering operational costs, including wages for those providing services.

Purpose of service costs component of research

Good governance is defined for the national level as "competent management of a country's resources and affairs in a manner that is open, transparent, accountable, equitable and responsive to people's needs" (IndII 2013). Equitable distribution of the costs in the delivery of cost effective sanitation services is an important aspect of effective governance.

Early investigations in this project raised a series of questions about the costs for local scale services – such as:

- What is the magnitude of lifecycle costs from design/construction to long-term operation and maintenance?
- Who pays for what, and when?
- How do these costs compare with centralised sanitation services?
- Does the community management model inadvertently lead to inequitable cost distribution across key stakeholders?

This review and comparative analysis of local scale and centralised sanitation service provision seeks to shed light on the distribution of costs in the investment and delivery of services, within the scope of the project. To this end, we undertook a brief and high-level analysis of who pays and when for local scale and centralised wastewater (air limbah) service provision.

The main audience for this working paper is sanitation decision/policy makers in Indonesia. The findings may also be of interest to stakeholders of local scale sanitation policy and implementation in other countries.

Research questions of service costs review

Our review was structured by the following specific questions:

RQ1. What are the major cost elements in wastewater service provision at community scale? What are indicative costs for each element? Who usually pays these costs?

RQ2. What are the major cost elements in centralised wastewater service provision? What are indicative costs for each element? Who pays these costs?

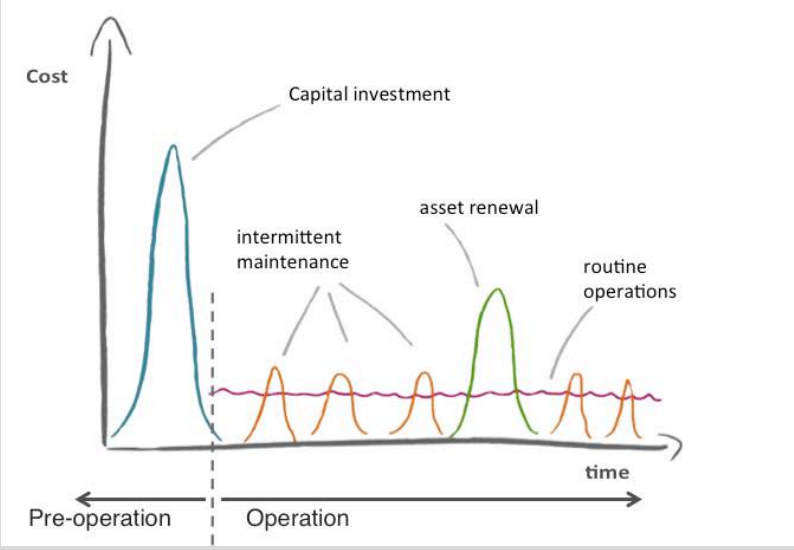
RQ3. How do these two approaches compare?

Clarification of terminology in this report

'Costs' is defined here to **include time as well as money.** Voluntary/unpaid work is an opportunity cost that is reasonable to recognise and value.

The timing of lifecycle costs (Figure 1) is categorised as costs occurring **'pre-operation'** (community engagement, project preparation, system design, site preparation, procurement, construction, installation, commissioning etc.); and **'operation'** (all post-commissioning costs that include day-to-day **routine operations**, **intermittent maintenance** and asset renewal expenses).

Figure 1: Life cycle cost elements and timing



'Local scale' wastewater services refer to *sanitation services that utilise local scale infrastructure* (services that collect wastewater from 50-200 households and treat wastewater locally/close to where it is produced). In Indonesia, such services have historically been referred to as 'community' systems.
The terminology of 'local scale' is introduced to separate the *scale of technology* from the locus of *responsibility for operation and management*. Our intention is to make clear that local scale wastewater services may be managed by various entities, including community based organisations, public and private stakeholders, alone or in combination.

The delivery model for local scale sanitation services in Indonesia is for community management led by a **'KSM' (Kelompok Swadaya Masyarakat)** – a community based organisation (CBO) comprising local leaders, likely chosen by household representatives. A KSM is formed to oversee the pre-operation stage. This KSM may continue on to the operation phase, or may be disbanded and a new CBO formed. The KSMs may or may not be legal entities.

SANIMAS, or community managed local scale systems, include three configurations of wastewater treatment facilities (IPAL): Communal toilet/washing facilities (MCK), households connected by simplified sewerage (SSS) to the IPAL, and combined systems (MCK/SSS).

'Government' refers to central, provincial or local government, that provides funds raised through taxation or on-granting donor funds.

'Research informants' is the term used in this document to refer to individuals with relevant practical experience and insights who provided professional estimates and opinions used in this report.

Methodology

Our mixed methods research methodology included:

- Document review;
- Interviews with KSM leaders during site visits and with staff from local government agencies, NGOs and civil society groups 1;
- Half-day workshop to elicit actual data on construction and operational costs (time and money) from representatives of 16 KSMs in Kota Bogor and 4 facilitators/trainers with broad experience across West Java and across various programs 2;
- A second workshop with KSM and local government representatives from 12 cities and regencies (kota/kabupaten) across South Sulawesi, to corroborate Bogor workshop data;
- Interviews and Focus Group Discussions at national level with the Project Advisory Group and representatives from national government and international donors 1 .

Collecting actual cost information is difficult in any situation. In our financial and economic work in Australia and elsewhere over the past 15 years, we have learned that expenditure records are sparse, incomplete, and generally fail to include information about the boundaries of reporting – so what is included and excluded in numbers, although critical, is often unclear. Our experience in this project to date has been no different. In addition, services differ: local scale services include communal toilet and washing facilities (MCK) and sewage treatment, simplified sewer collection and treatment systems (SSS), and combinations of these; centralised services typically include sewerage and treatment offsite. A statistically significant and comprehensively representative set of figures remains elusive. What is possible, however, and what this project presents and integrates, is distinct sets of practice-based experiences and professional estimates from diverse perspectives.

Costs are thus approximate and indicative, based on the sources noted in the methodology. Our focus is actual costs incurred on the ground (rather than estimated or budgeted costs). We used real 2014 Rupiah as the basis of comparison, and converted costs from earlier years (e.g. 2006 cost data reported in USAID (2006)) using Consumer Price Index (CPI) figures from Statistics Indonesia[3]. Cost data provided by our Research Informants during 2014-2016 was treated as real 2014 Rupiah unless otherwise stated.

Voluntary time spent on maintaining community-managed local scale systems is recognised as a dimension of the cost of service provision (Human Rights Commission 2015) and is included in this report. We chose to monetize this contribution to facilitate comparison with systems operating on paid labour. We assume that the minimum labour wage set by the national government in Indonesia (UMP Upah Minimum Perorgangan) provides a reasonable proxy for valuation of this time, since it likely represents a reasonable estimate of unskilled staff costs that local governments would pay for centralized sewage system operation. We therefore monetized medians of voluntary time data provided by Bogor KSM representatives, on the basis of the minimum labour wage in Indonesia (UMP Upah Minimum Perorgangan) of IDR 2.2M per month (USDP 2014, ILO 2015), further assuming 22 work days per month (5.5 days per week) and an 8 hour work day.

Performance data is typically not available, and we were able to visit only a subset of the systems represented in the data collection workshop, so we have not included an assessment the effectiveness of services, i.e. the extent to which the facilities are used, or how well they delivered adequately maintained facilities that ensure dignity and safety of users, protect public health and safeguard the environment over the long term.

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[1] Data provided by this group is attributed as 'Research Informants'

[2] Data obtained through this workshop is attributed as 'Bogor KSM representatives'. Median and range of numerical data from this group is based on KSM data only. This comprised 6 MCK systems, 6 combined systems (MCK/SSS) and 3 SSS systems. Facilitators' data, and suspect data from the 16th KSM, were omitted from the analysis.

[3] Published by *Trading Economics* (http://www.tradingeconomics.com/indonesia/consumer-price-index-cpi)

Findings

RQ.1 What are the major cost elements in local scale sanitation service provision? What are indicative costs for each element? Who usually pays these costs?

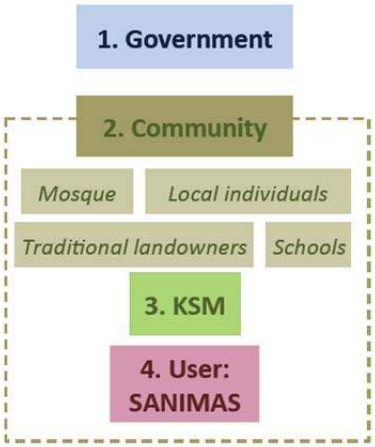
PRE-OPERATION COSTS

The community makes a large co-investment in the pre-operation costs of local scale sanitation systems, which is seldom quantified or recognised in estimations of service costs.

The main actors[4] involved with paying for local scale sanitation services (Figure 2) are:

1. 'Government' – through various local scale sanitation programs ('SANIMAS').
2. 'Community' (*masyarakat*) - all those linked to a specific locality – some of whom would be users, some not.
3. KSM – a community-based organisation consisting of a chairman, treasurer, secretary, and other members responsible for management.
4. Users – the direct beneficiaries of the sanitation service.

Figure 2: The main actor groups involved in paying for local scale sanitation systems



Contributions from the community have been a requirement of most local scale sanitation programs. The specified scale of these contributions is typically 2-4% of the total construction project budget, in cash or in-kind (Eales et al., 2013). The community contributes to many components of the key cost elements of the pre-operation phase, summarised in Table 1. The value of the community's contribution is usually 'loosely' interpreted (Eales et al. 2013) – which means the extent of community contributions is generally not tracked.

For each of the cost elements in Table 1, we sought indicative values for the community's co-contribution from our mixed methods approach. These values are summarised in Table 2 with a brief discussion.

[4] Although local government agencies (e.g. UPTD) are 'actors' with roles in sanitation service provision, (e.g. sludge related services), they cover their costs by sales/fees and government payments. They are not included here since they do not contribute money or time of their own.

Table 1: Summary of key Pre-operation costs and who pays

Activity/ cost item	Cost to Community (money and/or voluntary time)	Cost to Government (money)
Land for MCK/IPAL [5]	Land for communal facilities (MCK/IPAL) Land ownership transfer documentation	
Socialisation	Attending community meetings to learn about sanitation options Preparing expression of interest for programmatic support Initiating KSM Community and KSM training and capacity building Participation in health and hygiene promotion program/s (based on Sijbesma & Mozar 2011)	Facilitators (training and wages)
Planning and managing construction	*Services by KSM in consultation with community:* Feasibility planning Community Action Plan for implementation Financial management (banking, accounting, book-keeping, reporting) Technical feasibility and detailed design Procurement of materials Recruitment of labour Construction supervision (based on Sijbesma & Mozar 2011)	Supporting professional consultants, technical facilitators and/or supervisors
Construction of communal infrastructure	Volunteer labour Local materials Food for construction workers	Materials Paid labour
Construction of on-lot infrastructure	The cost of household latrines is usually met by households. The cost for households to connect to a simple sewerage system is often met by households. Some funding programs cover this cost.	

Table 2: Estimates of community contributions per local scale system in the pre-operation phase

Activity/ cost item	Cash co-contributions *(IDR)*	Voluntary time *(person-hours)*	Significant but difficult to quantify
Land for MCK/IPAL Towards land purchase Legal documentation	 IDR 50M – 150M IDR 1.5M – 5 M*	 Can be significant	 Gift of land
Socialisation KSM notarisation:	 IDR 0.6M*	 30 – 90 *	
Planning and managing construction *(KSM)*		90 – 2700 (*Median* 800)	
Construction of communal infrastructure	IDR 0.05M – O.1M per household*	25 – 7,200 (*Median* 1,100) 9,000-20,000 *	Food for workers
Construction of on-lot infrastructure *(Users, or program)*	IDR 0.3M – 3M per household (*Median* 1M)		

Sources: Bogor KSM representatives except * Research Informants

[5] Although some local government representatives mentioned the possibility of building treatment systems under roads (also noted in Eales 2013), all but one of the communities we engaged with through this project provided the land.

Contribution of land:

Availability of land for accommodating communal infrastructure has been a pre-requisite of local scale sanitation funding programs (e.g. DAK SLBM, PU SANIMAS, USRI). As of 2016, government land, such as under roads, may be used.

This pre-requisite has been interpreted as a requirement on communities to provide the land. Amongst the 15 local scale systems represented at the KSM workshop in Bogor, a variety of routes to securing land were indicated, which included land purchased through funds raised from the community (as 'wakaf' – donations for the greater good), land gifted/granted by individuals, or through mosques and schools, and traditional 'Adat' lands being made available. In one instance, the KSM reported the land was funded by a grant from local government and an international NGO (IUWASH). All require significant negotiations within the community.

The time and cost to procure land transfer/ownership documentation is also borne by the community. Documentation costs varied from IDR 1.5M – 5M, depending on their legal standing (e.g., land deed and tax documents registered with the land office). Only three of our 15 KSMs in Bogor had legally secure documents (akta hibah/akta tanah), the others in Bogor, and all KSMs in our South Sulawesi workshop, had formal 'grant letters' (surat hibah) at best, which provide no legal security of ownership. Whilst we did not collect data from these KSM on why legal transfers occurred in this way, potential reasons include prohibitive costs, lack of awareness of need or risk, lack of familiarity with legal service providers and legal actions.

Contribution of voluntary time:

Based on the medians of voluntary time estimated by Bogor KSM representatives (Table 2), we estimate that the KSM and wider community together provide around 2000 person-hours for unpaid services associated with construction, equivalent to 250 person-days, or about one year of full-time employment. Whilst our Bogor KSM representatives drew on their personal experience of their own system, our Research Informants drew on their personal experience of many systems delivered through diverse programs. They estimated larger contributions, typically over 1500 person-days. This level of work without pay is a significant burden, especially for economically vulnerable people.

If a monetary value is assigned to this voluntary time[6] on the basis of Indonesia's minimum monthly labour wage (UMP Upah Minimum Perorgangan) of IDR 2.2 M (USDP 2014), it would add around 5-35% to the capital cost of a system (IDR 25 M – 150 M per system, or IDR 0.4 M – 2.5 M per household served, based on median number of 60 households served per system reported by Bogor workshop participants).

The capital cost for local scale systems is context specific and varies widely.

Per household capital costs (for communal infrastructure, paid labour and household connections), as reported by KSMs in Bogor varied widely – reflecting their context-specific nature (e.g. location specifics of facility, combinations of MCK and household connections, features of MCK, number of households served, geography of community served, topography/biophysical characteristics of land selected, etc.). We express capital cost in IDR per household served to enable comparison (Table 3). Consistent with the national analyses conducted elsewhere in this project (Mitchell et al., 2016), the number of actual users (households) reported in our costing data collection was frequently lower than design capacity of treatment systems, so costs were quantified by both designed and actual households served.

[6] This estimate is based on 22 paid working days per month.

Table 3: Capital cost of local scale systems per household served

	Cost per designed number of user households Median *(Range)*	Cost per actual number of user households Median *(Range)*
Local scale systems	IDR 4.2M *(0.5M – 18M)*	IDR 4.5M *(0.5M – 60M)*

Source: Bogor KSM representatives

The responsibilities that KSMs have for planning and construction, including account keeping (Table 1), means their location-specific expenditure data is likely to provide reliable cost estimates. These costs are a subset of the full pre-operation cost; other costs include e.g. professional consultants, facilitators, program administration, etc.

USDP (2014) estimated investment costs of IDR 8.5 M/household for community scale systems based on cost modelling. Our Research Informants estimated investment costs that span the range of our estimates and published figures: IDR 3.8M – 8.7M per household.

Ministry of Public Works (PU) records show that grant programs (SANIMAS Regular and SANIMAS USRI) provide IDR 350-400 M per site, regardless of the form of infrastructure provided (MCK, SSS, or combined MCK/SSS). With an average of 45-50[7] beneficiary households per system, the investment for community scale systems may be placed at around IDR 8 M/household.

The presence/absence of a MCK (has a significant impact on both capital and operational costs of local scale systems. It would be valuable for future sector grants, cost discussions and analyses of SANIMAS systems to distinguish between the three (MCK, SSS, combined) system types.

Construction budgets regularly prioritised wastewater treatment systems (IPAL) and communal facilities (MCK) over household connections. This constrains operational revenue.

There was broad agreement amongst our Research Informants that expenditure on IPAL and MCK was prioritized over household connections. This was consistent with the Bogor KSM representatives who reported 80-95% of material expenditure was for the IPAL and MCK (for combined systems). Likewise they reported 50-75% was spent on the IPAL for the three simple sewerage systems that did not include MCK. In some cases, construction budgets were exhausted before all planned pipework was installed, leaving shorter mains or fewer secondary pipes for household connections. Reduced household connections means fewer households paying fees so reduced potential for revenues and operational cost recovery.

[7] 'Typical' number is highly variable. USRI Program Coordinator's data from 2013 and 2014 averages 45 hh/system. USDP uses average of 80 hh/system. Our Bogor KSMs median is 60 hh/system.

OPERATION COSTS

Routine (day-to-day) operation costs for community scales systems are greater than revenues raised.

For day-to day ***routine operations*** (in Figure 1 terminology), the main cost categories as reported by participating KSMs in Bogor were *personnel, electricity and consumables/goods* (e.g. cleaning products, replacement faucets, minor repairs). These costs are primarily associated with the running of MCK – our three Bogor KSM representitives managing SSS systems reported either no monthly operating costs or that those costs were met by community[8].

Typically, the only *personnel* who might receive payment is the 'operator', responsible for maintenance of the MCK. He/she may be a volunteer or receive partial in-kind payment, or payment in the form of an honorarium that is frequently below the rate based on minimum monthly wage of IDR 2.2M stipulated by government (USDP 2014, ILO 2015) for the hours they worked. For example, Bogor operators worked a median of 60 hours/month (range 10 – 90 hours), equivalent to around 0.4 FTE but wages were typically well below the pro-rata minimum wage. Community members and the KSM carry out additional tasks without payment (see below and Table 5). Even when a mechanism is in place to pay the operator, research informants report that operators are not always paid – we surmise that the funds available each month determine whether or not the operator receives payment.

Research participants consistently reported that user fees were inadequate to cover monthly costs (Mitchell et al. 2015). While monthly household fees varied, the median monthly fee was IDR 5,000 for the 9 (of 15) participating KSMs who reported on their revenues – that coincided with the median monthly household fee estimates from other sources (22 Research Informants). We surmise that monthly operating costs payable are constrained by revenue, since several reported using supplementary revenue streams from innovative side businesses selling drinking water, and one reported receiving charitable collections raised by local women – corroborating the inadequacy of user fees to cover costs.

Estimates of monthly operating costs and tariffs, based on Bogor KSMs are summarised in Table 4. It is noteworthy that the KSMs of three SSS systems did not report any revenues from fees or otherwise.

Table 4: Monthly operating costs for Bogor KSMs with MCK

Monthly Cost	**Rupiah per month** Median *(range) (n=9)*
Personnel: Operator honorarium (per system)	IDR 200,000 *(range 30,000 – 800,000)*
Electricity (per system)	IDR 120,000 *(range 50,000 – 400,000)*
Consumables/goods (per system)	IDR 50,000 *(range 10,000 – 360,000)*
Estimated total cost	IDR 370,000 per system **IDR 6,000 per household**
Monthly Revenue	
User fees	**IDR 5,000 per household** *(range 2,000 – 27,000)*

Source: Bogor KSMs

USDP's (2014) estimate of monthly operating cost, IDR 11,000/household, is double the cost estimated from the Bogor workshop, highlighting the variance of cost estimates due to boundary issues, specific assumptions and local contextual factors.

[8] Elsewhere in Indonesia, we encountered an SSS operator being paid a small monthly wage (around IDR 50,000).

Responsibility for day-to-day operations requires significant amounts of unpaid time from KSMs and the community on an ongoing basis.

KSMs are responsible for a range of services, including fee collection, bill payments (energy, water), administration (book-keeping, meetings, reporting), hiring/supervising operator/s, purchasing tools and consumables/goods, and general oversight of services.

Beyond operator and KSM activities, members of communities with MCK or combined systems also spend time every month on checking system functions; and checking cleaning, and generally maintaining communal facilities and surroundings. SSS systems also require volunteer time. For example, SSS households need to manage their own grease trap, and may be involved in system-wide maintenance, such as coordinated flushing and desludging.

For systems with an MCK, the combination of voluntary time contributed every month by the KSM and community is around 20 person-days (sum of medians in Table 5). This is essentially the equivalent of a full-time job, which, when assessed at the minimum monthly labour wage (UMP Upah Minimum Perorgangan), has a value of IDR 2.2M (USDP 2014). Although time contributions are not evenly distributed across users, this contribution equates to around IDR 35,000 per household per month.

Table 5: Voluntary time contributions for monthly operations (person-hours per month)

Voluntary time Median person-hours per month *(range)*		
	KSM (excludes operator)	**Community**[9]
MCK/combined systems:	75 person-hours *(30 – 280)*	89 person-hours *(15 – 360)*
SSS systems:	2 & 18 person-hours*	2 & 30 person-hours*

Source: Bogor KSM representatives; *two data points only

Planning for lifecycle costs including intermittent maintenance is generally beyond KSMs financing capacity.

Costs for ***intermittent maintenance*** (in Figure 1 terminology) include desludging the treatment system (IPAL), and repairs and replacements such as to pipes and pumps, with indicative costs summarised in Table 6. Monitoring effluent quality is often specified by programs but rarely carried out.

KSMs and their financing structures are not set up to cover the full lifecycle costs including intermittent maintenance and asset renewal (Figure 1). Regular revenues from user fees are generally insufficient to cover anything additional to routine operational costs. There is no common policy or approach for meeting these additional costs. Some Bogor KSMs reported making special 'one off' collections from user households to cover specific costs such as desludging. Some KSMs report that KSM members cover intermittent costs such as replacement pumps from their own funds. A KSM of an SSS system noted assistance from an international NGO (IUWASH) to cover a costly pipe repair. Increasingly, some local governments have met some intermittent maintenance and asset renewal costs, on a case-by-case basis. There is no data on the frequency of these costs, and estimating frequency is unreasonable because there are widely varying triggers, from a pump being stolen, to unexpected large trucks driving over poorly placed pipework.

[9] Community time does not include any paid or unpaid operator time.

Table 6: Indicative costs of some intermittent maintenance items

Intermittent maintenance cost item	Cost (IDR)
Pump repairs	100,000 – 500,000
Pump replacement	500,000 – 3,000,000
Pipe repairs	100,000 – 600,000
Desludging fee	100,000 – 1,000,000

Source: Bogor KSM representatives, and Research Informants.

RQ. 2 What are the major cost elements in centralised wastewater service provision? What are indicative costs for each element? Who pays these costs?

Discussion of conventional sewerage systems in Indonesia distinguishes between 'centralised' and 'kawasan' scales, with kawasan referring to medium scale systems serving several hundreds of households. We have adopted this distinction. Kawasan scale systems are expected to have lower capital costs than conventional centralised systems under assumption they serve a smaller area using smaller diameter pipes at less steep gradients (USDP 2014) with simple treatment technology.

Reliable data on the capital costs for centralised sewerage systems, based on actual expenditure data, is difficult to find.

The lack of reliable and comprehensive data makes Indonesia no different to Australia and many other countries as noted in the methodology. While the limited data provides a wide range of estimates, the indicative estimates provide a useful understanding of relative *orders of magnitude of costs* for the purpose of this research. For this reason, we use logarithmic scales in this part of the report. For comparative purposes we have used capital costs per connection expressed in real 2014 Rupiah.

We identified three data sources for our analysis, which provided cost data summarised in Table 7 (also represented graphically in Figure 4).

1. A recent study by USDP (2014) estimating the costs for sewerage services of different scales (centralised scale, local scale, kawasan scale) using standard engineering cost modelling methodologies, cross-checked with interview data from the city of Banjarmasin for centralised system costs.

2. Research informants with specific experience and knowledge about centralised sewerage system costs.

3. A USAID (2006) study of *centralised wastewater treatment plants* (cited by World Bank 2013, Eales 2013) that uses project financing information to estimate capital costs. Note that this study related to costs of treatment plants alone. These costs are therefore considerably lower than the full capital cost for centralised services, including networks. In Northern countries, the cost of sewer networks is about ten times more than corresponding treatment facilities (Wilderer 2001). In comparison, in Indonesia, sewerage networks are less extensive (reducing the multiplier) but treatment systems are simpler (increasing the multiplier). It is reasonable to say that the cost of sewerage networks in Indonesia will be a significant proportion of overall cost, but there is insufficient information to suggest a rule-of-thumb multiplier.

Table 7: Estimates of capital costs per connection for centralised and kawasan scale sewerage systems in Indonesia

Data source	USDP (2014) (Costs per connection in 2014 IDR) assuming 5 pp/household	Research Informants (Costs in IDR, 2014/15 interviews)	USAID (2006) (Costs converted to real 2014 IDR) Wastewater treatment plant only (i.e. much lower than full capital cost)
Centralised scale systems	13M-21M [a]	12M – 20M 40M[c]	*Median IDR 6.2 M*[b] (range IDR 1.5M – 27M) .
Kawasan scale systems	12M – 17.5 M [a]	6M – 15M 6M – 8M	

[a] Estimated from modeling
[b] Data from 9 cities using a range of different wastewater treatment technologies
[c] Estimate for Makassar

Pre-operation costs for centralised/kawasan systems are met by government funds, with the exception in most cases of household connections and on-lot investments, which are met by households.

A significant proportion of operation costs for centralised- and kawasan-scale sewerage systems is funded by government.

The major cost elements for operation for centralised/kawasan scale sewerage (USDP 2014) are:

- *Personnel costs*
- *Energy costs for wastewater treatment and pumping*
- *Asset maintenance costs*
- *Sludge disposal costs*

The bulk of the operating costs are associated with wastewater treatment plant costs (for gravity sewer systems), including significant personnel costs.

For centralised scale systems USDP (2014) using Banjarmasin, a city with around 10,000 connections (World Bank 2013) as a representative city, estimates seven management-level staff each receiving around IDR 10M per month; and 46-49 support staff.

Staff from our case study local government reported that their monthly operating costs for the city's sewerage system (381 connections plus management of sludge from onsite systems) were IDR 150M for the treatment plant and a further IDR 45M for monthly staff wages.

A comparison of monthly costs per service connection and fees per connection (Table 8 and Figure 6) indicates that operating costs per connection are significantly higher than the tariff. For government service providers (UPTD, BLUD, PD-PAL or PDAM) to continue operations, it would seem that local government meets the shortfall between revenue and operating costs.

Table 8: Monthly operating costs per connection for centralised and kawasan scale sewerage

Data source	USDP (2015) (Costs in 2014 Rupiah)	USAID (2006) (Costs converted to real 2014 IDR)	Case study local government (Costs in IDR, 2015 interviews)	Research informants (Costs in IDR, 2014/15 interviews)
Centralised				
Operating costs per service connection	IDR 28,000 [a]	*Median IDR 24,000* [b] (range IDR 10,000 – 1,170,000)		
Fees per service connection	–	*Median IDR 11,000* [b] (range IDR 1,000 – 26,000)		
Kawasan				
Operating costs per service connection	IDR 29,000 [a]	–	IDR 518,000	–
Fees per service connection	–	–	IDR 2,000 – 25,000 [c]	IDR 12,500

[a] Estimated from modelling
[b] Data from 9 cities, wastewater treatment only
[c] Reported tariff based on 70% of water use

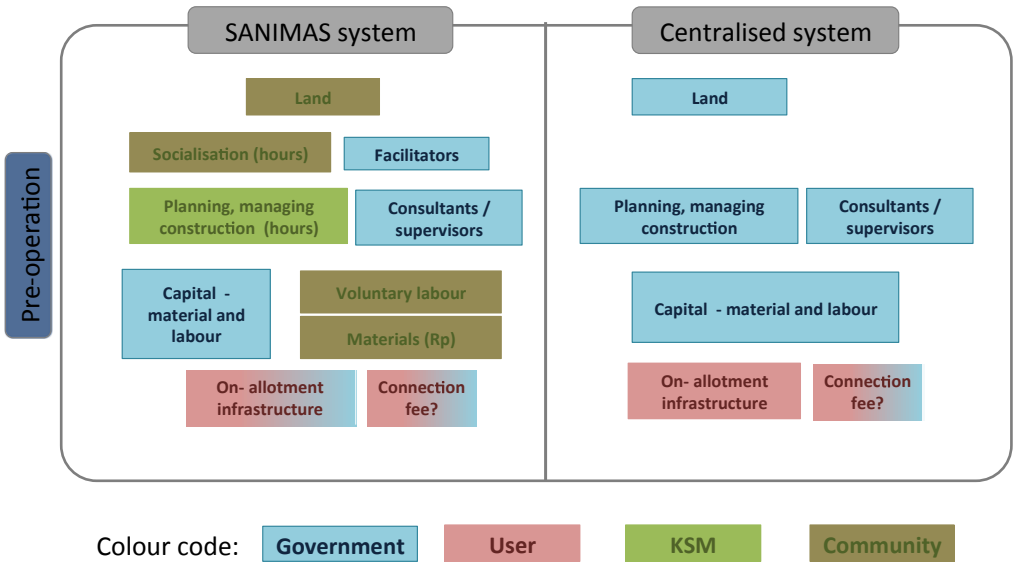
RQ. 3 How do these two approaches compare?

Centralised systems receive more public funds for pre-operation costs and place fewer demands on households than community-managed local scale sanitation

Recipient communities of local scale sanitation provide significant contributions of assets and time while centralised service recipients do not. Figure 3 below summarises our findings regarding who pays for the main pre-operation phase activity elements for SANIMAS and centralised systems (as delineated in Table 1 for SANIMAS). Kawasan systems may involve socialisation but would otherwise be similar to centralised systems. On-allotment infrastructure (latrines, pipework) and connection to the simplified/conventional sewerage system may be funded by households, or by program funds.

Voluntary services provided by communities and the KSM in construction of local scale systems amounts to around 250-1500 person-days, a significant amount of time

Figure 3: Who finances pre-operation costs: comparison of local scale and centralised scale systems



The quantum of public funds for pre-operation investment per household is significantly larger for centralised and kawasan systems than SANIMAS systems as shown in Figure 4. A logarithmic scale is used in Figure 4 to highlight orders of magnitude, drawing on data from
Table 7 (centralised and kawasan) and Table 3 and page 7 (SANIMAS) of this report. The data from the Bogor KSMs shows costs per *designed* number of households, to be consistent with the data from the other sources. Actual numbers of connected households are often lower than designed, and for our Bogor KSMs, that would have the effect of increasing the upper end of the range for per-household investment for SANIMAS.

Figure 4: Total capital cost per household (in 2014 IDR) for Centralised, Kawasan and SANIMAS

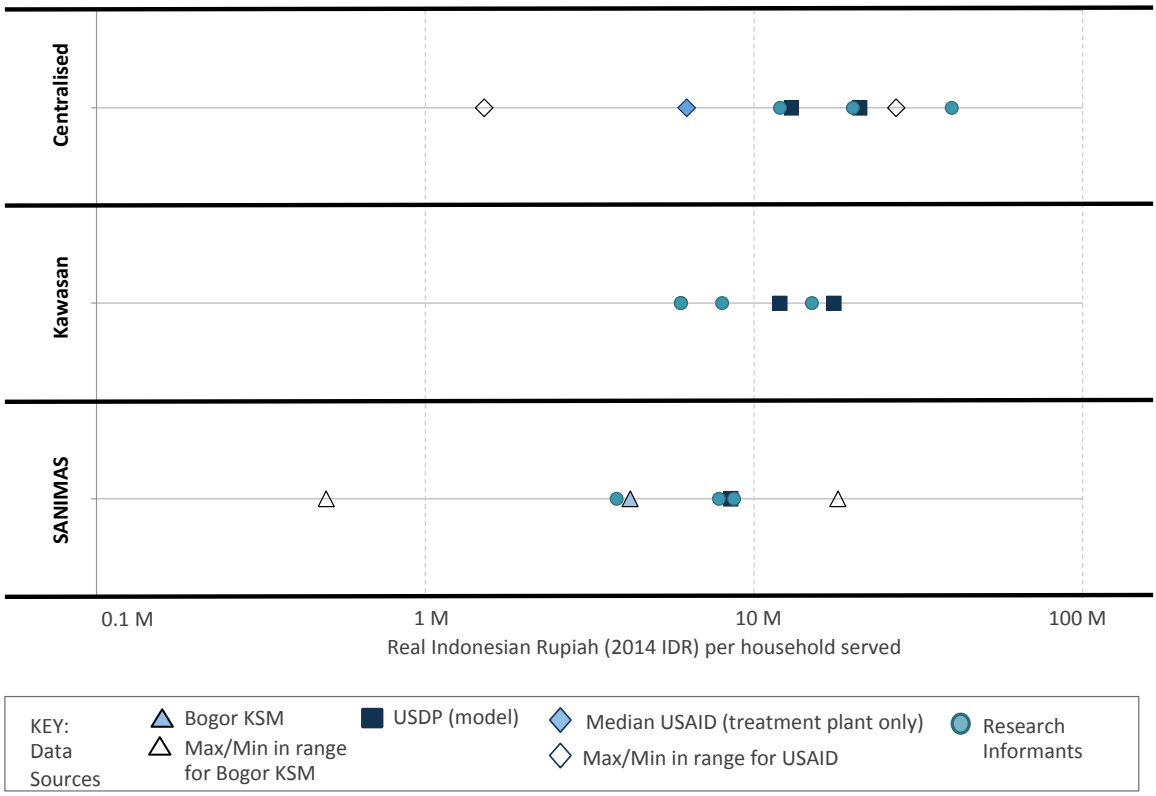
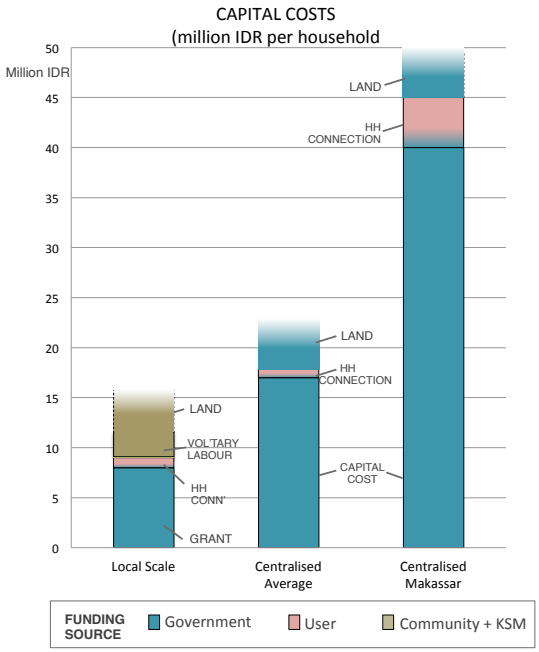


Figure 5: Pre-operation costs per connection, including who pays



An alternative representation of pre-operation costs based on our analysis shows the relative contributions made by the three stakeholder groups: government, users, and community (Figure 5).

Data sources:

Local scale:
Ministry of Public Works for Grant
Household connection cost from Bogor KSM workshops
Monetised voluntary labour based on 1500 person-days (Research Informants).

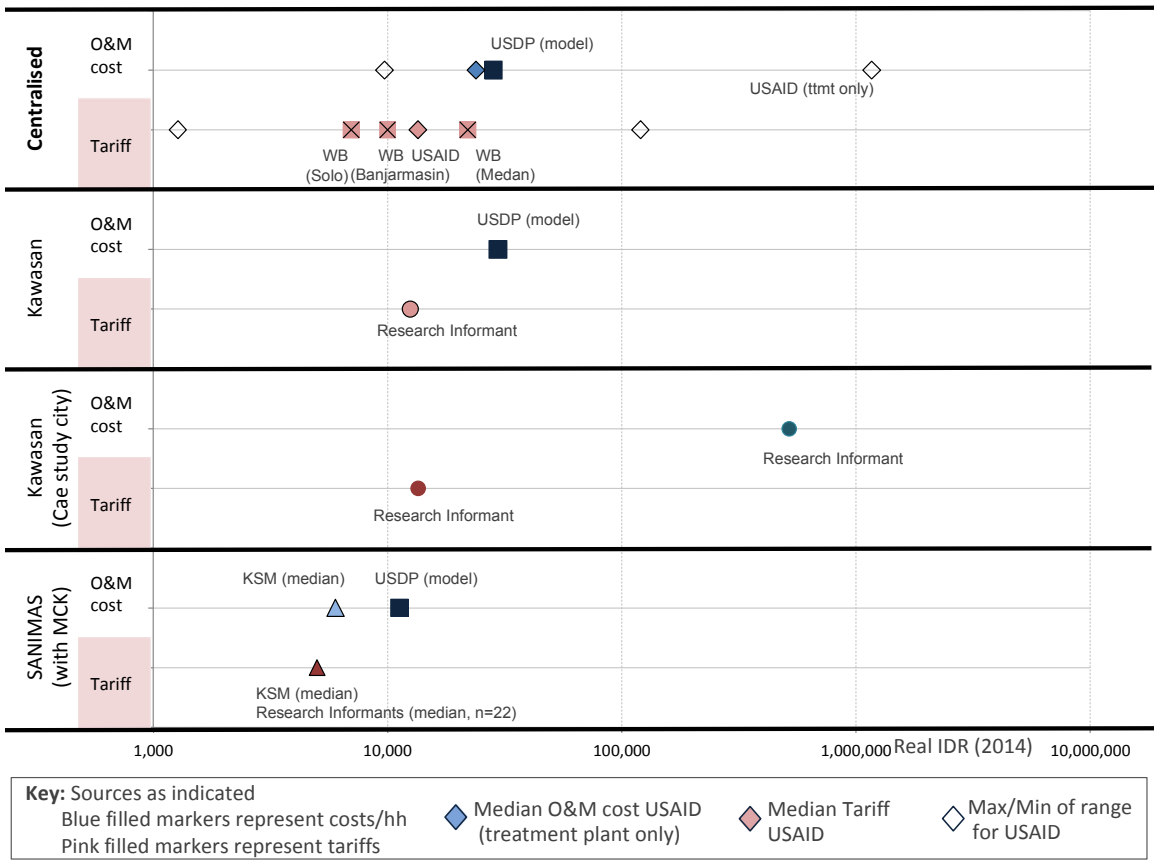
Centralised:
Mid-point of USDP estimates for average cost per hh. Research Informants estimates for household connection cost.
Research Informant's estimates for Makassar, 2015

While household connection costs are shown as funded by user households, there is uncertainty whether user always pays, or whether costs are shared with or borne by local government.

Monthly operating costs for local scale systems are lower than for centralised systems. This is influenced by significant voluntary time contributions for local scale systems.

The data on monthly O&M costs and monthly tariff information from our various sources (Table 4, page 8, Table 8) and World Bank (2013), shown graphically in Figure 6 below, shows that operating costs for local scale systems are lower than for centralised and kawasan scale systems.

Figure 6: Monthly O&M costs per household and monthly tariffs for Centralised, Kawasan and Sanimas systems with MCK



The distribution of costs is summarised in Figure 7. Tariffs generally go towards paying for routine

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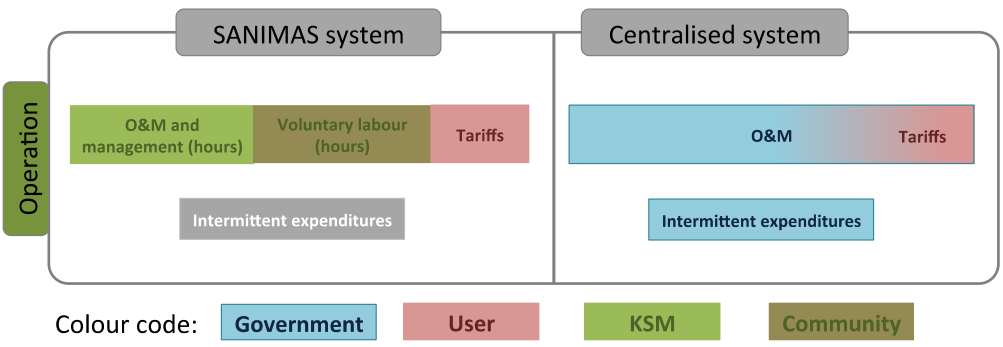
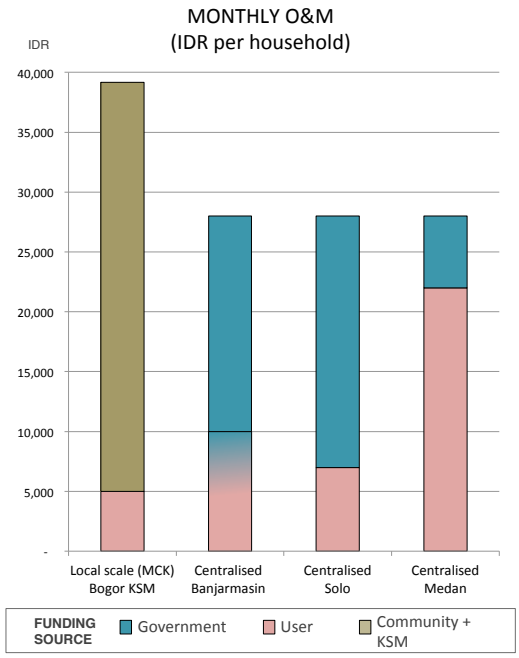


Figure 8: Illustrative post-construction monthly costs



To meet the aims of this study, we seek to *illustrate the relative contributions* made by government, users and community, for meeting the post-construction costs of representative centralised and local scale services – while acknowledging the limitations of our data[10].

We also note the challenges of defining consistent system boundaries for analysis. Our focus here is on the service, and so we have taken a service orientation to boundary definition, rather than defining the boundary of analysis according to a point in the technological components of the system, such as only downstream of the toilet. That means for example for MCK systems, the service begins at the facility, so we include the part of the service that relates to keeping the toilets clean and available. For people served by centralised and kawasan systems, the service begins at the sewer connection, so cleaning of toilets in people's homes is excluded. Our chosen service definition means that other 'upstream' differences are excluded. For example, we exclude the relative burden users of public facilities face (such as time, inconvenience, availability). .

For local scale systems, we use data from our workshop with Bogor KSM representatives (page 8-9). Monetised labour costs relate to systems with MCK only. O&M costs include routine maintenance costs for systems with MCK only.

For centralised services, USDP's estimate of O&M costs is the sole available figure (Figure 6). For centralised tariffs, we use average tariffs for the cities represented in World Bank (2013). Banjarmasin tariff collection rate is 30%.

We assume, for Figure 8, that local government meets the shortfall between revenue and operating costs for centralised services.

The illustrative comparison highlights that (a) the per-household cost of providing community managed local scale systems with MCK is similar to the cost of centralised services when voluntary time provided by communities (including KSM) is valued (b) centralised services are supported by significant public funds that are not available to local scale services.

[10] Our representation excludes costs for intermittent maintenance as we had insufficient information to convert data into a monthly cost for local scale systems. It is not clear to what degree USDP (2014) included intermittent maintenance costs for centralised systems.

Revenues from tariffs are generally insufficient to cover operation costs for all scales. Revenue shortfalls for centralised and kawasan scale systems appear to be covered by public funds, while local scale systems rarely receive equivalent support.

Figure 8 shows that across all scales of service provision, tariffs are always insufficient for covering operation costs. Local government owned agencies (PD-PAL, PDAM, BLUD, UPTD) that provide centralised/kawasan services presumably have their operation costs subsidised by government when tariff revenues are insufficient (as indicated in Figure 8). In contrast, KSMs respond to shortfalls in operating revenues by finding innovative ways to raise additional revenues, special fee collections to cover specific intermittent activities (e.g., desludging), personal contributions from individuals, or cutting costs further and/or allowing services to decline.

The types of services provided by KSMs is similar to services provided by 'personnel' on the payroll in government agencies providing centralised/kawasan services.

The community and KSMs together provide around 20 person-days of voluntary services each month for systems with MCK. For SSS systems, it is much less – around 1-5 person-days per month (Table 5). KSMs bear significant responsibility for ensuring that systems are providing adequate sanitation services to their communities – providing services including fee collection, utility bill payments, administration (book-keeping, meetings, reporting), hiring/supervising operator/s, purchasing tools and consumables/goods, and providing general oversight – services that are similar to the responsibilities of government agencies providing centralised/kawasan scale services. Yet members of KSMs likely need to work at livelihoods in addition to the unpaid hours they spend on their KSM roles. In a more equitable distribution of costs, KSM would be paid for the services they provide – which would require per-household operating revenues that are similar to centralised services (Figure 8).

Implications and key questions

Our analysis raises questions about the distributional equity, efficiency and effectiveness of current practices in relation to community managed local scale sanitation.

Many of our research participants expressed the view that local scale system users were recipients of generous public funding for their sanitation infrastructure, while participant communities also expressed gratitude for what they received. This is true considering the majority of urban households in Indonesia are served by onsite sanitation (household latrines and septic tanks/pits) where all infrastructure costs are likely self-funded.

That said, the current ethos for delivery of local scale sanitation services requires significant and potentially burdensome contributions from KSMs and the community.

Our analysis suggests that community management leads to **local scale systems receiving significantly less public funds than centralised systems (per household served) in both construction and operation phases**. Those receiving community scale systems need to make significant co-contributions to **pre-operation costs** (land/assets and time) that are not required of those served by centralised/kawasan systems. In addition, they receive no public funds for **operation costs**, so KSMs rely on volunteer labour, and need to find innovative ways to fill shortfalls in operating revenues (or allow services to decline), whereas revenue shortfalls of local government agencies operating centralised/kawasan scale services seem to be met through public funds.

This distinction has historical roots: The originators of the SANIMAS program explained that a core element of the original spirit of SANIMAS was about changing sanitation behaviours away from open defecation. However, this intention is less relevant today: stand alone MCKs are built by exception, and

almost all new installations are simplified sewer systems or combined MCK/SSS. Our research informants observe that where SSS are installed, people generally have toilets already. So, if that fundamental behaviour change driver is mostly absent, what rationale remains for the inequitable situation that exists between local scale systems within communities and centralised or kawasan systems? Our research suggests it is a mix of governance and financial constraints. Part of the original justification for the community management model was the professed need to reduce costs to the government (GoI 2003). In practice, under decentralization, national government's role does not extend to operational activity, and local governments are unlikely to have adequate funds, as well as being uncertain about the legitimacy of contributing to operational costs for assets they do not own (Mason et al. 2015).

On the revenue side, it is evident that sanitation services at all scales in Indonesia are not yet recovering operational costs through tariffs. Within the limitations of available cost data, our analysis suggests that, when the value of voluntary community labour is adequately acknowledged, operating costs per household for centralised and local scale MCK services are of similar magnitude (Figure 8). One approach to make the situation more equitable would be if government provided support to fill the revenue gap for local scale services commensurate with support provided for centralised services. However, our Research Informants ruled out government subsidising routine day-to-day operations due to government resource constraints. Nevertheless, since local government has ultimate legal responsibility for sanitation service provision, it seems reasonable to expect local government to ensure support is available for intermittent maintenance and refurbishment expenditures that communities find particularly challenging in current circumstance. We recognize that subsidies are unlikely to be sustainable in the medium to long term, as both centralized and local service coverages expand, so alternative mechanisms are necessary.

Empowering service providers to set and collect affordable and equitable tariffs is essential to all approaches to cost recovery. Taking this as a starting point could empower service providers to raise the necessary revenues for *both centralised and local scale services* from tariffs. Across our project, we encountered a wide range of local scale sanitation tariffs. In a small number of location, KSMs reported that households paid IDR 30,000 per month. This suggests households may have the capacity to pay higher tariffs than most current settings require. As Figure 8 shows, for communities with MCKs, a tariff of this order would meet all the costs incurred in our case study city in west Java, ensuring funds were available to pay those with operational and management responsibilities, as well as contributing towards maintenance and asset replacement costs. At less than 0.1% of the World Bank's (2016) gross national per capita income for Indonesia on 2014 purchasing power parity ($10,190 International dollars), and around 1% of the UMP minimum wage, IDR 30,000 per household per month would seem potentially affordable, and less than current rules of thumb[11].

Setting tariffs that ensure affordability is complex and highly contextual (Human Rights Council 2015). This work is based on a small data set, and the concept of a cost-recovery tariff emerged at the completion of this study. In addition, communities served by SSS systems have lower costs, and SSS systems are increasingly prevalent. Therefore a wise next step would be to undertake a study in a number of locations across Indonesia to identify the real, full, costs for SSS and MCK/SSS combined systems, to provide a meaningful basis for setting locally feasible tariffs.

From insights gained across other components of this research, it would seem that the major barriers to setting local tariffs at these levels are political. National policy settings could therefore provide a powerful impetus for change, such as compelling local governments to set tariffs with regard to

[11] Rules of thumb give a starting point (e.g., current rules of thumb are of the order of 3-5% of household income for water and wastewater services), but can be problematic. For more, see this insightful commentary http://washfunders.org/Blog/affordability-of-wash-services-rules-of-thumb-and-why-it-s-difficult-to-measure

operational cost-recovery, and with regard to equitable outcomes as defined by a national minimum service standard for sanitation.

Another approach is to explore alternatives to the community management model for local scale systems. National policy could strengthen accountability from local governments to meet their responsibility for local scale sanitation, that could catalyse consideration of alternative governance models that do not require large amounts of voluntary time to ensure service provision (see Mitchell et al. 2016) . It could open new opportunities for innovation with local scale sanitation technologies, that reliably protect public health and enable resource reuse to generate additional income streams that aid sustainable cost recovery.

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Appendix 1. Glossary

ABPD	Local Government budget (Anggaran Pendapatan dan Belanja Daerah)
ADB	Asian Development Bank
APBN	National Government budget (Anggaran Pendapatan dan Belanja Nasional)
AKSANSI	Indonesia NGO supporting community scale systems in post-construction phase
Bappenas	National Development Planning Agency (Badan Perencanaan Pembangunan Nasional)
CBO	Community-Based Organization
Cipta Karya	Directorate General of Human Settlements at Ministry of Public Works
DAK	Special allocation fund (Dana Alokasi Khusus)
Desa	Rural village
DFAT	Department of Foreign Affairs and Trade
Dinas	Local government department
Dinas PU	Local Government Department of Public Works (Dinas Pekerjaan Umum)
Dinkes	Local Government Health Agency (Dinas Kesehatan)
IDB	Islamic Development Bank
FTE	Full Time Equivalent
IUWASH	Indonesia Urban Water Sanitation and Hygiene Program, funded by USAID
Kabupaten	Regency local government
Kelurahan	Urban village
KSM	Kelompok Swadaya Masyarakat (Community-based organisation, CBO)
Kota	City local government
MCK	Public Washing & Sanitation Facilities (Mandi, Cuci, Kakus)
MCK++	MCK with wastewater treatment (and possibly biogas plant)
MDG	Millennium Development Goal
MoHA	Ministry of Home Affairs
NAWASIS	National Water and Sanitation Information System
NGO	Non-Government Organization
O&M	Operation & Maintenance
PAMSIMAS	Community based water supply and sanitation program by GoI and World Bank for rural and periurban services to the underserved
PNPM	National program for community empowerment (Program Nasional Pemberdayaan Masyarakat)
Provinsi	Provincial government
PU	Ministry of Public Works (Menteri Pekerjaan Umum)
RW / RW	Sub-village levels of organisation: community groups (Rukun Warga) are further divided into neighborhood groups (Rukun Tetangga)
SAIIG	Australia-Indonesia Infrastructure Grants for Municipal Sanitation Programme
SANIMAS	Community-Based Sanitation (Sanitasi Berbasis Masyarakat)
SKPD	Local Government Work Unit (Satuan Kerja Perangkat Daerah)
SLBM	Community-based sanitation program (Sanitasi lingkungan berbasis masyarakat)
USDP	Urban Sanitation Development Programme
USRI	Urban Sanitation and Rural Infrastructure Project, funded by ADB