

PRAKARSA

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NEW RESEARCH IN WATER AND SANITATION

Governance Challenges For Improved Local Sanitation Service Delivery ■
Payment For Environmental Services (Groundwater) ■ Safe Management Of
Sewage In Urban Areas ■ Social Contracts To Improve Water Utility
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Editor's Message

Better outcomes in delivering water and sanitation are critical to improve individual and community health, especially that of women and children. While acknowledging the strong commitments of governments and donors, and the innovative work of facilities such as IndII, there remains a huge task for stakeholders and communities worldwide to improve the quality and delivery of water and sanitation. For Indonesia, the most immediate task is to meet the country's challenging target of providing access to safe water and adequate sanitation to 100 percent of the population by 2019.

The Australian Government has been supporting water and sanitation (watsan) initiatives in Indonesia for almost 30 years. Over the past few years, support through IndII has included the rollout of the Australia-Indonesia Infrastructure Research Awards (AIIRA). This involves a partnership between an Indonesian university or research institution and an international partner to identify practical solutions to some of the challenges facing infrastructure development in Indonesia. AIIRA has received 50-plus applications from partners in Indonesia and in Europe, North America, Asia, New Zealand, and Australia. Eleven partnerships received full research funding.

This special edition of *Prakarsa*, scheduled to align with the completion of all AIIRA research activities, is dedicated to communicating selected watsan-related research findings and recommendations from six partnerships. Many of these research outcomes emphasise the need for multidisciplinary approaches and key stakeholders' engagement to ensure that water and sanitation infrastructure development is systematic, evidence-based, and sustainable.

Three of the six research activities have developed practical "tools" or assessed the use of specific models to assist with watsan governance:

- The research partnership between Universitas Negeri Jakarta, the University of South Australia and Gresik Regency sought to build a simple framework for measuring and accounting for the value of an infrastructure initiative to a community. In this case, an SROI (Social Return on Investment) approach provided the basis for the AIIRA partners' development of an **Infrastructure Impact Calculator**, to assist the local government to choose the best (and most cost-efficient) sanitation projects to improve long-term community well-being.
- In developing a scientifically robust methodology to **enhance decision making for the safe management of sewage in urban areas** in Indonesia, AIIRA partners used a Decision Support Framework (DSF) approach. In Semarang, research teams from the Queensland University of Technology and the University of Diponegoro collaborated on field work, laboratory testing, spatial database development, geospatial analyses, and system modelling.
- **Payment for environmental service (PES)** schemes are market-based instruments in which an environmental service (such as the protection of forests or catchments) is bought by the beneficiaries of that service (such as water users). A partnership between Soegijapranata Catholic University and the Australian National University investigated whether a PES scheme could offer greater access to safe water by protecting catchments and increasing groundwater supply.

Two other partnerships have used in-depth case studies to investigate potential improvements to watsan governance:

- The International WaterCentre in partnership with Bappenas and the Association of Indonesian Water Supply Companies (Perpamsi) reviewed the potential for piloted social contracts to encourage trust in improved water governance and service delivery in Indonesia. Four pilot studies were conducted and two of these were reviewed to assess the impacts of social contracts in comparison with a high performing water utility *without a formal social contract*.
- To improve sanitation outcomes in Indonesia, greater understanding is necessary of the **challenges faced by local governments for delivering sanitation services**. A research partnership between the Institute of Sustainable Futures at the University of Technology, Sydney, Kemitraan, and SNV engaged with local stakeholders in detailed case studies of small towns in Sumatera. It focused on the institutional framework for sanitation services including city sanitation plans, local government sanitation committees, and their roles and responsibilities.

The sixth AIIRA-funded program has involved research not necessarily identified as a mainstream watsan activity:

- A multidisciplinary research team from Charles Darwin University and Nusa Cendana University addressed the **management of water resources in three irrigation developments**, one each in Sumba, Nusa Tenggara Timur. The integrated approach considered irrigation, sanitation and household water resources, – and the realities of living in and managing the water resources within irrigation developments.

While these sample AIIRA research findings by themselves do not provide all the answers to the complex water and sanitation challenges faced by Indonesia, they will encourage continuing strategic improvement, discourse, and collaboration in planning, governance, and implementation. •MR

Infrastructure by the Numbers

| | |
|--|-------------|
| | 100% |
| The government's target of providing access to drinking water and adequate sanitation to the people of Indonesia by 2019. | |
| | 3.7% |
| Percentage of water utilised for daily use. | |
| | 7 % |
| Percentage of the Indonesian population that has access to water through a community-based system. | |
| | 5.7% |
| Percentage of predicted increase in the water purifier market in Indonesia during 2015-2020. | |
| | 80% |
| Percentage of water taken from surface and groundwater in Indonesia that is used for agriculture irrigation. | |
| | 2020 |
| Year by which Indonesia will face scarce water resource, especially in Java, Bali, and Nusa Tenggara. | |

Irrigation Water Everywhere – But Is It Fit to Drink?

Irrigation schemes are intended to improve people’s livelihoods. However, they often bring challenges associated with access to drinking water and adequate sanitation. Multi-disciplinary research in three villages in Sumba, East Nusa Tenggara, investigates these challenges and offers recommendations to help practitioners better understand the factors that lie behind these challenges. • Bronwyn Myers • Emma Williams • Sarah Hobgen

In the eastern Indonesian Province of East Nusa Tenggara (NTT) there is an extended dry season each year during which limited water poses a major constraint to agricultural productivity and rural livelihoods. Unlike western Indonesia, the landscape of NTT is dominated by savanna which is frequently burnt by wildfires. Most of the population is dependent on subsistence, rain-fed agriculture, and maize is the traditional staple crop. It is only possible to grow one maize crop each year and a “hungry” season occurs before each maize harvest.

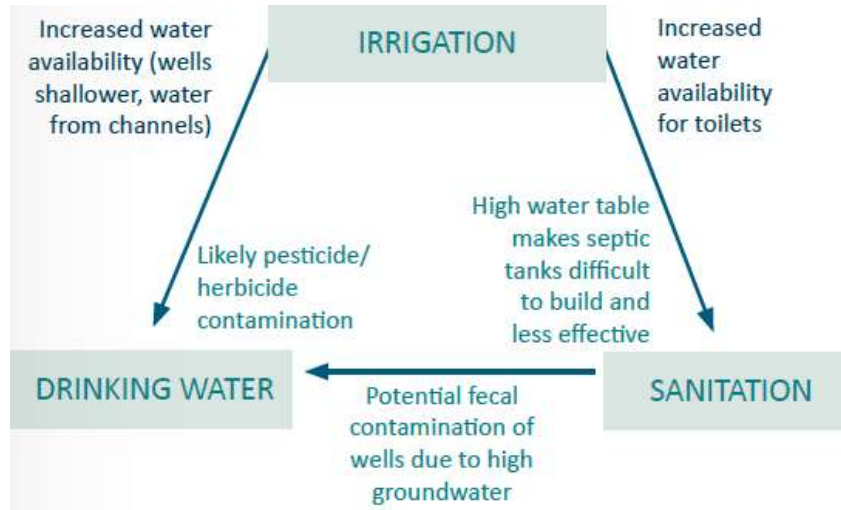
To mitigate water shortages and boost food production in NTT, irrigated paddy has been established in the lower reaches of the major catchments through schemes established in the 1990s by the Government of Indonesia (GoI) with support from international donors, including the Japanese Small Scale Irrigation Management Project (SSIMP), the Australian Government through the Indonesia Australia Development Project (mostly located in Central Timor), and Australia-Indonesia Partnership programs focusing on management of clean water¹.

Assessing Irrigation Impacts

These irrigation schemes have not achieved their intended benefits. Rice productivity in these areas is low (1–1.5 tons/ha, compared with 6–8 tons/ha in western Indonesia)². Broad acre paddy cultivation is foreign to the farmers of NTT. The irrigation system is plagued by high rates of sedimentation³ and, coupled with poor management, results in unreliable and inequitable water delivery⁴. People living in irrigation areas also face challenges associated with access to drinking water and sanitation (see Figure 1). Irrigation has caused the groundwater level to rise, in places resulting in well water becoming saline and being of dubious quality. The higher water table also causes septic tanks to slump, collapse, and become dysfunctional.

In 2015, a research project under the auspices of the Australia-Indonesia Infrastructure Research Awards (AIIRA) investigated the challenges of effective, equitable irrigation water delivery and access to suitable drinking water and adequate sanitation in the irrigation areas of NTT. The research aimed to understand the factors influencing these challenges so that livelihoods can be improved within irrigation areas – an aim that is all the more pressing as new irrigation areas are still being developed in NTT. This paper reports early results from this multi-disciplinary and mixed-method investigation in three villages of eastern Sumba within a major irrigation scheme.

Figure 1: How Irrigation Can Impact Access to General Water Resources, Drinking Water, and Sanitation



Box 1. The Realist Approach to Research

Realist approaches, pioneered by Pawson and Tilley (1997, 2004) are based on a realisation that interventions such as the provision of water and sanitation infrastructure – or of programs to build knowledge and change behaviour related to sanitation and water treatment – do not “cause” change. They are delivered into and are then embedded within complex environments; although physical infrastructure and education programs provide resources for change, it is individuals’ engagement with the resources provided by such interventions that determine what impact they will have.

Realist approaches assume that nothing works everywhere or for everyone, and that context really does make a difference to program outcomes. [They are well suited to situations where]... policy-makers and practitioners need to understand how and why programs work and don’t work in different contexts, so that they are better equipped to make decisions about which programs or policies to use and how to adapt them to local contexts.

The “pivot around which realist research revolves” (Pawson and Tilley 2004: 6) is the notion of the mechanism, “the interaction between what the program provides and the reasoning of its intended target population” (Westhorp 2014: 5). Mechanisms can be investigated by collecting data on outcomes, contexts and the “reasoning” of the target population, with this term referring to more than logical thinking processes; it also encompasses beliefs, values, cultural norms and roles.

Key Points:

Irrigation schemes have been implemented, with limited success, in East Nusa Tenggara (NTT) where there is an extended dry season each year. People living in irrigation areas face challenges associated with access to drinking water and sanitation. Irrigation has caused the groundwater level to rise, in places resulting in well water becoming saline and being of dubious quality. The higher water table also causes septic tanks to slump, collapse and become dysfunctional.

In 2015, research was conducted by an international research partnership comprising Nusa Cendana University (Undana, Kupang) and Charles Darwin University (CDU, Northern Territory, Australia) to investigate the challenges of effective, equitable irrigation water delivery and access to suitable drinking water and adequate sanitation in the irrigation areas of NTT. The mixed-method research included inspection of irrigation infrastructure by engineering specialists and open-ended interviews with community residents in three village administrative units (kelurahan). Questions focused on: (i) decision-making related to irrigation management; and (ii) water and sanitation, including toilet access and use, sanitation programs, sources of water for drinking, washing and bathing, and treatment of drinking water.

Almost all respondents were dissatisfied with water delivery for irrigation; amounts received were inconsistent and unpredictable and agricultural extension officers were not seen as a useful source of information. In terms of sanitation, there was a range of knowledge about toilets, but most people indicated interest in having one. With regard to water, wells that had supplied drinking water became unsuitable after irrigation began, with the consequence that many respondents had built new wells further from the channels or now accessed drinking water from sources a considerable distance from their home.

Overall the research reveals that sedimentation in channels and inequitable delivery of irrigation water could be addressed by greater coordination and effective communication, and that household interactions with toilets, drinking water, and local health and sanitation programs are driven by multiple factors. Further analysis and research of this type is planned so that funders, policy makers and practitioners can facilitate sustained positive impacts in the future.

The research was conducted by an international research partnership comprising Nusa Cendana University (Undana, Kupang) and Charles Darwin University (CDU, Northern Territory, Australia). The district government staff in South Central Timor, East Sumba and Nagekeo provided valuable human resources and information. In addition, many of the interviews were conducted by students from the School of Economics (STIE), East Sumba.

Mixed Methods Used

Irrigation infrastructure was inspected at weirs in East Sumba, Nagekeo and West Timor by project team members with engineering expertise. Mutual capacity building in conducting qualitative research in a culturally appropriate way was integral to the project. Interview tools were developed collaboratively during an initial workshop in Kupang, with contributions by district government staff from South Central Timor, East Sumba and Nagekeo as well as staff of Undana and CDU. A realist approach was taken (see Box 1). Open-ended questions were

developed, piloted by research teams including students from STIE, and refined through further discussion with the project team. Preliminary analysis was also conducted collaboratively, at a workshop in Darwin.

Questions were developed for interviews and focus group discussions on two topics: decision-making related to irrigation management; and water and sanitation, including toilet access and use, sanitation programs, sources of water for drinking, washing and bathing, and treatment of drinking water. Questions were asked in a semi-structured way, to elicit not just information on facilities and behaviour, but also to reveal the “reasoning” underlying behaviour.

Data was collected at three village administrative units (*kelurahan*) in East Sumba: one close to the weir (Kelurahan A); one in the centre of the irrigated area (Kelurahan B); and one near the end of the main channel (Kelurahan C), near the coast. All appear rural, although they are within the administrative boundary of the city of Waingapu and so are officially eligible to receive piped water supplied from the local water company (PDAM). In Kelurahan C, the majority of residents identify as being from the Sabu cultural group (a small island off the coast of Sumba), whereas residents of Kelurahan A and Kelurahan B are identified as belonging to a local Sumba cultural group.

Irrigation Management

A key cause of the sedimentation of irrigation channels was found at the headworks of the irrigation system. The sluice gates, which control flow from the weir pool into the primary irrigation channel, have been displaced by seismic activity, so that now they cannot be shut. This means that at times of peak flow and heaviest sediment load, there is no option of sending the flow down the river instead of into the irrigation channel system, necessitating frequent removal of sediment from the channels. Interview of respondents revealed that clearing of the primary channels (which is the responsibility of the district government) occurs infrequently, while cooperative community clearing of other channels occurs but is sometimes in isolated sections, rendering it ineffective.

In general, rice yields are well below potential: the Ministry of Agriculture stated a potential of 12 ton/ha of unhulled rice, whereas respondents reported maximal yields of 2–4 ton/ha, with commonly reported yields below 1 ton/ha. Many factors contributed to poor yields, including low or unreliable water delivery and ineffective pest management (often linked to unreliable water supply).

Almost all respondents were dissatisfied with water delivery: most respondents in all *kelurahan* received insufficient irrigation water. In Kelurahan A near the primary channel, 40–50 ha were permanently inundated, adversely affecting the livelihoods of 50–60 families. The system of local water management officers (Perkumpulan Petani Pengguna Air – a formal association of water-using farmers) was reported to be defunct, with farmers managing water themselves, resulting in

those furthest from the main channel receiving the least (and in some cases no) water. Although most respondents knew of agricultural extension officers, many observed that these officers did not visit many farmers' fields, rather spending time at demonstration plots. Most farmers said they would not consult these officers, and the few who did said the information was not helpful. Many farmers consulted other farmers or sellers of agrochemicals, and many simply ignored the problems.

The data collection happened to take place while government contractors were clearing the primary channel, consequently stopping water flow in the channel. Some respondents had received written warning, either directly or through farmers' groups or community leaders. However, some of these respondents said the information was incorrect; the date they were given for the stoppage was earlier or later than the actual occurrence, or they were told that water stoppages would affect a smaller area than they actually did. Some respondents knew nothing of the water cuts until they saw evidence of the cleaning operation on site or experienced the stoppage of water flow. When no warning was given or inaccurate information was provided, crop failure occurred. During the cleaning and repair operation, water was released into the channel periodically. However, for many respondents this was not enough to support their rice crop, or was insufficient to reach their fields at all.

Sanitation in Irrigated Areas

Efforts have been made to improve sanitation in the study area through government and NGO programs. Since 2014, the Health Department has operated a Community-Based Total Sanitation (CBTM) program, funded by UNICEF, in the kelurahan being studied. At Kelurahan B there was also a World Vision Indonesia (WVI) sanitation program prior to 2012 that provided some assistance for building toilets although it is unclear to what extent this was implemented. The WVI program continues but only for child development activities, which include sanitation education.

The CBTM program reported decreases in open defecation in Kelurahan A and Kelurahan C (see Figure 2). In Kelurahan A there was increased use of semi-permanent toilets and shared toilets, and in Kelurahan C there was increased use of permanent toilets and shared toilets. In Kelurahan B the incidence of open defecation remained high and, while there was increased use of people's own permanent toilets, there was also a decrease in the use of shared toilets.

Piped water from the PDAM is available in Kelurahan A only and residents must pay to use this water. There was a communal toilet and wash house provided by the Department of Public Works (Dinas Pekerjaan Umum), using piped water from the PDAM. This was the only "communal toilet" found in the study area. A communal toilet is defined as one owned by the community, as distinct from a shared toilet which is one built and maintained by a household, but used by a number of households.

Figure 2: Outcomes Reported for the CBTM Program in Selected Kelurahan in East Sumba

| Kelurahan | Use of toilet facilities (percentage of households) | | | | | | | |
|-----------|---|---------------------------|---------------------------|-----------------|----------------------------------|---------------------------|---------------------------|-----------------|
| | Before CBTM program, 2013/2014 | | | | After CBTM program, January 2015 | | | |
| | Own Permanent Toilet | Own Semi-Permanent Toilet | Neighbour's Shared Toilet | Open Defecation | Own Permanent Toilet | Own Semi-Permanent Toilet | Neighbour's Shared Toilet | Open Defecation |
| A | 28.1 | 0 | 2.8 | 69.1 | 31.7 | 18.8 | 20.3 | 30.0 |
| B | 13.7 | 19.3 | 6.5 | 60.4 | 19.8 | 21.0 | 1.1 | 58.1 |
| C | 37.8 | 30.6 | 2.1 | 30.0 | 46.5 | 31.9 | 14.4 | 7.2 |

Box 2. Community Residents' Comments About Toilets

- "It is difficult to make a toilet for myself because if we dig into the soil one or two metres deep to make a septic tank, we will reach water. And we must make a strong wall for the septic tank so that it will not collapse."
- "We have not found a design of toilet that is appropriate for us. We asked for a toilet design when sanitation socialisation about latrines was conducted in the village administration office, but there has not been any response."
- "The toilet has a positive impact on health because the environment becomes clean, and on ethics because it is more polite to defecate or urinate in a toilet. I use my own toilet."
- "I defecate in a hidden place when I am attending a ceremony or working in the rice field because I do not want to bother myself looking for a toilet."
- "The problem is the cleanliness of the [communal] toilet. Not all villagers have the same awareness of it."

Our research indicated some reasons for the reported patterns of toilet usage/open defecation. While almost every respondent indicated interest in having a toilet, there was a range of knowledge about toilets. See Box 2 for illustrative comments from interview respondents. Respondents wanted to have and use their own toilets because they felt the environment would be cleaner, people would

Box 3. Community Residents' Comments About Drinking Water

- "There has not been any outside person who has tested the water quality. We were just given chlorine by the Department of Health."
- "No water test has been conducted so far either by the government or by an aid organisation. Thus we never know whether the water we drink is categorised as clean and free of chemical substances or not."
- "After the irrigation system was built...the [well] water was contaminated with bacteria and chemicals from the rice fields. This was proven by the test conducted by a team from Australia in the early 2000s."
- "We drink the water without boiling it first and we have never been sick from drinking the well water, because we have gotten used to it."
- "We boil the water...especially for my children...I drink water that hasn't been boiled and have never been sick from drinking it."
- "For drinking water, we strain it first to take out the leaves and after that we boil it. Once it is cool it is filtered again and put into a drinking water jug or thermos."
- "The well water is healthier than the piped water because there is less carbonate than in the piped water."
- "We got piped water from PDAM in 2011...We still use well water when the PDAM water does not flow; sometimes the PDAM water is oily but only for a short time. If it is cooked the oily flavour is not there anymore."
- "One year ago, there was a water pipe system, but because the community did not want to pay, the water was turned off."

be healthier, and dignity would be preserved. Some respondents noted that special designs were required in irrigated areas. However, some respondents who had a toilet at home admitted still practising open defecation at times.

Also, while some classifications such as the “watsan ladder” (a way of presenting the access to drinking water and sanitation figures by disaggregating and refining data analysis in “ladder” format developed by the WHO/UNICEF Joint Monitoring Programme) do not distinguish between types of “shared toilets”, respondents made a strong distinction between a toilet shared between households versus a public/communal toilet, whose upkeep was not taken up by anyone, and for which no one individual or household felt responsible.

Impacts on Drinking Water

The irrigation system also affected drinking water. For many respondents, wells that had supplied drinking water became unsuitable after irrigation began, with the consequence that many respondents had built new wells further from the channels or now accessed drinking water from sources a considerable distance from their home. See Box 3 for a sample of comments made by residents about their drinking water.

Almost all respondents said there had been no tests of water from wells. Even in the few cases where respondents indicated they believed testing had been conducted, there had generally been no communication of results. A notable exception was one respondent who recalled water testing showing contamination of well water.

Responses on whether drinking water was boiled were mixed, with some boiling water at all times, others sometimes or just for children, and some respondents not boiling drinking water at all.

Interestingly, although the “watsan ladder” places piped water above well water, some respondents who had experienced access to piped water preferred well water due to issues of quality, cost and consistent access.

Overall the research reveals that sedimentation in channels and inequitable delivery of irrigation water could be addressed by greater coordination and effective communication, and that household interactions with toilets, drinking water, and local health and sanitation programs are driven by multiple factors. Further analysis and research of this type is planned so that funders, policy makers and practitioners can facilitate sustained positive impacts in the future.

Recommendations

The primary recommendations resulting from the study include:

- Repair sluice gates to enable diversion of peak sediment flow away from the primary irrigation channel. Design them to withstand seismic activity and impacts of large flood debris.

- Together with stakeholders, create and implement a simple system for measuring the condition of irrigation infrastructure and collating this information, so that it can be used to coordinate the management and maintenance of the irrigation system. A prototype system has been developed by this AIIRA project.
- Develop more effective and inclusive systems of communication to enable communication among farmers, officers with agronomic expertise, and agencies responsible for management and maintenance of the irrigation system.
- Set up a district level “one stop shop” that includes officials from the local Departments of Agriculture and Public Works, to which farmers can go to make complaints or requests.
- In future sanitation programs, develop designs and materials that are appropriate for areas with high water tables. Provide farmers with information about these, and also address issues of who is responsible for maintenance of sanitation infrastructure.
- Test drinking water resources frequently, focusing on both fecal and farm chemical contamination. Communicate the results to users and take appropriate remedial measures.
- Interpret “watsan ladders” with care depending on the context. This research showed that well water was generally preferred to piped water by respondents, and also an important distinction emerged within the category of shared toilets. Toilets shared between households, perhaps particularly when built by a kin group with shared resources, were regarded differently and were better maintained than public/communal toilets.
- Conduct further research using a realist approach to understand the factors influencing program outcomes in different contexts and how to achieve improved outcomes through stakeholder participation. ■

NOTES

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Dr. Bronwyn Myers has research experience in a range of disciplines, including irrigated agriculture, catchment processes, food security and livelihoods in eastern Indonesia. She has extensive experience in managing research and development programs in eastern Indonesia, being responsible for developing realistic project plans and budgets, delivering outputs, and producing

positive outcomes that have been sustained beyond the life of the project. Dr. Myers has a strong record of establishing and strengthening research partnerships across disciplines and across sectors, particularly through partnerships between Australia and Indonesia. She has written and edited academic and technical publications, and supervised postgraduate students with research in Asia and Southeast Asia.

Emma Williams, currently Principal Scientist in the Evaluation for Northern Contexts team at the Northern Institute, Charles Darwin University (CDU), previously worked in government facilitating research and community visioning processes to guide planning in a rapid population growth area of Victoria, Australia. She also worked as a corporate planner within government, linking long-term community visions to government budget allocations, working closely with urban planners, engineers and service providers. Shortly before coming to CDU, Emma was Director of Social Policy in the Northern Territory Government; she currently has research and evaluation projects in northern Australia and eastern Indonesia, with a focus on “realist” approaches.

Sarah Hobgen is currently a Research Associate at the Research Institute for Environment and Livelihoods. She recently completed her PhD studying erosion and sedimentation in the Kambaniru River catchment in Sumba. Before joining the Charles Darwin University (CDU) team Sarah worked with Landcare and Catchment Management in the Murrumbidgee catchment in NSW, and with Bushfire Management with the Victoria Government. Sarah has lived in Sumba, Indonesia since 2008 and speaks fluent Indonesian and some of the local Sumbanese dialect.

New Tools to Help Decision-Makers Provide Safe and Appropriate Sanitation Infrastructure

A Decision Support Framework based on sophisticated statistical and technical analyses can provide a scientifically robust means of determining what locations are most vulnerable to public health risks and what the best solutions are.

• Mochamad Agung Wibowo • Ashantha Goonetilleke

Despite the outlay of significant resources, progress on urban sanitation is lagging in Indonesia. Communities still face health risks due to poor sanitation. Gains made under the Millennium Development Goals (MDGs) such as higher levels of access to safe drinking water are at risk of being reversed. Only 11 cities in Indonesia have reticulated sewerage systems, and the treatment of sewage in the majority of the cities is dependent on on-site systems such as individual systems or small-scale decentralised systems.

Little guidance is available to help local officials identify where intervention is needed most and what form that intervention should take. Small-scale systems are commonly implemented in a uniform manner, with little consideration of the factors that should be taken into account in order to prevent environmental degradation and contamination of shallow groundwater, which is the primary potable water source for the majority of the urban population. This lack of guidance and uniform approach were the key drivers for the research described in this article.

The primary objective of the research project was to develop a scientifically robust methodology to enhance decision-making for the provision of appropriate sanitation infrastructure for the safe management of sewage in urban areas of Indonesia. It was based on the hypothesis that a Decision Support Framework (DSF) underpinned by the concepts of landscape epidemiology¹ and public health risk provides a scientifically robust approach. The project brought together research teams from Queensland University of Technology (QUT), Australia and University of Diponegoro (Undip), Indonesia to undertake this challenging research endeavour. Semarang City was selected as the case study area, and the Semarang Local Government, through its Water and Natural Resources Agency – Dinas PSDA ESDM (*Pengelolaan Sumber Daya Air dan Energi Sumber Daya Mineral*) was also a key partner in the research project.

The primary objectives of this multidisciplinary research project were:

- To support the Government of Indonesia's initiative to accelerate its improved sanitation program and to achieve the associated MDG (Goal 7) target (Target 7C)², which is currently lagging by a significant margin.
- To contribute to the practical implementation of the wastewater master plan for Semarang City (and subsequently Indonesia-wide) by providing the decision support tools to prioritise

appropriate intervention measures and to optimise return on investment in relation to sanitation.

- To contribute to capacity building and cutting-edge knowledge transfer to Indonesian partner institutions in the areas of geospatial and Bayesian analyses³ and risk assessment.

Key Points

Despite substantial expenditures, progress on urban sanitation is lagging in Indonesia. Little guidance is available to help local officials identify where intervention is needed most and what form that intervention should take. Research teams from Queensland University of Technology and University of Diponegoro worked together to develop a Decision Support Framework (DSF) to help local decision-makers provide safe and appropriate sanitation infrastructure. They hypothesised that a DSF based on tools that identify areas of greatest public health risk would offer a scientifically robust approach. The city of Semarang was selected as the case study area.

The primary objectives of this multidisciplinary research project were to support the Government of Indonesia in accelerating its improved sanitation program and achieving the associated Millennium Development Goal; to contribute to the implementation of Semarang's wastewater master plan; and to contribute to capacity building and knowledge transfer with Indonesian partner institutions.

The project consisted of field data collection, sampling and laboratory testing, spatial database development, Geographical Information System (GIS) and geospatial analyses, Bayesian Networks analysis, and system modelling for the creation of the DSF.

The study consisted of five phases: (1) Selecting 11 study locations and determining basic characteristics related to landscape; population; urban form; climatic attributes; soil, surface, and groundwater characteristics; and existing water, sanitation and stormwater infrastructure. (2) In-depth assessment of wastewater generation, stormwater runoff and health, including sample testing for pH, electrical conductivity, total suspended solids, chemical oxygen demand (an indirect means of measuring water pollution), oils and fats, and E. coli; and delineation of catchment areas for detailed flood modelling. (3) Development of mathematical relationships to help identify areas with relatively high public health risk. (4) Spatial analysis and development of scenarios based on population and urban growth. (5) Development of a DSF to inform future policy development and management practices.

The research found that the statistical tools used provide a scientifically rigorous methodology for public health risk assessment; that flooding is a key risk factor while neither population density nor land use shows a direct causal relation to potential waterborne disease risk; and that obtaining expert knowledge early in the process is crucial. Among the recommendations from the research are harnessing expert knowledge where available data are sparse; using Bayesian Networks for modelling; understanding complex relationships among water quality, landscape, environmental and human settlement factors; predicting the key indicators of disease potential with associated uncertainty; and incorporating socio-economic data into the analysis.

"Flooding is the most significant factor in the identification of potential high risk areas."

The project consisted of field data collection, sampling and laboratory testing, spatial database development, Geographical Information System (GIS) and geospatial analyses, Bayesian Networks analysis, and system modelling for the creation of the DSF. Obtaining secondary data (such as administrative boundaries and demographic and disease incidence data) was challenging. Incomplete and inaccurate datasets and the lack of metadata in the case of spatial datasets was a significant constraint. However, the most important task was developing the framework, not ensuring the accuracy of a specific dataset. Therefore, the project focused on developing a scientifically robust methodology using the “best available information”. The quality of the answers can be improved when better data becomes available.

The conceptual framework for the project was underpinned by these assertions:

- Decision-making in relation to the provision of sanitation infrastructure is multidisciplinary. It requires integrating geospatial analysis, mathematical and computer modelling, public health, microbiology, environmental engineering and human settlements planning.
- Landscape factors are the key to understanding the potential contamination of water resources resulting from the unsanitary disposal of sewage.
- Accordingly, the concept of landscape epidemiology provides a scientifically robust approach for the evaluation of potential public health risk arising from sewage contamination of water resources.
- Bayesian network modelling provides a mathematically robust approach for the integration and analysis of qualitative and quantitative data relevant to decision-making in relation to the provision of sanitation infrastructure.
- System modelling can include expert opinions on potential remedial measures to enhance resilience and devise sustainable design strategies based on human settlement and the physical characteristics of a particular area.

The study consisted of five phases, summarised below. The phases overlapped and a number of activities were undertaken concurrently.

Phase 1: Understanding the context of the case study region – 11 study locations were selected. The locations represented a cross-section of the characteristics of the case study region, including landscape; population; urban form; climatic attributes; soil, surface, and groundwater characteristics; and existing water, sanitation and stormwater infrastructure. Baseline data was input to a GIS. The spatial information obtained was validated through direct observation.

Phase 2: In-depth assessment of the selected 11 study locations – Researchers collected data on wastewater generation, stormwater runoff and human health. Surface and groundwater samples were collected for chemical and microbiological characterisation. The samples were tested for pH, electrical conductivity, total suspended solids, chemical oxygen demand (an indirect means of measuring water pollution), oils and fats, and E. coli. Using the spatial database developed,

the case study area was delineated into a number of catchment areas. Three catchments were identified for detailed flood modelling.

Phase 3: Development of mathematical relationships – Spatial statistics were employed for investigating the relationships between physical, chemical and microbiological parameters and for developing mathematical relationships between population, urban form, climate factors and public health risk. Spatial statistics were employed to evaluate the spatial dependence structure of those parameters of interest. A spatial response surface model was fitted to a range of parameter values over the study region to help in the identification of vulnerable areas, i.e. which areas have relatively high public health risk. In lay terms, this means that statistical and mathematical tools were applied to identify which locations would have the highest public health risks and what the relationships are among the measured characteristics of each location.

Phase 4: Spatial analysis and scenario development – Two methods were employed for the analysis of vulnerabilities of specific areas based on population and urban growth and accompanying public health risk and associated uncertainty. First, spatial analysis was undertaken using GIS software tools for the identification of vulnerable areas due to poor sanitation practices. This analysis was further refined using Bayesian Networks and the outcomes from Phase 3. This phase was iterative and the findings were progressively refined as more in-depth understanding of the interactions, impacts, and outcomes of a particular scenario were obtained.

Phase 5: DSF development – The analyses in Phases 3 and 4 underpinned the creation of the DSF using a meta-synthesis-based approach and system modelling. System modelling was conducted to include expert opinion on potential solutions that can inform policy development and management practices.

The DSF consisted of the integration of two key research undertakings. The first component was primarily undertaken by QUT and consisted of developing potential health risk maps for typhoid and diarrhoea based on ground elevation, land use, soil permeability, population density, flooding, and water quality. These are the two most prevalent diseases in Indonesia that arise from poor sanitation.

The second component was primarily undertaken by Undip. Using physical data and expert opinion, Undip created a decision support flowchart to assist in making decisions on what type of sanitation measures should be provided in a specific area. The complete development of the decision flowchart requires the inclusion of socio-economic data which did not form part of the current research project. Therefore, only the preliminary results are presented in this report. Undip is currently extending this project to include socio-economic data.

The key findings from the research project include:

- The application of Bayesian Networks for the integration and analysis of qualitative and quantitative data that are commonly generated from the investigation of the landscape system, environmental systems, and human settlement characteristics provide a scientifically rigorous methodology for public health risk assessment.
- The application of the concept of landscape epidemiology for assessing the potential public health risk in relation to sewage treatment and disposal is valid as an initial assessment methodology.
- Spatial response surfaces and Bayesian Networks can help to overcome the constraints which are otherwise imposed on the analysis of human health risk and water pollution, arising from the paucity of water quality data.
- The estimated response surfaces and risk maps enable the identification of potentially vulnerable areas within the study region.
- Comparison of the risk maps from the Bayesian Networks analysis with those from GIS analysis demonstrates the role played by three intermediate indicators, namely, total nitrogen, bacteria, and fat/oil.
- Comparison between Bayesian Networks and GIS analysis results revealed that flooding is the most significant factor in the identification of potential high risk areas. Rainfall has an impact, but is not directly related to risk potential.
- Interestingly, neither population density nor land use shows a direct causal relation to potential waterborne disease risk.
- Expert knowledge was found to be of critical importance at various stages in the analysis – including geospatial analysis, Bayesian analysis, and system modelling – because it serves as prior information before models are fitted to data, resulting in more reliable and informative outcomes.
- Use of expert knowledge at the start of the study helps to mitigate against the perils of generalising results from small sample sizes.
- The DSF created using complex statistical and Bayesian Network tools and systems modelling for integrating the outcomes from sophisticated spatial analyses, field sampling and testing and modelling outcomes provides a way forward to strengthen decision-making in the provision of sanitation infrastructure in the face of compounding issues facing the urban environment in Indonesia, and for the advancement of sector knowledge.

The key recommendations from the project are:

- As prior information played an important role in the various analyses undertaken, in situations where the data available is sparse, experts should be elicited to harness any available prior knowledge about the system being modelled.

- In order to understand the influences on water quality, a modelling approach which is able to handle sparse data and complex relationships and inter-dependencies between variables is needed. Bayesian Networks provide a framework to facilitate this understanding.
- For this study, informed decision-making could only be achieved through an understanding of the complex relationships among water quality, landscape, environmental and human settlement factors. It also required the precise prediction of key indicators of disease potential and the associated uncertainty. It is therefore recommended that these features should be characteristics of future decision-making frameworks.
- The methodology developed in this project for understanding disease potential is not specific to the study region and can be extended and developed further for other regions and for studies other than water quality. It is therefore recommended that this methodology be adopted in further environmental studies.

The methodology developed in this study should be further improved with the following enhancements:

- Including socio-economic data as part of the spatial database.
- Improving factor layers⁴ by modelling temporal, seasonal and cyclic attributes of the factors where relevant, and derived factor layers, e.g. rainfall variability and seasonality.
- Creating an overall disease incidence factor layer from a comprehensive health centre data record set – cases for all villages for all days/weeks/months/years of a research epoch.
- Utilising remote sensing and other imagery to improve the classification and grouping of land use and land cover.
- Consulting a wider range of experts to gain further expert elicited data.
- Consulting other important groups, including the private sector, academia, and not-for-profit organisations to develop options and costs to inform decision-makers.
- Conducting water sample collection and testing on a further round of sites, with site selection informed by the outcomes of the initial study undertaken.
- Incorporating higher-order terms of variables into the Bayesian network as additional nodes to capture potential nonlinear features in the network (the current Bayesian network considers linear dependence only).

The groundbreaking nature of the research undertaken provided significant opportunities for knowledge creation, knowledge transfer and capacity building. Furthermore, the adoption of a robust project management strategy based on shared responsibility and ownership of the project and open communication between the partners helped to establish a strong collaborative partnership. ■

NOTES

1. “Landscape epidemiology” is a methodology for determining the risk of disease transmission in a geographic area based on an analysis of the area’s physical elements, such as elevation,

rainfall, land use, vegetation, human structures and similar.

2. Goal 7 is “Ensure Environmental Sustainability.” Target 7C is “Halve, by 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation.
3. Bayesian analyses assign probabilities to various outcomes based on an understanding of the evidence available and how different aspects of the environment interact. A Bayesian Network creates a graphical model of these relationships.
4. Factor layers are the individual “layers” of data that are collected using a GIS, such as elevation, flooding area, and land use.

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Governance Arrangements for Small City and Town Sanitation

How do local governments' sanitation planning lead to real wastewater outcomes? Research findings from six in-depth case studies of small towns in Sumatera provide some answers. • Joanne Chong • Juliet Willetts • Kumi Abeysuriya • Lenny Hidayat • Hery Sulistio

In Indonesia it is well understood that many Local Governments (LGs) invest low levels of funds in wastewater sanitation services, and that there are many challenges to achieving effective and sustainable local service delivery. It is also recognised that governance and institutional arrangements, rather than lack of financing per se, pose major barriers to effective local sanitation planning and service delivery. New insights into how to best foster good governance at the LG level are thus crucial for the national government, donors, and civil society to develop more successful support mechanisms.

But what is the best way to generate such insights into the governance challenges and opportunities for LG sanitation service delivery? A team of international researchers, local researchers and NGO practitioners (Institute for Sustainable Futures [ISF] at University of Technology Sydney, Kemitraan [Partnership for Governance Reform] and SNV Netherlands Development Organisation), supported by Bappenas, identified the value of hearing directly from a wide range of LG stakeholders about governance issues, and also providing platforms for these stakeholders to share their experiences with each other. The research adopted a consultative, participatory social research approach that involved a total of 138 local stakeholders, in six in-depth case studies of small towns in Sumatera.

The research was centred as a starting point on the District/City Sanitation Strategies (*Strategi Sanitasi Kabupaten/Kota*, or SSK). These SSK serve as the key planning instrument for implementation of the Government of Indonesia's national program for Accelerated Sanitation Development for Human Settlements (*Percepatan Pembangunan Sanitasi Permukiman*, or PPSP).

Our key research question was: What (governance) factors influence how sanitation planning through the SSK process can lead to effective wastewater outcomes for small towns in Sumatera? Within this scope, the team investigated:

- The effectiveness of the *Pokja Sanitasi* (Local Government sanitation committee)
- The links between planning and investment
- LG actor roles and responsibilities, including for financing, decision-making and investment

The research activities were conducted from October 2014 to April 2015, with participants in West Sumatera: Payakumbuh, Sawahlunto, Pariaman, and the towns of Lampung Selatan, Pringsewu, and Metro in Lampung.

Key Points

To improve sanitation outcomes in Indonesia, greater insights into the governance challenges and opportunities for Local Government (LG) sanitation service delivery are required. The team from the Institute of Sustainable Futures (ISF), Kemitraan, and SNV, supported by Bappenas, engaged with local stakeholders through a consultative, participatory approach in six in-depth case studies of small towns in Sumatera.

The study focused on the District/City Sanitation Strategy (Strategi Sanitasi Kabupaten/Kota [SSK]), the effectiveness of the Pokja Sanitasi (local government sanitation committee), and LG actor roles and responsibilities. The findings from this study show that:

- Whilst all the case study LGs had developed SSKs, in most cases the plan was not being used to strategically guide wastewater investment or service delivery.
- Pokja varied in their capacity to coordinate sanitation activities across LG.
- The links between planning and investment were weak, due to shortcomings in planning as well as barriers to effective budgeting.
- Participants reported barriers to operations and maintenance including a lack of LG asset ownership, and prescriptive budgeting processes.

Based on these findings, the researchers propose four key areas of change fundamental to improving local governance arrangements for sanitation service delivery. These areas are:

1. Effective city sanitation planning requires informed LG participation in and ownership of the planning process.
2. Support LG capacity to conduct cross-sectoral sanitation budgeting, including by changing the restrictive nomenclature budgeting requirements so that this nomenclature is aligned with sanitation activities listed in the SE660.
3. All levels of government have a role to play to promote wastewater (beyond Open Defecation Free and the toilet) as essential to ensure public health and environmental quality – and the responsibility of governments to provide services.
4. Better coordination across levels of government and between agencies is needed to ensure the multiple sources of funding and multiple actors involved in wastewater service delivery result in effective sanitation outcomes. This coordination cannot be driven by LGs themselves.

Case Study Findings

How strategic and long-term are the SSKs? Whilst all the case study LGs had developed SSKs, in most cases the plan was not being used to strategically guide wastewater investment or service delivery. Many participants noted the SSKs were developed “as a formality” instead. In some cases Pokja members had limited involvement in developing the SSKs, and in others they noted the complexity of the SSK process. In practice, even where a SSK outlined planned priorities, actual investments could not be made consistent with these plans due to land availability and budgetary issues.

In contrast to the general findings, in Sawahlunto a common local economic development vision for the city had helped to drive strong LG interest in wastewater and the SSK.

How do Pokja Sanitasi operate in practice, including to coordinate SSK development? Pokja varied in their capacity to coordinate sanitation activities across LG. Several were significantly constrained by local leaders' lack of support for sanitation – especially where the Pokja comprised only lower echelon staff, were missing representation from key local task force (*Satuan Kerja Perangkat Daerah* [SKPDs]), and/or where the local leaders (e.g. Regional Secretary, the Mayor, and members of the Regional Representative Council) lacked interest in wastewater.

Staff rotations and resource constraints further limited Pokja's ability to coordinate collaborative, cross-SKPD planning or implementation.

What are some specific governance issues affecting the links between planning and investment? Overall, the links between planning and investment were weak, due to shortcomings in planning as well as barriers to effective budgeting. Prescriptive local budgeting and approvals systems posed significant barriers to LG allocating funds for sanitation. LGs are required to use the nomenclature provided by the Ministry of Home Affairs (MoHA) when identifying LG budget (APBD) programs and activities, but there is a complicated mismatch between this list and the sanitation activities that align with guidelines in MoHA's Circular SE660 (2012), for implementing the SSK and the Memorandum of Sanitation Program (*Memorandum Program Sanitasi* [MPS]).

There are also many points at which LG budget allocations for sanitation under APBD can be easily "struck out" if higher level support does not exist (see Figure 1).

Across case studies, the largest proportion of wastewater funding was from special allocation funds (*Dana Alokasi Khusus*, or DAK) programs, and thus the focus and criteria specified in these programs (e.g. technologies) heavily influence what sanitation infrastructure is implemented on the ground and may not always be fit-for-purpose.

Case Study Highlights

Payakumbuh: Although key leaders who initiated consolidated action on sanitation had since left the LG, the Pokja Sanitasi remained enthusiastic and active and continued to engage community representatives, civil society and the media on sanitation. The focus of the previous SSK was on achieving open defecation free status.

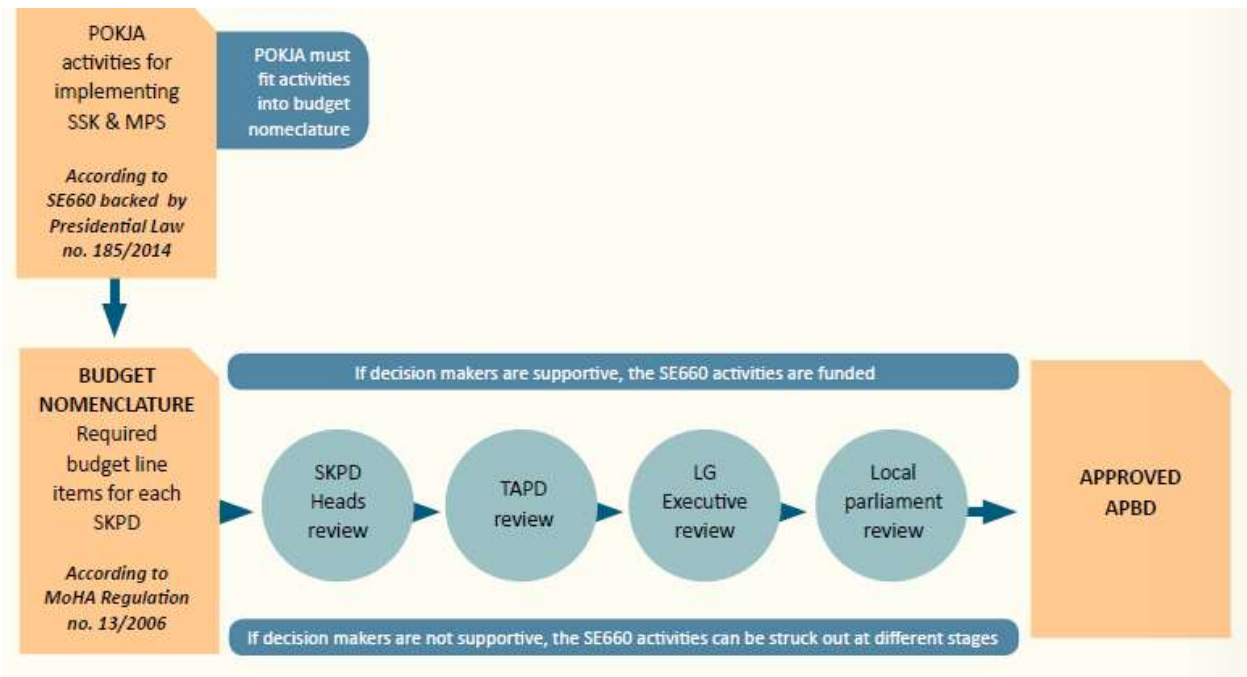
Lampung Selatan: LG staff were not significantly involved in the preparation of the SSK, which was conducted by an external consultant. Frequent staff rotations had limited the capacity of the Pokja to coordinate sanitation.

Sawahlunto: A common local development vision for tourism provided a basis for local decision-makers support for sanitation budget and implementations. The Pokja is on its own initiative revising the SSK to improve its utility as a planning instrument.

Pariaman: Although proposed sanitation budgets risked being rejected by local decision-makers, where programs were advocated and supported by central government (e.g. Australia-Indonesia Infrastructure Grants for Sanitation, or sAIIG) they were more likely to receive local approval for funding.

Pringsewu: Investment was based primarily on DAK-SLBM (*Dana Alokasi Khusus - Sanitasi Lingkungan Berbasis Masyarakat*) funding, although the requirement to secure lands before applying for funds has proved challenging.

Metro: Investment locations are also decided on the basis of land availability. The Pokja's capacity to coordinate sanitation was hampered by cuts to the budget for internal coordination and limited support from decision-makers for sanitation.

Figure 1: LG Budget Approval Process Explained

The budget approval process for financing LG activities holds many potential obstacles for gaining the necessary finances to implement sanitation in line with the SSK. In this process, the Pokja Sanitasi's role is to coordinate SKPD work plans to include sanitation activities that align with the guidelines in MoHA's Circular SE660 (2012), for implementing the SSK and MPS.

At the same time, SKPD need to prepare their budgets in accordance with a nomenclature specified by MoHA that operationalises the MoHA Regulation no. 13/2006. The nomenclature provides a set list of budget line items ($n > 2000$) for specified mandatory affairs (urusan wajib)* and optional affairs to be undertaken by LGs.

In order to be funded under the local budget (APBD), the sanitation activities under SE660 must therefore be "fitted" into the nomenclature that has wording that does not align exactly with the SE660. For example, the Health Agency's activities in training enumerators and implementing Environmental Health Risk Assessment (EHRA) mapping, and sanitation advocacy (activities specified in the SE660) would need to be placed under the nomenclature's budget lines for "Health Promotion and Empowerment Program". The specific lines in the nomenclature: media development and promotion of information for healthy living; community outreach for healthy lifestyles; improved education of health extension workers; monitoring, evaluation and reporting.

Budgets are reviewed by a series of decision makers, as above. At each review point, the decision makers determine whether the SE660 activities can be included within the nomenclature, or not. Where competing priorities take precedence, the sanitation activities are often deleted – a situation most case study participants highlighted as a barrier to implementing wastewater activities.

In the APBD budget approval process, the TAPD (LG budget team) compiles the SKPD plans and budgets. The TAPD consists of the Sekda, Finance and Revenue Agency, and the head and division heads of Bappeda. Their role is to ensure that budgets are in accordance with the priorities of the LG executive (headed by the mayor/regent), and to verify that plans are in accordance with the LG's medium term development plan (RPJMD). Thus, the TAPD has the power to delete or switch approved budget lines – but not to add or change line items.

A further complication for wastewater sanitation financing arises because, within the TAPD, the "supply" and "demand" sides are under the purview of different divisions in Bappeda. Budgets for the supply side, namely Dinas Pekerjaan Umum (DPU)'s construction of infrastructure, sAIIIG program funding, etc., are managed by Bappeda's Physical Infrastructure division (who is also the Pokja Sanitasi coordinator). Budgets for the demand side, namely the Health Agency's activities around community engagement and sanitation demand creation, are managed by Bappeda's Social and Cultural (Sosbud) division. When the head of the Sosbud division prioritises other activities over wastewater, they might reallocate the proposed budget for the Health Agency's wastewater demand-side activities elsewhere within the health or other

agencies.

Study participants pointed to the need for improved alignment between the activities of the SE660 and the nomenclature for achieving the outcomes of the PPSP. The urgency has increased since the passage of the Presidential Decree no. 185/2014 regarding acceleration of water supply and sanitation provision which gives the SE660 legal standing it previously lacked. It calls for revision of MoHA Regulation no. 13/2006 so the two work in coordination with each other.

**Mandatory affairs in LG budgets are: agriculture and food security, education, health, public works, housing, spatial planning, development planning, transport, environment, land, local autonomy, local financial administration, local task force, staffing, coding, demographics, women's empowerment and child protection, family planning and welfare, social, labour, cooperatives and Small Medium Enterprises (SMEs), regional investment, culture, youth and sport, national unity and politics of the interior, public administration, personnel, rural community and empowerment, statistics, archives, communication and information and library.*

Further, although DAK funding dominates, there were a myriad of national and sub-national funding sources. Across most case studies, the LGs are currently not in a position to actively, strategically coordinate the range of wastewater activities funded through these multiple programs, with the consequence that the resultant investments did not closely match what was planned through the SSK processes.

What factors inhibit LGs from taking responsibility for ongoing sanitation service delivery, including operation and maintenance (O&M)? Participants revealed multiple institutional and systemic factors affecting LG service delivery. They reported that a major barrier to undertaking O&M is that they do not own many of the wastewater assets within their geographic area – these might be owned by the community, the province, or it could be difficult to determine ownership. As these assets are not listed on their asset register, they are unable to allocate funds for O&M. The restrictive budgeting process outlined above also limits LGs' ability to allocated funds to support O&M.

In several cases, LGs focused on Open Defecation Free (ODF) behaviour and considered that the community should have primary responsibility for managing wastewater outcomes, rather than a shared responsibility between LG and community. Furthermore, in practice there is weak accountability for the quality of implementation of SSKs, or for the achievement of environmental and public health outcomes from wastewater investments.

In two case studies it was evidence of faecal contamination of rivers that acted as impetus for LG to further their efforts in sanitation service delivery, demonstrating the significant potential for better monitoring and accountability to continue to drive action.

Implications for LG

There are many interlinked changes required for improving local governance of sanitation. Improved water quality and service standard monitoring is required, for example, to form the basis for strategic prioritisation in plans and also to help make the case amongst the community and leaders for improving wastewater. Furthermore, actions to address systemic issues concerning budgeting should precede further efforts to improve the quality of plans. In essence, a pragmatic balance needs to be struck between investing in “comprehensive” planning

approaches and “good enough” planning to identify sanitation strategies that are not only appropriate to ameliorating public health and environmental risks, but also will have a chance to be funded and implemented in practice. SSKs thus need to recognise, without being entirely limited by, existing contextual constraints (whether related to land availability, budgeting, decision-making, capacity or other factors) so that the SSK is useful to guide strategies in practice, and planned strategies are achievable. The team identified four key areas of change fundamental to improving local governance arrangements for sanitation service delivery.

1. Effective city sanitation planning requires informed LG participation in and ownership of the planning process, based on a keen understanding of these internal institutional and coordination barriers.

Across case studies, there was a range of levels of involvement in developing SSKs. Where ownership is lacking, LGs tended not to recognise nor use the SSK as a strategic basis for budgeting and implementing wastewater. During the planning process, concurrent strategies are needed to foster local leadership buy-in and interest in sanitation, as well as more intensive technical support.

2. Support LG capacity to conduct cross-sectoral sanitation budgeting, including by changing the restrictive nomenclature budgeting requirements so that this nomenclature is aligned with sanitation activities listed in the SE660.

Participants revealed that it is challenging for Pokja staff to navigate the APBD budgeting nomenclature, including determining where and how to insert wastewater-related activities, and to prevent these proposed activities being "struck off" and removed from the budget. This reveals a specific area to target capacity building and guidance.

MoHA has also identified that the APBD budgeting nomenclature could be updated so that it is consistent with the SE660.

3. All levels of government have a role to play to promote wastewater (beyond ODF and the toilet) as essential to ensure public health and environmental quality – and the responsibility of governments to provide services.

In some case study locations it was apparent that there remains the legacy of targets, programs and policies that focused essentially on ODF (rather than the whole sanitation chain) and incentivised certain forms of community-based sanitation. The PPSP objective is expressed as 100 percent ODF and the National Medium Term Development Plan (2009-2014) that was in place at the time of the research also specified an ODF target. The new National Medium Term Development Plan (2015-2019) extends the focus to include reference to adequate sanitation, representing an opportunity for national policy to signal the need for a sustainable, whole-of-system approach incorporating subsequent steps of containment, transport, treatment

and disposal or re-use of both effluence and faecal sludge.

There are multiple institutional and coordination barriers which inhibit LGs from adopting a “service orientation” towards sanitation provision, beyond the private household domain of toilets to addressing public infrastructure, services and public health. For changes and improved governance arrangements for sanitation to occur within LGs, support and incentivising needs to occur from without.

4. Better coordination across levels of government and between agencies is needed to ensure the multiple sources of funding and multiple actors involved in wastewater service delivery result in effective sanitation outcomes. This coordination cannot be driven by LGs themselves.

In practice wastewater activities are funded through multiple national and donor sources, administered by various agencies, and implementation overseen by a further range of actors. In our case studies there was a mismatch between SSK strategy and implementation, and it was also evident that Pokja and LGs are currently not in a position to actively coordinate the range of sanitation infrastructure developments funded by different sources. From the perspectives of participants in the case study, it would seem unrealistic to expect the drive for better coordination across and within levels of government to be instigated by LGs themselves. ■

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Setting Priorities for Water and Sanitation Projects Using Social Return on Investment

Expenditures on water and sanitation infrastructure can produce significant benefits. But how can Local Governments determine which projects offer the greatest benefits for the money spent? A tool that calculates Social Return on Investment can help. • Bruce Gurd • Unggul Purwohedi • Mohamad Rizan

Water and sanitation projects improve community well-being. But there is never enough money to finance all infrastructure needs; choices must be made. The extent to which infrastructure improvements will influence community well-being is dependent on each community's physical and demographic characteristics. To take an extreme example, in an area where most houses have septic tanks, connecting them to a community sanitation system (*Instalasi Pengolahan Air Limbah*, or IPAL) has modest benefits. In an area where there is an open defecation field or the river is used as sewer, the benefits are very significant.

One tool for determining the level of benefits provided is Social Return on Investment (SROI). SROI offers a framework for measuring and accounting for value to society. It places a monetary value on social impact and compares this with the cost. Originally developed in the United States, it is now most prominently used in the United Kingdom. SROI is an extension of cost benefit analysis, except the benefits are outcomes (such as reduction in mortality rates) not outputs (such as number of household connections added). Costs are measured comprehensively, and include not only financial resources but less obvious costs such as, for example, contributions of time by volunteers and food for workers provided by families in the community. SROI uses a logic model which clearly specifies all components, starting from inputs and progressing to outcomes and impact (see Figure 1).

Figure 1: SROI from Inputs to Impact

| Inputs / Resources | Activities | Outputs | Outcomes | Impact |
|---|--|--|--|--|
| What goes in | What happens | Immediate results | Short and long term result | Effects on root causes-sustained change |
| <ul style="list-style-type: none"> Resources Equipment Knowledge/expertise | <ul style="list-style-type: none"> What does your organisation/enterprise do? | <ul style="list-style-type: none"> How much activity occurs? For each activity what are the results? | For example <ul style="list-style-type: none"> Improved living conditions Increased income | For example <ul style="list-style-type: none"> Change in poverty Change in social norm & attitudes |

Under the auspices of the Australia-Indonesia Infrastructure Research Awards (AIIRA) program, a research partnership among three institutions (Universitas Negeri Jakarta, University of South Australia, and Gresik Regency) explored how the SROI concept could be applied to sanitation

infrastructure development in Indonesia, using Gresik as a model. The goal was to build a simple approach to measuring and modelling SROI. The outcome of this research is an Infrastructure Impact Calculator that enables Gresik to put in key characteristics of a new project and estimate the ratio of outcomes to inputs. The calculator allows Gresik to choose the projects that will be the most effective at improving long-term community well-being. It replaces approaches that just measure outputs such as improvement in water quality or the number of houses connected for a certain expenditure.

The SROI Process

SROI is guided by seven underlying principles: understand what changes; involve stakeholders; value the things that matter; only include what is material (i.e., relevant to the process); do not over-claim; be transparent; and verify results.

Key Points

Because funds are limited, choices must be made on where to spend them. A research partnership among Universitas Negeri Jakarta, University of South Australia, and Gresik Regency explored how the calculation of Social Return on Investment (SROI) can help policy-makers in Indonesia decide which infrastructure projects are likely to produce the highest level of positive economic, social, and environmental outcomes in relation to the expenditure required.

SROI is guided by seven underlying principles: understand what changes; involve stakeholders; value the things that matter; only include what is material (i.e., relevant to the process); do not over-claim; be transparent; and verify results. It follows six steps: (1) establish scope and identify key stakeholders; (2) map outcomes; (3) provide evidence of outcomes and give them a value; (4) establish impact; (5) calculate the SROI figure; and (6) report, use, and embed.

The central goal of the research conducted was to measure individual infrastructure projects. In the early stages the focus was on evaluation of past projects, but this shifted to forecasting for proposed future projects. Inputs were sought from key stakeholders in the community and Local Government (LG) through focus group discussions and interviews. While some inputs were clearly known at the start, such as aid revenue or funding from the Government of Indonesia, researchers were able to identify additional inputs from community members, such as volunteer labour. Households were asked about the changes they experienced due to infrastructure projects. Results were used to create a theory of change for each site. A “golden thread” analysis then identified outcomes experienced by stakeholders, highlighted significant change, and specified which outcomes were significant. Golden thread results were confirmed through a large survey of households that had experienced improved water or sanitation facilities for two or three years, to provide a sufficient time period to experience the outcomes.

Results were shared with Gresik officials, who can use the evidence to help convince community members of the value of improved facilities.

A final outcome of the project was a software tool which can be used not only by Gresik’s LG, but which can be adapted by any Indonesian LG to calculate the SROI of water and sanitation projects. The software is accompanied by a questionnaire that users can employ to collect the data needed for the calculator.

Ideally the outcomes of this research can be further developed to create an Infrastructure Value Calculator useable across Indonesia for many kinds of infrastructure in addition to water and sanitation.

The calculation and use of SROI is based on six steps:

1. Establish scope and identify key stakeholders
2. Map outcomes
3. Provide evidence of outcomes and give them a value
4. Establish impact
5. Calculate the SROI figure
6. Report, use and embed

The six steps look deceptively easy, but doing SROI well requires solid evidence through data collection. Careful documentation is required at each stage. Our research relied on assistance from Social Ventures Australia to help design the research project and train the research team.

SROI can be used to evaluate whole organisations, but this approach is often criticised as just being for the purpose of external validation. In our case, the central goal was to measure individual infrastructure projects. In the early stages the focus was on evaluation of past projects, but this shifted to forecasting for proposed future projects.

A Participatory Approach

The key stakeholders for projects in Gresik are the communities that benefit from the water and sewerage projects, and the Local Government (LG) that manages the projects. The project team held focus group discussions and interviewed these stakeholders to collect data about inputs, activities, outputs and outcomes. Some inputs to the projects were clearly known at the start, such as aid revenue or funding from the Government of Indonesia (GoI). Researchers identified additional inputs from community members, such as volunteer labour.

Using the interview protocol we developed, we asked residents about the changes that they were experiencing after the infrastructure had been installed. We asked each household about what had changed, how they compared their current and previous conditions, and how they felt about these changes. At this point, our objective was to explore the possible outcomes that they were experiencing and gather evidence of these outcomes. The research team keyed in all the data into a database and analysed all the responses to create a theory of change for each site. For example, interviews revealed that because of the sewerage infrastructure, drainage was improved and people now do not dump their sewage in the drainage or field near their homes. This eliminates mosquito breeding grounds and results in fewer mosquitoes, which in turn leads to fewer mosquito-borne diseases. The outcomes were separated into immediate, short term (less than six months), middle term (six months to one year), and long term (more than a year) categories.

Golden Threads

In mapping our theories of change, we colour coded different types of outcomes such as health, social, environment, education and economy. Starting with multiple theories, we sought to

create a single theory of change applicable to each IPAL and water supply across Gresik. The researchers conducted a “golden thread” analysis: that is, we looked at each thread of outcomes experienced by stakeholders, highlighted significant change, and specified which outcomes were significant. A yellow colour was used for this golden thread in the preliminary theories of change at each site. This golden thread analysis is based on the fourth SROI principle, which is to only include what is material. If a specific and most valuable outcome was experienced by a large number of our respondents, it was classified as a golden thread.

In order to confirm our golden thread outcomes, we conducted a large survey in early March 2015. We surveyed 644 households in regard to IPAL and 872 households on water facilities, with the focus on established facilities which had been in operation since 2012 or 2013, to provide a sufficient time period to experience the outcomes. In total, data was obtained from 47 locations in 27 villages in the three most populous subregencies: Gresik, Manyar, and Kebomas.

Sharing Results

The next step was to allow key stakeholders to review our work and engender consensus on many assumptions. Gresik LG was shown the survey results which showed mainly positive outcomes. There are some negative impacts such as IPAL dysfunctionality (e.g. a broken facility in the household) and more water spending, but those negatives are not dominant. These positive outcomes will be used by Gresik officials to show the benefits of IPAL and water projects to other sites, so that more people will understand the project benefits, accept the program, and connect to the sanitation facility.

Social Infrastructure Calculator

A final outcome of the research project was a software tool which can be used not only by Gresik’s LG, but which can be adapted by any Indonesian LG to calculate the SROI of water and sanitation projects. The software is accompanied by a questionnaire that users can employ to collect the data needed for the calculator. The calculator has been handed over to Gresik Government, and training provided to staff on how to use it. Recently, they calculated an SROI ratio of Rp 1.19:1, based on real data for Gending, Kebomas Subregency. This ratio means that every 1 Rupiah of investment in this IPAL facility produces economic, social, and environmental outcomes with a value of Rp 1.19. Ongoing data collection is underway in Gresik so that the SROI calculator can be used for other IPAL and water facilities as well.

Conclusion

In the longer term, we are optimistic that the outcomes of this research can be developed in two ways:

- Develop an Infrastructure Value Calculator to be used across Indonesia
- Develop the methodology so that it can be used for additional purposes other than water and sanitation projects

There were some constraints and challenges during the implementation of the research. The main challenge was producing an SROI tool that was simple enough to be used by staff at all levels and which does not need extensive training to be delivered.

The calculator shows great promise for helping the GoI and donors to develop a better decision-making and evaluation process for infrastructure projects. It enhances their ability to increase capacity building, improves the quality of information available, and strengthens accountability. ■

About the authors:

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Developing an Integrated Water Supply to Save the Ecosystem: An Agenda for Water Supply Reform in Indonesia

Findings from five areas in Indonesia show how the Government of Indonesia's target of 100 percent water supply coverage by 2019 can be met through holistic water management and innovative approaches to the Payment for Watershed Services scheme. • Wijanto Hadipuro • Benny D Setianto • Agatha Ferijani • Daniel Connell • Richardus Indra Gunawan • Erik Olbrei

Just 20 percent of the Indonesian population have access to piped drinking water and another 50 percent have access to some form of protected sources of water – mostly groundwater sources. The latter group includes wealthier families, industries and commercial operations which use groundwater sourced from their own artesian wells. The remaining 30 percent who are not served by either source, predominantly the poor, are dependent on unsafe water sources.

Recognising the social and economic benefits of providing water to the poor, the Government of Indonesia (GoI) aims to ensure that 100 percent of the Indonesian population will have access to piped or protected water sources by 2019. But four major challenges stand in the way of this goal.

First, available funds are insufficient. GoI can provide only 20 percent of the Rp 253 trillion that will be needed, while local budgets can contribute a further 15 percent, leaving a 65 percent shortfall.

Second, available water from catchments (raw water) is declining in quantity and quality, with river flows decreasing significantly over the last 30 years. A major cause is degradation of catchments.

A third problem is the poor financial position of most regional water utilities (Perusahaan Daerah Air Minum or PDAM). PDAM revenues are low because few people use piped water systems and because those who do are generally poor and pay reduced tariffs. As wealthier households generally use their own artesian wells, they do not contribute to PDAM revenues. Thus a potential revenue source and an opportunity for cross-subsidisation are foregone.

A fourth problem is that of environmental degradation. Apart from the degradation of catchments, excessive groundwater consumption causes land subsidence, lowering of water tables, and seawater intrusion in low-lying coastal communities.

These problems have not been well addressed. GoI and some development agencies have noted the limited financial capacity of PDAMs without appreciating the constraints they face in collecting revenue. Nor has the problem of declining quantity and quality of raw water been fully appreciated.

Key Points

Recognising the social and economic benefits of providing water to the poor, the Government of Indonesia (GoI) aims to ensure that 100 percent of the Indonesian population will have access to piped or protected water sources by 2019. However, there are four major challenges standing in the way of this goal, namely insufficient available funds, declining quantity and quality of raw water (water from catchments), poor financial position of most regional water utilities (Perusahaan Daerah Air Minum or PDAMs), and environmental degradation.

The GoI and some development agencies have noted the limited financial capacity of PDAMs without appreciating the constraints they face in collecting revenue or the problem of declining quantity and quality of raw water. PDAM revenues are low because few people use piped water systems and because those who do are generally poor and pay reduced tariffs. As wealthier households generally use their own artesian wells, they do not contribute to PDAM revenues. Thus a potential revenue source and an opportunity for cross-subsidisation are foregone.

The challenges of providing safe water for all, the limited financial capacity of PDAMs and the problems of raw water require an innovative solution. Payment for Environmental Services (PES), which includes Payment for Watershed Services (PWS) schemes, offers a comprehensive solution to these problems.

The research conducted by the team from the Centre for Management Studies and Development (CMSD), Soegijapranata Catholic University, and the Crawford School of Public Policy, Australian National University was centred on four key tasks addressing the possibility of integrating PES/PWS schemes into overall water management in Indonesia:

- Examining the operations of PDAMs and their approach to addressing the challenges
- Examining the regulatory framework surrounding urban water provision
- Investigating the experience with PES/PWS in Indonesia and internationally through a literature search
- Examining how the issues facing PDAMs and the challenges of urban water provision can be addressed through PWS schemes

In interviews conducted in five areas across Indonesia (Medan, Jakarta, Semarang, Mataram/West Lombok, and Ambon) from March 2014–April 2015, respondents of the research acknowledged their willingness to contribute to conservation and stated a strong preference for any PWS scheme involving local agencies which were closely connected to communities.

The research confirmed that there are two national laws which provide for PES/PWS schemes in Indonesia: Law no. 32/2009 on Environmental Protection and Management, and Law no. 23/2014 on Local Government (LG). However, at the subnational level, new or modified LG laws and regulations are needed in relation to spatial planning, governance of conservation areas, local administrative structures, and management of surface water and groundwater.

Another conclusion was that the pool of “buyers” of environmental services should include all water users (that is, both piped water subscribers and groundwater users) as well as government. PWS funds should be distributed to enhance PDAM financial capacity as well as to assist impoverished and marginalised communities living near upper catchment streams.

The research findings recommend that LGs wanting to implement PWS schemes need to enact legislation on issues including spatial planning, conservation areas in the upper catchment areas, local planning, technical operations and law enforcement, as well as groundwater and surface water management in the lower sections of the catchment. A single agency should be responsible for all forms of water supply (both piped and non-piped water such as groundwater) as well as water resource development within a given catchment, and PDAMs are well placed to take on that role.

Regarding distribution of income from a PWS scheme, the research findings proposed that 25 percent be provided as financial support to PDAMs to enable them to expand their coverage. The remaining 75 percent should be allocated for conservation of catchment areas.

It was also recommended that some form of multi-stakeholder institution be established to disburse PWS funds and that government at all levels needs to play a major role, especially in issuing the regulations for PWS and PDAMs.

Lastly, the need was highlighted for GoI to issue regulations that will clarify the division of authority among national, provincial and city/municipal governments to carry out their specific responsibilities in water management.

Box 1. Findings From the Literature Review

The literature review investigated international experience with Payment for Environmental Services (PES)/Payment for Watershed Services (PWS). The environmental and hydrological problems of watersheds have been a major focus for PES schemes, especially in Latin America. Here we summarise the main lessons that should be considered in designing an Indonesian PWS scheme.

A Market Mechanism?

PES has been promoted as a market mechanism whereby sellers of environmental services can find willing buyers of those services. In fact most PES schemes are organised by governments and funded by donor agencies and government. It may be more useful to see PES schemes as agreements between Local Government and upstream communities, funded mainly through government-derived sources (e.g. water user fees). The role of government is to create an enabling environment for stakeholders to unite to achieve a win-win outcome.

Problems With PWS Schemes

The international experience with PWS schemes has been problematic. Many proposed schemes have not been implemented. Among those that have, few have been unambiguously successful in meeting their hydrological, environmental and social objectives. In some cases, hydrological objectives have been poorly defined and/or unproven assumptions have been made that a particular environmental service will lead to a particular hydrological outcome. In others, no scientific and hydrological preparatory studies have been undertaken.

Funding problems have also plagued PWS schemes, with funds diverted to other government activities rather than being distributed to environmental service providers. When funds have been allocated to upland farmers, they have sometimes been insufficient to compensate recipients for the cost of providing those services. In some cases the full cost of a PWS scheme is higher than the value of the environmental services provided, rendering a PWS scheme unviable.

In many cases, where payments are made to sellers of environmental services, the payments have been made irrespective of whether the service has been provided. This failure to make payments conditional on performance makes it difficult for the PWS scheme to actually meet its objectives. In many cases, the individuals and communities who use land do not have secure title, making it much more difficult for them to guarantee environmental outcomes.

An innovative approach to addressing such problems is the use of Payment for Environmental Services (PES) schemes. These are seen as market-based instruments where an environmental service (such as protection of forests or catchments) is bought by beneficiaries of that service (such as water users). This involves a payment from a “buyer” of the service to the “seller” of that service. Many PES schemes have focused on catchment or watershed protection to secure the water supply for downstream towns and cities. These are known as Payment for Watershed Services (PWS) schemes.

Research Goal

Based on the above challenges, a team from the Centre for Management Studies and Development (CMSD), Soegijapranata Catholic University, and the Crawford School of Public

Policy, Australian National University, is looking into the possibility of integrating PES/PWS schemes into overall water management in Indonesia. The overall goal of the research is to investigate whether an Indonesian PES/PWS scheme can support greater access to safe water by protecting catchments and increasing raw water supply, enabling more effective and better funded PDAMs, and addressing environmental problems associated with groundwater extraction.

The key research objective was to develop policy recommendations to reform the governance arrangements that apply to the water supply systems of Indonesian cities and that apply to PES/PWS schemes, to ensure improved financial performance and raw water supply of PDAMs.

The research centered on four key tasks:

- Examining the operations of PDAMs and their approach to addressing the challenges they face
- Examining the regulatory framework surrounding urban water provision
- Investigating experience with PES/PWS in Indonesia and internationally through a literature search
- Examining how the issues facing PDAMs and the challenges of urban water provision can be addressed through PWS schemes

The context of the research is summarised in Figure 1.

Figure 1: The Research Context

| Problem | Direct Cause | Reason | Possible Solution | Issues to be Investigated |
|---|--|--|--|--|
| Urban water utilities (PDAMs) unable to provide effective water supply. | PDAMs starved of funds. | Wealthy households and businesses opt out of the piped water system. | All water users to contribute funds. | Need to ensure that funds collected for Payment for Watershed Services (PWS) schemes actually go to PWS, not to Local Government. |
| | PDAMs lack authority to deal with problems. | Fragmented system of governance. | A single agency with authority over all water-related functions. | Options for establishing a single agency to manage all aspects of water supply and development. |
| Groundwater extraction leads to land subsidence and seawater intrusion in coastal cities. | Wealthy households and businesses opt out of the piped water system. | Fragmented system of governance. | - | 1. A single agency to manage all aspects of water supply and development – including groundwater use. 2. Effective approaches to controlling groundwater use. |
| Quality and quantity of raw water supply from catchments are declining. | Upstream land degradation problems. | Marginalised communities, land insecurity, and poverty, all lead to poor land use practices. | PWS scheme aimed at watershed protection and rehabilitation. | 1. How can PWS schemes increase raw water quantity and quality? 2. What lessons can be learned from other PWS schemes? |

Research Findings

Through interviews with a wide range of stakeholders in five case study locations (Medan, Jakarta, Semarang, Mataram/West Lombok, and Ambon) from March 2014–April 2015, the research team found that all respondents, including both PDAM subscribers and those drawing their water from groundwater sources, experienced a decrease in the quality and quantity of their water supply. Respondents were willing to contribute to conservation of catchment areas. They strongly preferred any PWS scheme involving local agencies which were closely connected to communities.

The research confirmed that there are two national laws which provide for PES/PWS schemes in Indonesia: Law no. 32/2009 on Environmental Protection and Management, and Law no. 23/2014 on Local Government (LG). However, at the subnational level, new or modified LG laws and regulations are needed in relation to spatial planning, governance of conservation areas, local administrative structures, and management of surface water and groundwater. The research concluded that PDAMs should be established as the agencies with sole responsibility for all water supply provision as well as catchment area conservation.

Another conclusion was that the pool of “buyers” of environmental services should include all water users (that is, both piped water subscribers and groundwater users) as well as government. PWS funds should be distributed to enhance PDAM financial capacity as well as to assist impoverished and marginalised communities living near upper catchment streams.

Discussion

The challenges of providing safe water for all, the limited financial capacity of PDAMs and the problems of raw water require an innovative solution. PWS schemes offer a comprehensive solution to these problems. The PWS approach was widely welcomed, supported not only by PDAM subscribers and non-subscribers but also by LG officers, except in Semarang. The reasons given for supporting the PWS included the need for action in light of decreasing quality and quantity of raw water, the need for better flood prevention efforts, and a recognition of the need to contribute to conservation efforts.

Currently, responsibilities in three sectoral areas relevant for water management (environment, forestry, and public works) overlap. An integrated approach to water resource management is needed. The scope for integration has been enhanced by the merger of two ministries into the new Ministry of Environment and Forestry (responsible for Law no. 32/2009 which deals with PES schemes). However the Ministry of Public Works and Housing, which is responsible for river basin management, also needs to be included. The annulment of Law no. 7/2004 on Water Resources Management provides an opportunity for this ministry to develop a new law on water resources management which could lead to the integration of river basin management, water supply management and forest management, clearing the way for comprehensive PWS schemes.

Mataram City and West Lombok Municipality provide good examples of what is needed, in particular with regard to allocation of PWS funds, management and tariff setting, as well as collection and compliance for stakeholders who will need to contribute. At the level of the

PDAMs it is important to reject “business as usual” and accept the responsibilities involved in expanding the ambit of their operations. Looking more broadly, donor agencies should redesign their programs so that their technical and financial support is properly targeted to achieve PDAM reform.

LGs wanting to implement PWS schemes need to enact legislation on issues including spatial planning, conservation areas in the upper catchment areas, local planning, technical operations and law enforcement, as well as groundwater and surface water management in the lower sections of the catchment.

The literature findings in Box 1 point to the need for careful design and assessment of Payment for Watershed Services (PWS) proposals. Key elements of good PWS design are set out below.

Solutions at the Planning and Design Stage

1. The initial planning for a PWS proposal is critical for establishing whether a proposal is feasible. The hydrological, environmental and social outcomes to be achieved need to be defined clearly. International partners can provide technical advice and possibly financial support with the design of Payment for Environmental Services (PES)/PWS schemes. Several international programs or agencies can help, such as RUPES, WWF, IIED, and possibly the IUCN¹.
2. Scientific studies are needed to establish how changes in land use will impact on water quality and quantity. The RUPES Rapid Hydrological Appraisal tool may be useful. The experience of the Singkarak Lake Basin team with this tool should be studied.
3. The funding available for a scheme must be estimated carefully in order to ascertain whether payments to landholders will be sufficient to induce them to provide the environmental services that are needed.
4. The social, economic, cultural, institutional, land ownership, land use rights, gender, and traditional knowledge dynamics in the target watershed must be understood. The 2006 IUCN publication *Establishing Payments for Watershed Services*, while dated, may be a useful guide.
5. Women play a major role in local economies, in local water management, and in local water governance. Therefore gender analysis is essential. The 2006 UNDP/Gender and Water Alliance Resource *Guide to Mainstreaming Gender in Water Management*, while dated, may be a useful resource.
6. Similarly, analysis is needed of the role of traditional wisdom in the target watershed, and identification of opportunities to draw on traditional practices as part of the environmental services to be provided.

¹RUPES = Rewarding the Upland Poor in Asia for Environmental Service They Provide, a program of the International Fund for Agricultural Development (IFAD); WWF = World Wildlife Fund; IIED = International Institute for Environment and Development; IUCN = International Union for Conservation of Nature.

Solutions at the Organisational and Management Level

1. A public sector management structure that can capture all elements of the water supply system within a catchment is needed, as this can help to ensure that sufficient resources can be obtained to fund PWS schemes. In practice, this means that public sector water management within a catchment needs to cover both piped and non-piped (especially groundwater) sources.
2. The PWS governance framework needs to include all stakeholders, including upland community representatives, NGOs, Local Government, downstream water users and water utilities. Management boards which comprise these stakeholders will enable them to articulate their interests, exercise their legal rights, take decisions and mediate their differences.
3. The best governance structures are at arms-length from government and other interested groups. The trust fund model, controlled by governing boards with multi-stakeholder representation, and where funds are reserved solely for environmental services, can protect funds from being diverted.

"PDAMs should be established as the agencies with sole responsibility for all water supply provision as well as catchment area conservation."

Recommendations and Conclusion

To achieve a holistic approach to water management, a single agency should be responsible for all forms of water supply (both piped and non-piped water such as groundwater) as well as water resource development within a given catchment. PDAMs are well placed to take on that role.

Regarding distribution of income from a PWS scheme, it is proposed that 25 percent be provided as financial support to PDAMs to enable them to expand their coverage. The remaining 75 percent should be allocated for conservation of catchment areas. This approach differs from the Mataram and West Lombok cases where 25 percent of the funds collected for PWS are allocated to LG. The priority is to ensure that 75 percent of funds actually reach the impoverished and marginalised communities living in catchments.

Some form of multi-stakeholder institution should be established to disburse PWS funds, following the example of Mataram and West Lombok involving upland community representatives, NGOs and other community groups, LG, downstream water users and water utilities. This institution should draw on traditional wisdom to decide on disbursement of PWS funds.

To draw levies from parties other than PDAM subscribers, LG offices which issue permits for various reasons (for business, environmental reasons, groundwater or surface water extraction) should collect PWS contributions from these categories of "buyers".

Government at all levels needs to play a major role, especially in issuing the regulations for PWS and PDAMs. GoI needs to issue Government Acts on PES/PWS implementation Law no. 32/2009, and a Government Act to replace Government Act no. 38/2007 on the Role of Central Government and Local Government. This sets out the division of authority among central, provincial, and city/municipal governments.

The research demonstrated that if a PWS could be successfully implemented, many of the problems of PDAM finances and of raw water shortfalls could be alleviated, making a significant contribution towards the GoI target of 100 percent water supply coverage by 2019. ■

About the authors:

Wijanto Hadipuro obtained his PhD from Radboud University Nijmegen, the Netherlands, with his thesis entitled "Water Supply and Urban Livelihoods". Through application of sustainable livelihoods analysis, he investigated the contribution of water supply providers in an urban area of Semarang. His publications can be found in many national and international journals. His research includes studies on the performance of Bogor City and Batam PDAMs; the allocation of water from

the West Tarum Canal of Jatiluhur Dam which is the source of bulk water for Jakarta; the management of Semarang City, Surakarta and Salatiga PDAMs; and the analysis of a business contract between PAM JAYA and its two private partners.

Since 2002, Wijanto has been instrumental in the management of water in general and specifically for water supply in Indonesia. In 2007 he was a research fellow for the Green Governance Project at the University of California, Berkeley.

While studying for his first Master's degree from Monash University, **Benny D Setianto** encountered environmental justice terminology for the first time. He then deepened his knowledge with another Master's Degree at the University of Nottingham, UK. Currently he is writing his dissertation for Radboud University Nijmegen, the Netherlands on environmental governance in Semarang dealing primarily with solid waste collection, water management and conflict resolution. Since 2003, he has been involved in adopting the Netherlands Polder System for flood management in Indonesia.

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Erik Olbrei is currently undertaking doctoral research (PhD) in climate change at the Crawford School of Public Policy, Australian National University (ANU), under a scholarship awarded by ANU. His research focus is on the political economy of deforestation in Indonesia, and on how reductions in deforestation emissions might be achieved through civil society efforts to combat governance failures and capture of forest resources by various elite groups. He has a strong background in public sector policy development, systems and processes. With his education background and working experiences, Erik has contributed to this project by conducting a literature review on PES/PWS both within and outside Indonesia

Improving Water Utility Governance and Performance in Eastern Indonesia Through Social Contracts

Research in two pilot sites in eastern Indonesia shows that social contracts are an effective tool for building social capital among stakeholders in water service delivery. •

Declan Hearne • Brian Head • Fany Wedahuditama • Dwiki Riantara • Bronwyn Powell

In mid-2015, the Government of Indonesia (GoI) established a target of delivering universal access to clean water to all Indonesians by 2019. Local water utility companies (*Perusahaan Daerah Air Minum*, or PDAMs) are key actors responsible for the operation and delivery of urban water supply services. These PDAM will play a major role in achieving the 2019 target.

There has been gradual improvement over the past five years in the number of PDAMs that have been rated as having a “healthy” performance, but 49 percent of PDAMs continue to face lasting barriers to service delivery¹. Rapidly expanding urban areas, coupled with poorly performing water utilities, are creating challenges that continue to inhibit improvements in water service coverage². The new goal offers opportunities to drive improvements in PDAM performance and presents challenges as GoI works to reverse deteriorating trends in urban water supply.

Pilot Social Contracts

In the current context of decentralised governance, improvements to the relationships among local utilities, Local Governments (LGs) and customers – in other words, the utilities’ external environment – are critical for sustainable water service delivery and for reversing historical underinvestment and declining coverage levels.

In Eastern Indonesia, social contracts have been developed as a tool to address external risks. These contracts provide a framework for improving awareness of local stakeholder relationships and practices, and they reinforce understanding of existing roles and responsibilities. The concept arose from observations of a number of recently improved PDAMs. It was noted that reform of the external environment had a transformative influence on PDAM performance.

The Australian Government-supported Indonesia Infrastructure Initiative (IndII) first piloted social contracts at four sites in Eastern Indonesia in 2010³. The pilots were implemented for a six-month period with in-depth support from an IndII consultant. The pilot social contracts established a three-stage process that built trust among water supply actors through deliberation and identifying and committing to actions that led towards a set goal. The three stages were:

- Initiating the social contract process

- Formalising expectations in the social contract document
- Implementing commitments made in the social contract

Key Points

In 2013, the International WaterCentre (IWC), in partnership with Bappenas and the Association of Indonesian Water Supply Companies (Perpamsi), received a grant under the Australia-Indonesia Infrastructure Research Award program to explore whether social contracts can contribute to improved water governance and utility performance. Two sites that had developed social contracts as part of an IndII pilot project, Sumba Timur and Ende in East Nusa Tenggara, were selected for the review. The city of Mataram in West Nusa Tenggara which had a high performing PDAM without use of a social contract, was selected as a comparison site.

The pilot social contracts used a three-stage process (initiation, formalising expectations, and implementing commitments) to build trust, deliberate, and identify and commit to actions towards a set goal.

During the pilot phase, the social contract served as a formal document in which the negotiated expectations of water supply stakeholders were embedded in a non-legally binding agreement. Key social contract stakeholders included the Bupati, the PDAM, customer representatives (through the PDAM supervisory board), and the project consultants who played a brokering role.

The social capital perspective is based on the premise that improvements in water service delivery require collective action from a range of actors, including PDAMs, LGs, and consumers. Social capital theory guides what interim outcomes are sought, by viewing the pilot social contracts as an innovation process. Using this conceptual model, IWC developed a set of participatory field tools to seek evidence that social contracts can improve the governance and management of urban water supply services. While the study was limited in scope, the findings showed that social contracts contribute to improvements in governance and performance in urban water supply services. There is a positive correlation between levels of participation/maturity of engagement and the resulting functional trust (trust in the ability of others to perform a particular task or function) among stakeholders. Where this functional trust – a form of positive social capital – was observed, the levels of service improvement were seen to be more robust.

In the two case study sites, Mataram and Sumba, the level of engagement of key stakeholders was proactive. They demonstrated leadership and open communication in the implementation of activities. Similarly, the quality of relationships among key stakeholders in Mataram and Sumba was considered to be mature, enabling functional trust among actors. In Sumba, an active and informed consumer body provided useful support to the PDAM for tariff increases. In Ende, engagement was for the most part less mature, and stakeholders followed rather than led the process steps. In late 2014, a tariff reform was presented as an emergency adjustment and passed directly by the local mayor, a process that is not consistent with the social contracts approach.

A series of recommendations to guide future implementation of social contracts have been drawn from the study findings and a retrospective review of the theory of change. Recommendations focus on changes to strengthen the value of the social contract within the implementation process and on how the program can be scaled up.

During the pilot phase, the social contract served as a formal document in which the negotiated expectations of water supply stakeholders were embedded in a non-legally binding agreement. Negotiation of the contract took into account stakeholder expectations; the needed capital investments, training, and technical assistance; and the high visibility of the donor-supported project. Figure 1 outlines key internal and external steps implemented during the pilot social contracts. Key social contract stakeholders included the Bupati, the PDAM, customer representatives (through the PDAM supervisory board), and the project consultants who played a brokering role.

Figure 1: Key Activities Implemented During the Pilot Social Contracts

| External Steps (focused on the PDAM's external environment) | Internal Steps (focused on internal PDAM concerns) |
|--|--|
| <ul style="list-style-type: none"> • Fit and proper tests for director of water utility • Initiation process (deliberating and agreeing on shared goals) • Signing of social contract • Customer surveys • Revitalisation/establishment of channels for guidance and feedback (supervisory boards/customer forums) • Participatory development of corporate plan • Tariff reforms | <ul style="list-style-type: none"> • Training on and application of financing information system • Strengthening of the capacity of water utility staff in technical and customer services • Procurement of water network accessories such as water meters • Subsidising upgrades of new connections/ network improvements (e.g. asbestos removal) |

In 2013, the International WaterCentre (IWC), in partnership with Bappenas and the Association of Indonesian Water Supply Companies (Perpamsi), received a grant under the Australia-Indonesia Infrastructure Research Award program to review the potential of piloted social contracts to stimulate trust for improved water governance and service delivery in Indonesia. The aim of the review was to explore whether social contracts can contribute to improved water governance and utility performance, and to gather supporting evidence of this.

Measuring Impacts

The social capital perspective takes a wider view of water governance. It is based on the premise that improvements in water service delivery require collective action from a range of actors, including PDAMs, LGs, and consumers. Social capital theory emphasises four key factors to re-create a supportive external environment: i) relations of trust; ii) reciprocity and exchanges; iii) common rules, norms, and sanctions; and iv) connectedness or relationships among stakeholders. The theory guides what interim outcomes are sought, by viewing the pilot social contracts as an innovation process. Positive social capital is documented to reduce the transaction costs of decision-making and increase ownership of policy decisions and collective actions⁴.

We can consider how change occurs and explore different components within the innovation process (see Figure 2). Using this conceptual model, IWC developed a set of participatory field tools to hunt for evidence that social contracts can improve the governance and management of urban water supply services in Ende and Sumba Timur. To measure the impact that social

contracts have on governance, various characteristics of social capital (relations of trust, reciprocity, rules, and norms) were considered.

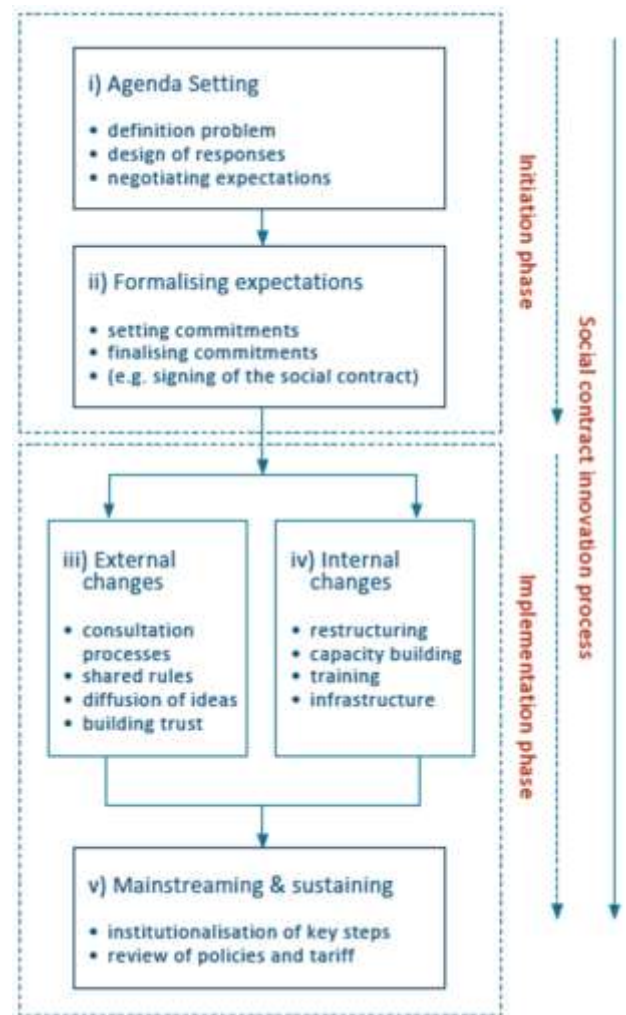
Key Findings

While it is important to acknowledge the limited scope of the study, the findings did reveal evidence that social contracts contribute to improvements in governance and performance in urban water supply services. The adoption of social contracts was positively supported in both piloted case study sites. They were seen to be a catalyst for improving focus and attention on key water supply concerns. While the contract helped increase the prioritisation of water concerns, the associated process steps of engagement, deliberation and negotiation were also seen to be a catalyst for strengthening relationships and building trust.

Evidence gathered from the pilot case study sites and the comparative site suggests that there is a positive correlation between levels of participation/maturity of engagement and the resulting functional trust (trust in the ability of others to perform a particular task or function) among stakeholders. Where this functional trust – a form of positive social capital – was observed, the levels of service improvement were seen to be more robust.

In the two case study sites, Mataram and Sumba, the level of engagement of key stakeholders was proactive. They demonstrated leadership and open communication in the implementation of activities. Similarly, the quality of relationships among key stakeholders in Mataram and Sumba was considered to be mature, enabling functional trust among actors.

Figure 2: Conceptual Framework for Considering the Relative Role of a Social Contract Against Initiation and Implementation Phases of an Innovation Process



(Source: IWC, 2015)⁵

The Sumba PDAM was particularly proactive in engaging a wider range of external stakeholders, including the local legislature (DPRD). This was seen as important when pursuing tariff reforms. Reports from outside the case study sites indicated that the DPRD often disallows tariff adjustments, arguing that they are “protecting existing consumers”. Thus, an active and informed consumer body can be an ally and provide support to the PDAM for tariff increases, on the condition of improvements in service delivery, but also highlight the need for consideration of unserved portions of the community.

In Ende, engagement was for the most part less mature, and stakeholders were observed to be following rather than leading the process steps. Interactions remained reactive, and while there was evidence of developing relationships, trust remained a concern among key stakeholders. Subsequently, where mature functional relationships were established (in Mataram and Sumba), efforts to gather support for tariff reform were met with less resistance. This ability to reach a mutually difficult decision without resistance is evidence of positive social capital and trust between stakeholders.

After implementation of the social contracts, PDAMs in Ende and Sumba demonstrated improved financial returns and improved service delivery⁶. However, challenges related to operational costs reoccurred in Ende. By 2014, Ende had serious financial issues, and while the challenges were partly technical in nature (excessive pumping costs), it was evident that the lack of functional relationships and trust (i.e. social capital) impacted on the strategies used to achieve tariff reforms. In late 2014, a tariff reform was presented as an emergency adjustment and passed directly by the local mayor. This process of reform is not consistent with the social contracts approach and increases the risk that stakeholders are alienated from the process.

Experiences from Mataram

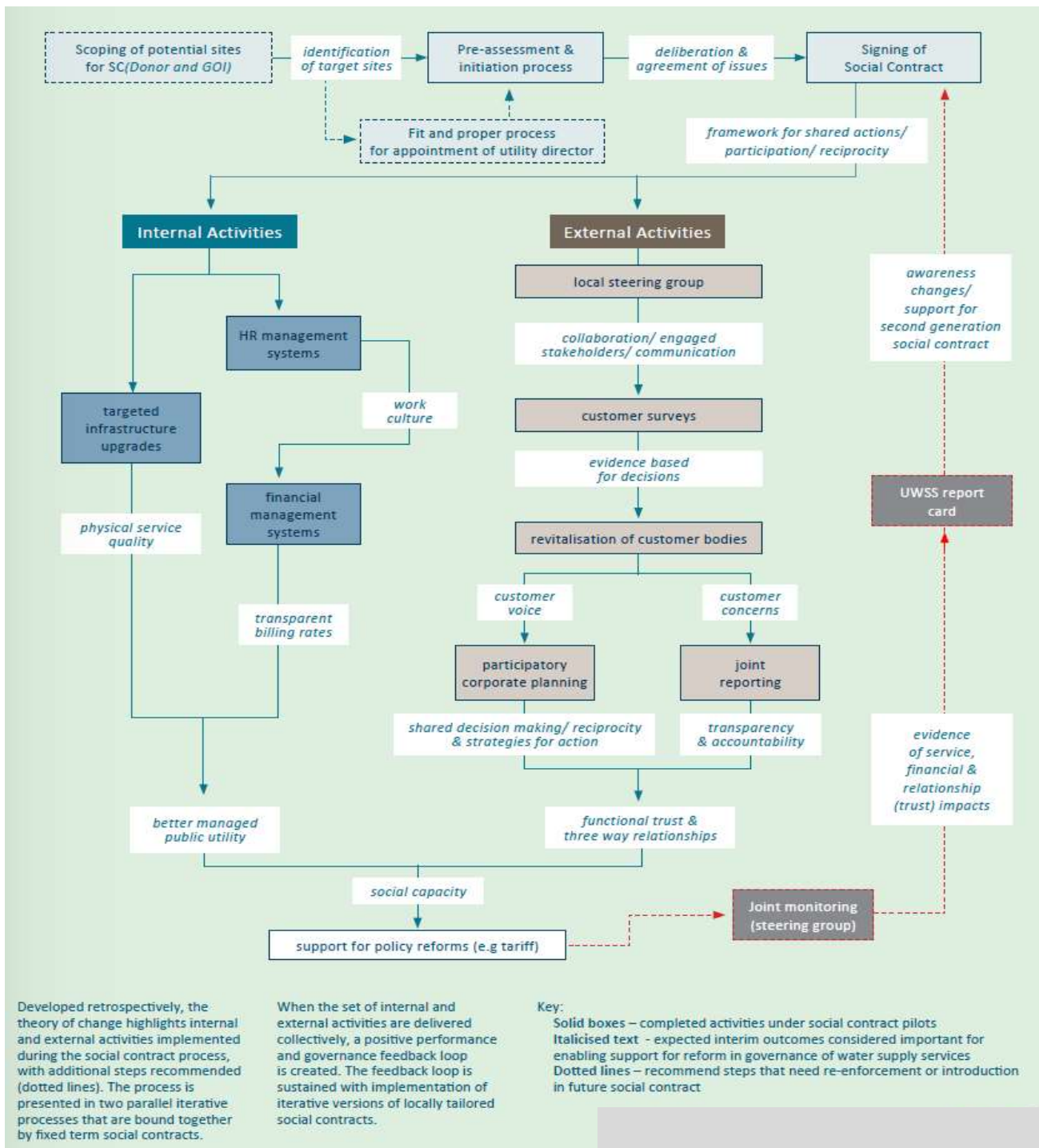
Experiences from Mataram demonstrated that positive social capital (engagement, reciprocity and trust) had been achieved through process steps not dissimilar to the social contracts. This is an important observation as it validated the range of activities included in the social contract process, but also highlighted that similar processes can be locally led. Furthermore, in the Mataram case, local leadership at the initiation stages enabled financial contribution from LGs right from the outset. The Mataram case study also demonstrated that neighbouring LGs can partner and successfully govern a single water utility of greater scale, with strong economic and service delivery performance and proactive management of shared water resources.

Pathways of Change

The retrospective analysis that was conducted considered the role of social contracts and the interim outcomes from each stage, and helped identify gaps or risks that could potentially undermine the sustainability of improvements (Figure 3). A review of the interim outcomes highlighted how the focus on internal capacities enabled the PDAM to improve service delivery and responsibly manage finances. Meanwhile, the external collaborative activities increased

awareness of roles and responsibilities, triggered an understanding of the benefits of participation by different actors in decision-making, and supported the development of functional relationships (trust). While the findings indicate a strong logic and motivation for the GoI to support scaling up of social contracts, there is scope for improvement and evolution of the social contract concept.

Figure 3: Theory of Change for Social Contracts (Source: IWC, 2015)



Developed retrospectively, the theory of change highlights internal and external activities implemented during the social contract process, with additional steps recommended (dotted lines). The process is presented in two parallel iterative processes that are bound together by fixed term social contracts. When the set of internal and external activities are delivered collectively, a positive performance and governance feedback loop is created. The feedback loop is sustained with implementation of iterative versions of locally tailored social contracts.

Key:

Solid boxes – completed activities under social contract pilots

Italicised text - expected interim outcomes considered important for enabling support for reform in governance of water supply services

Dotted lines – recommend steps that need re-enforcement or introduction in future social contract

Recommendations

A series of recommendations to guide future implementation of social contracts have been drawn from the study findings and a retrospective review of the theory of change. Recommendations focus on changes to strengthen the value of the social contract within the implementation process, followed by recommendations for scaling.

Recommendations to guide future implementation of social contracts include:

- *Visualise change*: Use the conceptual model in Figure 2 as a framework to guide social contract change processes intended to shift local norms through targeted actions. *Encourage and monitor participation*: Assess the appropriate levels of participation on a case-by-case basis. Give greater consideration to the needs of secondary stakeholders including the DPRD, Bappeda, and the Local Government Office for Public Works.
- *Promote accountability*: Integrate activities with existing LG planning cycles to improve legitimacy and accountability. The Ministry of Home Affairs (MOHA) should consider opportunities to include water supply as one of the criteria for assessing LG performance.
- *Create a local steering group*: Integrate existing local coordination structures under future social contracts.
- *Give voice to consumers*: Create functional customer forums, especially if they can represent a wider unserved community. Establish links between customer forums and PDAM supervisory boards to increase the legitimacy of both bodies.
- *Track change*: Use participatory measurement of social contracts to support ownership and motivate change. The BPPSPAM benchmarking initiative and the Water and Sanitation Index (see “A Promising Tool to Improve Water Governance” on page 18 of the July 2014 *Prakarsa* for information about this tool for improving governance) should be tested as frameworks for monitoring progress of social contracts over time.
- *Conduct risk assessments*: Utilize integrated and adaptive approaches to source-water management to mitigate future risk to water security. Social contracts have the potential to help address social, economic and political concerns, even though they have not yet focused on managing future water security.

Recommendations for scaling up the program include:

- *Identify an honest broker*: When scaling up social contracts, both BPPSPAM and Perpamsi could play the role of “honest broker”. Any new regulation on water supply should consider the capacity of BPPSPAM.
- *Focus on building local capacity, ownership and resources for reviewing and repeating steps*: Additionally, focus on LG fiscal capacity and their capacity to partner with local consultants (e.g. academia, the private sector, and NGOs). Engage the Ministry of Home Affairs in taking

capacity-building efforts into account as they develop a framework and guidelines for social contracts.

- *Build collaboration into water services:* Government agencies in Indonesia should consider the social contract process as a mechanism for building relationships and collaboration without compromising the cost recovery mandate of PDAMs. This would allow the strong cooperative focus of Law no. 11/1974 on Water to be combined with efficiency focus of Law no. 7/2004 on Water Resources.
- *Establish incentives:* In the short term, it will be critical to link the right set of incentives to motivate local participation and leadership in the implementation of social contracts. LGs with lower financial capacity and small PDAMs will continue to require external financial investment for infrastructure works. The successful delivery of social contracts could be considered by GoI as a prerequisite for accessing additional external funding support. Clear monitoring frameworks would need to be established to allow validation of progress.

The Way Forward

There are high expectations that water utilities will greatly improve service delivery in the coming years, but this will not happen without a sound understanding of roles and responsibilities; functional relationships that are based on trust; and reciprocal agreements that support water utilities, local governments and customers to work productively together. Evidence from the pilot sites suggests that social contracts can contribute to this process, and with refinements can help further break down misconceptions and allow greater understanding of the range of challenges faced by different stakeholders. Social contracts remain a new and evolving concept in the water supply sector in Indonesia and the definition, scope and key components are likely to evolve as further social contracts are implemented and results evaluated.

Moving forward, the findings in this project need to be validated against the findings from a larger sample of social contracts. However, immediate actions should be taken to address issues associated with the legitimacy of the supervisory board and to support the creation of functional customer forums. Issues associated with community voice must be progressively tackled to ensure that the “social” is firmly embedded in social contracts. Supporting greater local leadership in the social contract process may prove the key to enabling innovation and the sustainability of social contracts. In parallel with these operational steps, strategic engagement of national level Indonesia actors needs to be accelerated. These findings should be presented and further scrutinised by national government agencies including BAPPENAS, MOHA, and the Department of Public Works. Agencies with expertise in water supply performance and governance, including BPPSPAM and Perpamsi should also be engaged with to test opportunities for scaling up social contracts. ■

NOTES

1. BPPSPAM 2010 – 2014. Performance assessment report. Accessed online: <http://www.bppspam.com>
2. Institute for Sustainable Futures (ISF). (2011). *Indonesia Water, Sanitation and Hygiene Sector Brief*. Report for AusAID. Sydney: University of Technology Sydney.
3. A second phase of social contracts commenced in late 2014. This review does not include consideration of the second phase.
4. Pretty, J & Ward, H 2001, "Social capital and the environment," *World Development*, vol. 29, no. 2, pp. 209– 227.
5. IWC. (2015).
6. Cardno. (2012). *IndII Act. 276: Review of NTT / NTB Water Governance Program Final Report*. IndII.

About the authors:

Declan Hearne has over ten years experiences in the development and delivery of integrated water management and water, sanitation and hygiene (WaSH) with a range of internal NGOs across South East Asia and the Pacific. Declan joined the International WaterCentre (IWC) in 2013, bringing strong practitioner experience into the WaterCentre’s capacity development, training and applied research programs. Since joining the WaterCentre Declan has focused on three key thematic areas; water supply governance, water stewardship and hygiene and sanitation behavior change. Declan was the project manager and lead researcher for the review of social contracts in Eastern Indonesia.

Brian Head is a Professor of Public Policy and Sustainability in the Institute for Social Science Research, University of Queensland. He is a Fellow of the Academy of the Social Sciences in Australia. Brian had 13 years’ experience in senior executive roles with the Queensland Government before returning to university research in 2004. His research projects include evidence-based policy, better governance, policy innovation, program evaluation, and collaboration to address major policy challenges including water resources, climate change adaptation, and disadvantaged communities.

Fany Wedahuditama works at the Indonesian Ministry of National Development Planning (BAPPENAS), in the Water Supply and Wastewater Development Sub-directorate under the Directorate of Settlement and Housing, where he works on WASH sector coordination and monitoring and evaluation. One of his main roles involves development of Grand Designs of the water supply development program. Fany is passionate about alternative development schemes both at the macro (policy) and micro (program) level. He holds a Masters degree from the Institute of Social Studies, Den Haag, in the Netherlands, where he majored in the Politics of Alternative Development. Fany represented BAPPENAS in a research collaboration led by the International WaterCentre, focused on Improving Water Utility Governance and Performance in Eastern Indonesia Through Social Contracts.

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and attended a Partnership Management Program at the Maastricht School of Management in the Netherlands. He has interests in improving human capital and water utility's performance through water operators' partnerships based on the spirit of solidarity.

Bronwyn Powell (BSc/BA, MEnvSc) is a recognised water, sanitation, and hygiene (WASH) and integrated water management professional working in applied research, capacity building and knowledge management. Bronwyn is a social scientist and has led projects on water and climate change, governance and natural resource management in Southeast Asia and the Pacific over the past 16 years. Bronwyn works to build the evidence-based for effective development interventions by supporting and participating in research and innovation. Bronwyn is currently the Knowledge and Learning Manager of the CS WASH Fund (www.cswashfund.org). Bronwyn was previously Program Manager with International WaterCentre (2005 – 2015).

Social Inclusion and Gender Dimensions in Infrastructure and Sanitation Research

• Eko Setyo Utomo

In conducting research, we must constantly be aware of gender dimensions and other aspects of social inclusiveness. Such awareness includes being conscious of potential bias in research design, making sure to include women as respondents, using female researchers if needed to ensure that women are comfortable responding, and making sure that the data is collected in such a way that it can be disaggregated to differentiate between the impacts on and responses of men and women.

The International Centre for Integrated Mountain Development's "Guidelines For Gender Sensitive Research" (2009) state that gender-sensitive research "is not research on women or on gender relationships; it is research that takes into account gender as a significant variable in environmental and development studies." Taking gender into account does not change the scope of research, but "provides new perspectives, raises new questions, and uses new analysis tools to create a more complete picture of the problem. As men and women have different roles and different power, their perspectives on a problem can be quite different."

To put it simply, combining their different experiences and viewpoints can enhance the comprehension of a problem, and help provide more effective and sustainable solutions. The integration of social inclusion and gender aspects in research can be seen from both methodology and substance viewpoints.

Methodologically, a participatory approach involving experience, testimony, and information from a diverse group of men and women enables the collection of more comprehensive information. In exploring information, quantitative and qualitative approaches will complement each other. Gender integration depends to what extent the analysis used can map the problems and needs of men and women, identify influencing factors, and formulate relevant recommendations to address disparities.

In implementing programs, IndII continuously works toward the integration of social inclusion and gender dimensions, including in research on infrastructure and sanitation. Through the Australia-Indonesia Infrastructure Research Awards (AIIRA), the social inclusion dimension is reflected through a Social Return on Investment (SROI) approach used in the water supply and wastewater program in Gresik, East Java, in 2014–2015. The sanitation project was implemented in Singosari, Morobakung, and Randu Agung, while the water project was carried out in two areas, Doudo and Karangkiring. This approach included a survey of 644 households connected to a wastewater management system, and 872 households connected to a water supply network. (For detailed information about the research, see "Setting Priorities for Water and Sanitation Projects Using Social Return on Investment" on page 21.)

Through a participatory approach that involved inviting stakeholders and program recipients for a discussion, the study showed that results may be viewed from social, economic, and environmental aspects. Participation in the water program had positive value. Residents of Morobakung Village and Doudo, Gresik, East Java, said that having access to clean water meant they had more time to interact with their neighbours, take care of their business, and prevent diseases such as diarrhoea.

The sanitation program had a similar impact. Testimony from people in Singosari and Karangkring showed a rise in the community's spirit of solidarity and collective efforts, a healthier environment because of the absence of mosquitoes, and a lighter economic burden because they no longer needed to empty septic tanks¹.

These findings focused on the social dimension in general and did not specifically look into the issue of gender equality. There are, however, many aspects that may be specifically explored.

For example, in a qualitative gender study conducted in 2014 of the Water Hibah program in Malang, East Java, and Manggarai, Nusa Tenggara Timur (NTT), researchers discovered that the program had a real impact on gender. A water connection in homes made access to water much easier, preventing skin diseases and diarrhoea in children.

Also, during the dry season women were able to water vegetables they planted in the garden next to their houses, and sell them to obtain additional income. Under the sanitation program, people were encouraged to have their own bathrooms and toilets to provide privacy and comfort².

Social inclusion and gender dimensions need to be continued in infrastructure and sanitation research. Through gender-sensitive research, the problems and needs of both men and women can be identified to formulate appropriate recommendations for developing policies. ■

NOTES

1. Taken from the Case Study in the SROI research on the Water and Sanitation project in cooperation with the Local Government of Gresik, East Java, June 2015.
2. Those studies were conducted by IndII's gender team in 2014 under the Water Hibah program in Malang, East Java, and Manggarai, NTT, and under a Community Based Organisation (CBO) program in Lamongan, Tulung Agung, Blitar, and Malang (East Java).

About the author:

Eko Setyo Utomo is IndII's Gender Mainstreaming Officer. He has spent the last decade working on issues related to gender mainstreaming and anti-trafficking. Prior to joining IndII he was affiliated with a project operated by the International Catholic Migration Commission on Cross-Border Indonesia-Malaysia Anti Trafficking in Persons. His other positions include being Executive Director of the Institut Hak Asasi Perempuan (Centre for Women's Human Rights Advocacy), Team Leader of the City of Yogyakarta's Gender Mainstreaming Team, and Policy Advocacy Coordinator at the

Indonesian Women’s Coalition for Justice and Democracy, Yogyakarta Region. He has also done independent consulting on gender mainstreaming, program evaluation, and other topics for local and international development organisations. He is a graduate of the Syari’ah (Islamic Law) Faculty at Sunan Kalijaga Islamic University.

Upcoming Events and Activities

| What | When and Where* |
|--|--------------------------------|
| Workshop with local governments on the National Budget (APBN) and grant mechanisms | February 2016, Jakarta |
| Grand Launch of the Urban Transport Knowledge Portal | January/February 2016, Jakarta |
| Australia Indonesia Infrastructure Research Grants - Expert Panel Meeting | February 2016, Jakarta |
| Seminar on Gender and Disability in Non-BRT (Bus Rapid Transit) Transport | March 2016, Jakarta |

CORRECTION:
 In the article “Indonesia’s Road Infrastructure: Accelerating the Private Sector Contribution” by John Lee in the October 2015 edition of Prakarsa, Figure 3 on page 24 was incorrect. Interested readers can obtain the accurate figure by downloading a fresh copy of this issue of Prakarsa from the IndII website. We regret the error.

**Note that dates and places are tentative. Please contact IndII at enquiries@indii.co.id or +62 (21) 72780538 for more information.*

The Expert View

Question:

What are the constraints and opportunities for the knowledge sector in Indonesia to improve infrastructure planning and delivery?

Below are insights from several members of the Australia-Indonesia Infrastructure Research Awards (AIIRA) Expert Panel. The Panel is comprised of well-known professionals in infrastructure field with recognised expertise in Indonesia and abroad.

Dr. John Scott Younger OBE, C.Eng., FICE

Infrastructure Specialist

PT Nusantara Infrastructure

"The constraints on knowledge that can be applied to improve infrastructure planning and delivery must start with a focus on the education system generally and on tertiary education specifically when it comes to supporting applied research for problems faced in the infrastructure sector. There has been a lack of soundly based research over the years, both in terms of quality and quantity, that are targeted to the many problems that require to be addressed for fast-growing and expanding Indonesia.

Over the past decade or so, a significant number of Indonesian graduates have taken advanced degrees overseas and a good number in Australia, most returning to work in the country. However, there is a lack of institutions with suitable rewards that could attract returning high-level graduates to continue in infrastructure focused activities with a research base. This would include for both hard infrastructure and the often-ignored impact on benefitting communities, the soft side, and their role in the long term maintenance of the affecting built environment.

It is also important that appropriate centres of research and application are located away from Jakarta and can focus on regional problems. Only in this way can the country work towards its objective of sustainable equitable development. In parallel with the steady urbanisation of the country and in keeping with world trends, centres of excellence need to be established in several key areas of the archipelago. This offers an opportunity for engagement of Australia's top class universities and technical colleges.

From a recent discussion with Professor Richard Cogdell FRS, Glasgow University, a world leader on photosynthesis and with concern for the future of the water environment, he emphasised the importance of Indonesia as one of the world's most suitable laboratories for working on the key areas of the future human environment."

▶ **Bernardus Djonoputro**

General Head of the Indonesian Association of Urban and Regional Planners (IAP)
Commissioner/Member of the Board, PT Jababeka Infrastruktur

"Indonesia's greatest challenges today, in addition to the obvious gap in financing of major infrastructure projects, is the capacity and know how in managing the infrastructure projects. There have been delays and stoppage in projects due to these factors. The capacity to improve the quality of projects offered in terms of its feasibility, soundness, market acceptance as well as practical technicalities of each sector (specialisation), is often hampering the process of tender and project preparation. This is applicable not only in the central agencies, project owners and contracting agencies, but also at the commercial lending, banks' and potential financiers' level.

Hence, there is an urgency to address this, in order to come with quality projects to the pipeline. A promotion of knowledge sharing needs to be done sector wide, reaching all levels of stakeholders in the sector. Indonesia needs to promote the creation of 'community of practice' within infrastructure sector players. Having a more structured and clear leadership in the sector nationwide in addressing the urgent low-hanging-fruits' projects is key to this. As is with the creation of an industry fora to channel advocacies and market-soundness of the projects coming into the market."

▶ **John Black**

Emeritus Professor of Transport Engineering, UNSW Australia

"Infrastructure planning, project evaluation (economic, social and environmental assessments), financing and project delivery and on-going maintenance requires a multi-disciplinary approach. International construction consortia and their advisory consultants are well equipped to undertake these tasks providing government has fulfilled its political and statutory role with proper project preparations, including a pipeline of potential projects for investment. Practical examples of this life-cycle approach to infrastructure planning and delivery in Australia can be found in Austrade (2014). Capital and knowledge are key ingredients in Australia's comparative advantage in ASEAN infrastructure development.

The issue for the knowledge sector – meaning higher education institutions and think tanks – both in Australia and Indonesia, is that relevant expertise is located in government and industry – a problem compounded by confidentiality deeds on specific projects, especially where innovation is introduced. How can this constraint be broken down from the perspective of knowledge providers?

In general, the starting point in Indonesia is a dialogue between government and industry and the knowledge providers as to the objectives and outcomes, and syllabus of capacity building

programs (that could involve overseas experts). By including case study material a greater collective understanding of the issues arising from infrastructure planning and delivery can be made. This can provide opportunities for the knowledge sector to develop a research agenda and to conduct applied research on problems of national importance. A steering committee comprised of industry, government, universities and funding agencies could have responsibility of setting research priorities and selecting the best research proposals (hopefully structured using trans-disciplinary methodologies and partnerships) from knowledge providers.

A more specific suggestion on capacity building is to hold a two-week master class on infrastructure and procurement (including Public Private Partnership [PPP]) using Indonesian case study approaches from the infrastructure sector strategic plans and the project planning stage through to implementation and monitoring. The presenters would have theoretical knowledge and practical experience and the audience would be middle to high-level participants from both public and private sectors. Collective learning would be a component of the course objectives that can feed into a research and development program. Participants could report back one year later to explain the changes that have taken place in policy and practice, and identify further capacity building needs."

 **T. Nirarta (Koni) Samadhi**

Country Director, World Resources Institute (WRI) Indonesia

"Indonesia is a developing country, and gears up more toward infrastructure development as needed in order to cater for the economic growth that it sought. New and improved infrastructure technology, management and finance is therefore evolving albeit not at a desired pace.

Against such a backdrop, as an area of expertise, infrastructure is somewhat non popular in Indonesia compared to other body of knowledge. Sources of knowledge are almost exclusively coming from academic institutions and government research and development bodies. Channeling out knowledge derived from those sources to enrich the discourse of infrastructure planning and delivery in Indonesia is also another challenge.

An initiative like AIIRA is of course a fresh breath to strengthen and enrich infrastructure body of knowledge, particularly from practitioner perspective."

▶ **Dr. Ir. Wahyu Utomo, MS.**

Senior Advisor for Regional Development, Coordinating Ministry of Economic Affairs
Commissioner, PT Sarana Multi Infrastruktur

"To achieve an economic growth target of 6-7 percent per annum between 2015 and 2019, Indonesia must significantly develop its infrastructure. In meeting this development target, Indonesia will require to come out with innovative approaches of which one is the need for approximately 125,000 good engineers and a substantial number of other professionals over the next few years for: preparing; delivering project on time, within the given budget and quality; operating and maintaining the infrastructure.

Referring to the abovementioned situation, such demand would result in huge opportunities for the knowledge sector in Indonesia to contribute not only on producing the required resources but also to come out with innovative approaches to accelerate the infrastructure delivery.

However though it seems like a great opportunity, the knowledge sector in Indonesia must face a number of challenges for tapping to the opportunity. First, the knowledge sector must be able to attract an interest of young people to enrol in the study related to the infrastructure sector. Second, the knowledge sector must be able to produce graduates, who are not only good technically but also have good soft skills particularly foreign language skills. Third, the knowledge sector should be able to provide a good and attractive compensation/salary for all related people who work in the infrastructure sector. Last but not the least, the knowledge sector in Indonesia must also be able to compete against others in the ASEAN region particularly since the ASEAN Economic Community (AEC) is establishing."

Outcomes:

IndII contributes to National Sanitation Conference

As part of their efforts to accelerate access to improved water and sanitation, every two years Bappenas sponsors a National Water and Sanitation Conference known as KSAN. The most recent event was held on 11 November in Jakarta, with a theme of “Knowledge Day.” The conference was attended by the Minister of Bappenas; senior officials from the Ministry of Public Works and Housing and the Ministry of Health; heads of Local Governments (LGs); donors; and other water and sanitation stakeholders. IndII’s Water Hibah program, which offers output based grants to LGs that invest their own funds in expanding water connections, was a key element of the activities. Seno Samodro, Head of Boyolali LG (2010 – mid 2015), made a featured presentation on his locality’s experience joining the Water Hibah. As he described, it was initially difficult to obtain support from Boyolali’s Local Council, because the output-based mechanism was unfamiliar. But the program proved so successful that the Council eventually asked if the program could be expanded. Jim Coucouvinis, IndII Technical Director Water and Sanitation, joined Seno Samodro on stage to share evidence on how the Water Hibah supports the Government of Indonesia’s goals of providing universal access to improved water and sanitation, at the same time it enhances the capacity of LGs to provide water and sanitation services.

In Our Next Issue

Asset Management in Infrastructure

Much of the general narrative on Indonesia’s infrastructure problems centres on the need for new investment. However, major efforts to increase the stock of productive infrastructure are being undermined by the rapid depreciation and premature failure of existing assets. To borrow a local term, Indonesian infrastructure is to a large extent *jalan di tempat* (showing no progress): just as fast as new infrastructure comes online, existing capacity is lost elsewhere. The problem is poor asset management. There is little awareness and understanding of the economic benefits of whole-of-life management of assets. As a result, budgeting, planning and investment decisions are typically taken with little regard for ongoing maintenance of the assets being procured. Poor incentives and a lack of accountability are the key reasons why infrastructure assets are failing prematurely. The April 2016 edition of **Prakarsa** will examine the problem of asset management across a number of key sectors such as roads, water and sanitation and will propose a number of key reforms that will better capture life cycle economies of infrastructure investment.