WASH Technical Paper TP/06/2021

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Climate resilient urban sanitation in Indonesia

Hazards, impacts and response in four cities

SUMMARY

Climate hazards are already impacting Indonesia's sanitation systems. Indonesia is prone to natural hazard risks and historical data demonstrates the effects of climate change are already being felt with increases in surface temperatures, rainfall, severity of wet and dry seasons and extreme events.[1,2] Climate models indicate these hazards will increase in frequency and intensity, and 40 million people living in low-lying coastal areas are also at risk from sea-level rise.[1,2]

Climate change will likely limit sanitation progress which in turn can be expected to result in wider social, environmental and public health impacts. Urban areas face heightened risks, as impacts on sanitation from heavy rainfall and storm surges can increase spreading of disease and contamination of precious water supplies, while rapidly growing informal settlements, often with inadequate sanitation, are more susceptible to climate hazards.[3]

This first multi-city study on sanitation and climate change in Indonesia provides evidence of **significant impacts of climate hazards on households and service providers** along the sanitation chain. The four surveyed locations (Bekasi, East Lombok, Makassar and Palu) experience the key climate hazards faced in Indonesia: drought, flooding, sea-level rise and storms/strong wind.

An **extensive methodology** was applied. More than 400 households participated in surveys and 38 community members in focus group discussions. In addition, 12 service providers were interviewed, observations made of services and treatment plants, and more than 60 local government staff participated in interviews, inception and climate response workshops. The **key findings** were:

- Climate change, bringing increased climate hazards, poses a substantial threat to the achievement of an open defecation free Indonesia.
- Heightened stress and discomfort meeting defecation needs was experienced during climate hazards, including for women, children, and vulnerable households.
- All stages of the sanitation chain were affected by climate hazards, including to their function, their acceptability and ability protect health.
- Climate impacts on sanitation risk increasing contamination of water supply and waterways, while flooded drains and inadequate water also limited sanitation use and function.

Inaction is not an option. Action to develop a *resilient sanitation system* is critically needed. Collaborative, cross-agency implementation of adaption actions can avoid harm and protect human and environmental health.

There are many opportunities for Indonesia to move towards a **more climate resilient sanitation system**, with efforts needed across planning, institutions, financing, infrastructure options, user awareness, water cycle management and monitoring and evaluation. Local and national governments in Indonesia, and the sanitation sector more widely, can take many practical actions to incrementally achieve climate resilient sanitation. As a first step, climate change risks and resilient systems need to be reflected in sanitation policy, and climate policies, especially on adaptation, need to include sanitation.

Introduction

Indonesia has both a pressing need and great opportunity to integrate climate resilient sanitation into sanitation improvement and climate adaptation programs. Indonesia is ranked in the top-third of countries in terms of natural hazard risk, with 42% of the population exposed to these hazards, and the impacts from climate change are already being felt.[1,3,4] Climate models predict Indonesia will face a range of hazards which will vary across the country and season. This includes a significant increase in temperature, more frequent and intense heavy rainfall events and an increase in the mean sea-level by 2050.[2] The impacts of climate change are estimated to cost Indonesia 2.5-7% GDP[5] with the costs from sea level rise and health impacts mostly incurred in urban areas.[6] Population growth and urbanization will increase this risk, with the country's urban poor being most vulnerable.[7,8] Assessing the impacts and response of communities and systems to past climate hazards can inform action to increase sanitation resilience.[9] Given that Indonesia faces a wide range of hazards, which are already increasing due to climate change, it is a valuable context to explore the climate considerations for urban sanitation.

This brief presents the findings of data collected in 2020-2021 from households, service providers and local government in four locations in Indonesia with diverse climate conditions: Makassar City, East Lombok Regency, Palu city and Bekasi city. Methods included 412 household surveys, community focus group discussions and interviews, 35 key informant interviews with local government officials and sanitation service providers, and national and local government workshops. This project has helped form an evidence base on the need for climate action in the sanitation sector and engaging sanitation stakeholders in Indonesia.

"This research is an important input that the current conditions are leading to an extreme and increasingly massive disaster."
Climate response workshop Bekasi City

Climate impacts on sanitation

Variation in climate hazards were evident across the four cities. All hazards were reported in all cities, yet to different extents, including variations within cities. Flooding and water shortages were the most reported hazards, with access to toilets affected multiple times per week for 29% of drought impacted households and 11% of flood impacted households.

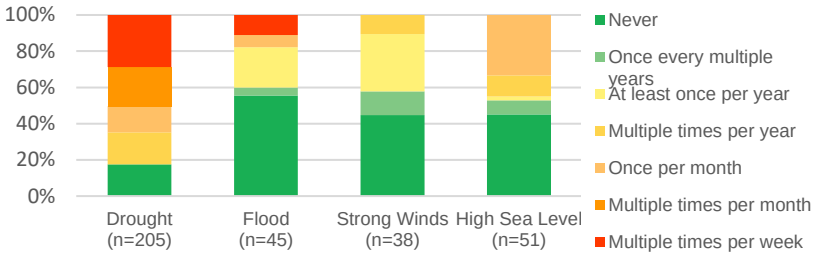

Figure 1. Frequency toilet unable to be used or accessed due to hazard
Note: Flood impacts assessed for access (others assessed use), and only for toilet exterior to house

Climate change poses a substantial threat to the achievement of an open defecation free Indonesia. Climate hazards were found to strongly reduce access, use and function sanitation. Water shortages prevented toilet use causing more than 50% of surveyed households to lose sanitation access multiple times per week or month. If water was insufficient for using the toilet, 30% of participants reported they would practice open defecation, including 71% of respondents in Lombok Timur. Lack of toilet access or function due to flooding, high sea-levels, and wind damage was also reported to cause open defecation or use

alternative toilets, such as family or neighbours toilets or public facilities.

Figure 2. Standing water in Lere village, Palu due to high sea levels

Heightened stress and discomfort meeting defecation needs during all climate hazards including for women, children, and vulnerable households. Households with lower quality or no sanitation facilities or with a family member with a disability were worse off and experienced more severe discomfort during climate events. Gender impacts, impacts on children and vulnerable groups will require targeted attention, as gender appeared to influence perceptions of climate hazards, stress experienced when hazards occur, and responses to climate hazards to meet defecation needs. Meeting menstrual hygiene needs during drought created shame and embarrassment for women.

"When the seawater overflows the septic tanks cannot be used, the community will do open defecation again and it is difficult to reach ODF." Palu Public Health Office

All stages of the sanitation chain were affected by climate hazards and the SDG target of safely managed cannot be achieved without paying attention to climate resilience. Toilet and containment overflows due to flooding from heavy rainfall or high sea levels was reported in all four cities, and some households were reported to flush out their containment into floodwaters. Demand for emptying increased due heavy rainfall, consequently in Bekasi treatment plant operators needed to work overtime. Emptying was more difficult following extended dry conditions or due to sediment deposited into tanks due to flooding, with flooded roads also limiting access to households or treatment plants.

Decentralised or communal treatment systems were flooded during high sea levels or heavy rainfall and were at risk of flood damage and functional issues being located on the edge or rivers or canals. Sludge treatment plants had been damaged by flooding and flood protection measures in Bekasi required shutting down the treatment five times in a 2-month period in 2020. This limited the number of trucks that could be received, and risks reduced effluent quality as the plant takes multiple days to restart.

The interactions between water supply, sanitation and drainage become even more apparent due to climate hazards including risks environment and public health and could also undermine progress on safely managed water. There was an increased risk of drain and surface water contamination due to increased toilet and containment overflow, while some households reported flushing out their containment into floodwaters. Flooding also increases exposure and contributes to widespread environmental contamination and resultant health risk. Households practicing open defecation were twice as likely to report increased cases of diarrhoea during flood or extended dry conditions than households with sanitation facilities. The interconnections of water supply and sanitation were two-way with insufficient water during dry periods the most reported limitation to sanitation access while cities were concerned about the increased risks of sanitation contaminating increasingly precious groundwater and surface water supplies due to climate hazards.

"When the septic tank overflows, it is certain that the feces will go everywhere and risks that fecal-related diseases will contaminate the water, it is definitely a risk to the family and the surrounding population."
Palu Public Health Office

Capacity to prepare and respond

Local government agencies were starting to adapt and take initiatives to prepare or respond to climate impacts ton sanitation. Initiatives undertaken to address problems related to climate hazards included installation of flood resilient septic tanks in Makassar and Bekasi, rapid flood response teams, water resource mapping in East Lombok and a map of natural disaster-prone areas in Palu.

Figure 3. Kota Bekasi installed over 1000 pre-fabricated biofilter septic tanks in flood prone areas

There are various challenges for local government that limited their capacity to prepare for and respond to climate impacts on sanitation, including:

- Unclear responsibility and lack of coordination for climate resilient sanitation and for investments that bridge disaster response and long-term repairs.
- Low awareness and priority of climate change impacts on sanitation.
- Limited sanitation budget and climate related resources focused on disaster response, no proactive investment in resilience.
- Unconsolidated data that limited its use to identify and plan for climate hazards
- Limited expertise in climate resilient sanitation and uncertain about appropriate climate resilient technical sanitation options.

"Right now, the impact of climate change on sanitation is not apparent enough" Inception workshop East Lombok

Service providers and operators had made minor adaptations due to hazards, but some struggled to maintain operation even in normal conditions. Private emptying operators avoiding operation of trucks in deep floodwater and one treatment plant operator-built flood barriers and turned off electrical equipment to protect it from flood damage. However, both these actions limit the service when it is at peak demand. The community-based operators of the communal treatment plants faced reduced motivation and difficulties operating the systems after climate hazards.

Households were already employing some coping mechanisms for climate events and were willing to invest in more climate resilient sanitation facilities. Households typically did not receive warning about climate hazards however employed some coping mechanisms for maintaining sanitation access during climate events: storing water, cleaning or unblocking pipes, using alternative toilets or modifying latrine structure. Almost half of households reported high willingness to invest to make their toilet more climate resilient.

Dimensions of a climate resilient sanitation system

Resilient sanitation integrates considerations of climate change into multiple aspects of a sanitation service delivery system and wider enabling environment. This research delineated key dimensions of a 'climate resilient sanitation system' (Figure 4) to provide a destination to aim for and take steps toward, both in Indonesia and elsewhere. Such dimensions are fundamental to and aligned with achieving city-wide inclusive sanitation (CWIS).

Summary of dimensions:

Institutions, governance and services

Clear institutional responsibilities and flexible service delivery arrangements: Sanitation governance and management arrangements allow alternative options for users to access sanitation during climate hazards and multiple services options to diversify risk.

Risk- and vulnerability- informed planning and decision-making: Sanitation plans assess climate risks, prepare for multiple climate scenarios, and account for the differential needs of diverse users. Historical climate data can be used as a starting point to identify and assess risk.

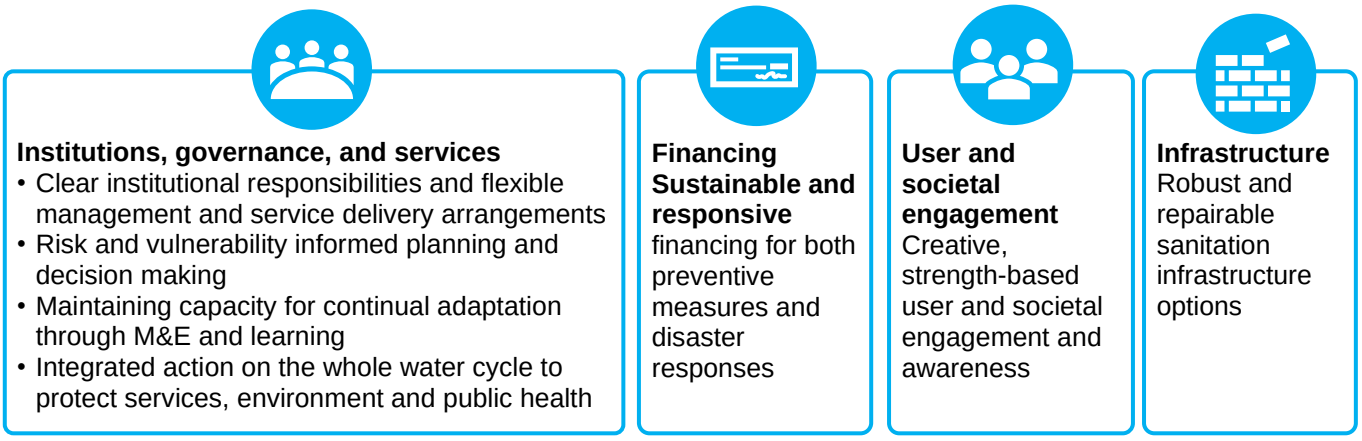

Figure 4. Dimensions of a climate resilient sanitation system

Maintaining capacity for continual adaptation through monitoring, evaluation and learning: Service providers monitor weather and climate and adapt services or operation, and the public has access to early warning systems to prepare.

Integrated action on the whole water cycle to protect services, environment and public health: Coordinated management and building climate resilience of water supply, drainage and sanitation achieves cross cutting objectives.

Financing

Sustainable and responsive financing for both adaptive measures and disaster response: Financing is available for proactive and preventative investment to build system resilience and funds accessible for unexpected hazards that prioritises the needs of vulnerable groups.

User and societal engagement

Creative, strengths-based user engagement and awareness: Campaigns that support people and community groups to mobilise their own capacities and knowledge to undertake 'doable' adaptive actions.

Infrastructure

Robust or repairable infrastructure options: Robust or flexible sanitation systems can withstand, absorb, or limit impacts across the range of uncertain future climate conditions. Maps of sanitation assets and assessment of their risk and consequence of hazards informs targeting of upgrades, improvements, or mitigation measures.

Local government response actions

Local governments in Indonesia can and must act to address the risks posed by climate change. These should be integrated within existing climate and sanitation policies and programs, not seen as an additional or future step.

These practical actions to incrementally achieve climate resilient sanitation were developed in response to the prevailing challenges found in the four cities studied in Indonesia, yet they are applicable to other city contexts around the world.

Institutions, governance and services:

- Delineate roles and responsibilities for climate resilience in sanitation, clarify the management of shared climate resilient infrastructure, and capacitate sanitation authorities on climate resilience.
- Integrate assessments of climate risk or maps of at-risk sanitation infrastructure into various processes, such as regional action plans, city strategies, or construction approval checks
- Monitor and evaluate direct impacts of climate on sanitation and take action accordingly and identify indicators to monitor status of sanitation climate resilience
- Manage the availability and quality of water resources linked to sanitation and assess public health risks from impacts on sanitation, including regular monitoring to track risks.

Finance: Consider the existing sources of funding and increased funding needs to prepare for and respond to climate impacts, and ensure it

is available to vulnerable populations most exposed to climate change

User and societal engagement: Build on existing capacities and provide the public and community groups with critical information for preparing for and responding to climate impacts, building on existing sanitation programs (e.g. ODF campaigns).

Infrastructure: Promote technologies that are more resistant to climate hazards and have processes to verify implementation and ongoing function of resilient infrastructure and services.

National recommendations

These recommendations aim to raise awareness, capacity and incorporate climate resilient sanitation into policies and programs:

Institutions, governance and services:

- Coordination between national agencies involved in climate and sanitation and confirm which local department, authority or working group should take the leadership role for climate resilient sanitation. Develop training materials to capacitate local government.
- Integrate climate change into sanitation policies, plans and strategies, and integrate sanitation into climate adaptation planning
- Develop a standardised approach for rapid climate assessment of sanitation as an input to city sanitation plans and combine existing datasets relating diseases, climate hazards and sanitation into a common portal.
- Support strengthened coordination across the total urban water cycle such that planning and management of water supply, onsite, communal-scale and offsite wastewater and sludge takes into account interlinkages, including under climate change scenarios

Finance: Confirm criteria for sanitation grants are able to support those facing climate risks, provide guidance on budget predictions given heightened operational costs, and coordinate climate finance proposals for sanitation adaptation.

User and societal engagement: Expand ODF campaigns and grant targeting to focus on locations suffering climate impacts on sanitation and socialise updated sanitation promotion materials and guidance that Integrate climate change with local governments

Infrastructure: Develop national standards for climate resilient containment, public/communal toilets and treatment plants, flexible sludge treatment plants for extreme weather and standard operating procedures to operate current facilities under different weather extremes.

Sector Recommendations

For global level actors this research provides evidence to underpin a call to action on climate change in sanitation, as it risks to significantly undermine progress and particularly impact disadvantaged groups. There is an urgent need to evolve sector frameworks on climate resilient sanitation, develop sanitation vulnerability indicators, common methods for risk and vulnerability assessment and to pilot and evaluate climate resilient sanitation infrastructure.

INTERNATIONAL CLIMATE FINANCE

Increasing climate resilience of sanitation systems must continue to seek further budget prioritisation for the sector but also likely to require additional finance. Funding for climate change mitigation or adaptation projects can come from many sources including multilateral climate funds such as the Green Climate Fund (GCF), the Adaptation Fund (AF), and the Global Environment Facility (GEF).

Climate funds have specific criteria that must be met. For example, criteria for adaptation/resilience projects include target impact indicators; co-benefit indicators (economic, social, environmental or gender empowerment benefits); catalyse impact beyond the one-off investment; and be aligned with national climate policies.[10]

Climate resilient WASH is considered as a sub-sector to achieving water security under GCF simplified approval process (SAP) proposals. There are also a number of sanitation relevant indicative activities in integrated flood and drought management that further highlight the importance of integrated approach to sanitation, drainage and water supply climate resilience. Many of the local and national government response actions presented align with GCF Water Security indicators and activities.[11]

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