Developing principle-based targets and indicators for the SDGs

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1 Introduction

The Sustainable Development Goals (SDGs) herald exciting momentum towards achieving global resilience. The overarching objectives of the SDGs are (a) poverty eradication; (b) changing unsustainable and promoting sustainable patterns of consumption and production; and (c) protecting and managing the natural resource base of economic and social development. Critical for the success of this initiative are appropriately scoped targets and indicators for 2030.

The greatest challenge in implementing the SDGs is in trying to ensure that our focus on the necessary specifics of the goals and indicators does not inadvertently cause problems elsewhere in our complex webs of social, governance and environmental systems. In this paper we offer three practical principles arising from transdisciplinary action research on sanitation, particularly in Indonesia, which help to address this challenge. These principles are (a) a reflexive practice on the Millennium Development Goals (MDGs) experience; (b) the use of systems analytical tools; and (c) a focus on the ultimate desired impact.

In this paper, we briefly introduce, review, and critique the sanitation MDGs and SDGs. We then explore how our proposed principles can act as powerful resources that might help every country hold a course in implementing the SDGs that is consistent with the notion of a safe and just operating space for humanity.

2 Sanitation SDGs: building from reflexive practice on the MDG experience

Although sanitation is a universal human right, it is also one of the most off-track of all

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the MDG goals. While the MDGs have catalyzed increased coverage at an unprecedented scale, the particular articulation of this MDG has sadly led to a short-term shift (toilet availability), rather than a long-term outcome (toilet or treatment functionality).

The fundamental objective of sanitation is to protect public health by preventing direct and indirect contact with excreted pathogens, and is generally defined as ‘the service that facilitates human excreta management such that fecal pathogens do not come into contact with people, animals, insects, crops or water sources’ . In other words, sanitation must separate people from the community’s pathogens, especially through the water cycle. Ensuring protection of public health requires attention to the entire sanitation lifecycle from source to final destination (Figure 1).

The sanitation goal within MDG goal 7C for environmental sustainability was to ‘halve, by 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation’, with progress measured by estimating ‘the percentage of the population with access to facilities that hygienically separate human excreta from human contact’ on the basis of improved toilet indicators. Improved facilities were defined as flush/pour flush toilets or latrines connected to a sewer, septic tank, or pit; ventilated improved pit latrines; pit latrines with a slab or platform of any material, which covers the pit entirely, except for the drop hole; and composting toilets/latrines. A definition of unimproved facilities is also provided, including ‘public or shared facilities of an otherwise acceptable type’.

Unfortunately, the potential intent of the goal was whittled away in the MDG process by the articulation of the indicator (Figure 1). ‘Access to basic sanitation’ and ‘hygienically separate human excreta from human contact’ could be taken as covering the whole sanitation service chain. The measurement focus on access to improved toilets directed attention to construction of the user interface, rather than the ultimate sanitation goal of separating people from the pathogens in their and their community’s fecal waste to protect public health, means the ultimate goal of separation is not being addressed. This focus in the developing world served only to strengthen an unfortunate statistic: more than 80% of wastewater globally is estimated to be discharged untreated into water bodies. It would seem then that this indicator inadvertently created two distinct and interacting gaps in practice – a lack of coverage of the service chain, and a focus on construction, rather than the combination of construction and operation.

The sanitation SDG for the period 2016-2030 addresses some of the lessons learned

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5 WRI. 1999. ‘Access to safe water, adequate sanitation, and exposure to insect-borne diseases in developing countries.’ World Resources Institute.
7 Ibid.
through the MDG experience, and has the potential to cover the sanitation service chain better than the MDG (Figure 1). The SDG is: (a) to eliminate open defecation; (b) achieve universal access to sanitation and hygiene for households, schools and health facilities; (c) to halve the proportion of the population without access at home to safely managed sanitation; and (d) progressively eliminate inequalities in access \(^9\). Significantly, the SDG includes a waste treatment objective in its requirement for ‘safely managed sanitation’, indicated by ‘the percentage of people … whose excreta is safely transported to a designated disposal/treatment site, or treated in situ before being reused or returned to the environment’. Significantly, the universal access goal recognizes that benefits gained by those with access may be undermined unless everyone else also has access \(^{10}\).

Once again, the indicators have the potential to inadvertently lead to perverse outcomes. For example, the focus on fecal sludge management ignores the reality that the great bulk of pathogens pass through septic tanks in the liquid stream, with risk of entering either ground or surface waters. The confusion here may be related to the difference in pathogen measurement from chemical pollutant measurement. Pathogens are more usefully measured in logarithmic terms on account of the very high influent values in raw sewage. Hence, whilst septic tanks are capable of about 90%, or 1 log, removal of pathogens, what that means is a reduction from say \(10^8\)CFU/100 ml to \(10^7\) CFU/100 ml. This is considered inadequate for public health protection \(^{11}\).

Another example of how the indicators have the potential to inadvertently lead to perverse outcomes concerns a key lesson from the MDGs: it is essential to facilitate infrastructure that can be upgraded later to expand and include more of the sanitation service chain, and to guard against the potential for ‘lock in’ or for stranded assets. Whilst the SDG notes that ‘there is a need to improve service levels and ensure services are sustainable’, this concept does not appear in the indicators, so time will tell how well it is implemented (Figure 1).

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\(^{10}\) McGranahan, G. 2013. Community-driven sanitation improvement in deprived urban neighbourhoods Meeting the challenges of local collective. SHARE (Sanitation and Hygiene Applied Research for Equity) and London School of Hygiene and Tropical Medicine, London (2013)

Figure 1: The sanitation service chain for managing human waste from source to final destination, and focus areas of MDGs and SDGs
3 Indonesia’s sanitation: a transdisciplinary action research view of recent history and potential futures

Indonesia was assessed to have made ‘good progress’ in increasing access to sanitation (based on MDG indicators), from 35% in 1990 to 61% in 2015 (Figure 2), although is off track to meet its MDG target of 65%.

Figure 2: Access to sanitation in Indonesia 1990-2015. Improved facilities (green); shared (pale green); unimproved (yellow); open defecation (orange).

Progress towards the sanitation MDG was enabled through the government’s program for Accelerated Sanitation Development for Human Settlements (2010-2014) that aimed to completely end the practice of open defecation within the program’s timeframe – an ambitious target for an archipelago with a population of around 250 million spread across around 1000 permanently inhabited islands. In its National Long Term Development Plan (2005-2025), the Government of Indonesia aims to provide universal access to adequate sanitation by 2019. It aims to achieve this through significantly increasing community-scale sewerage and conventional sewerage networks in urban

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areas to jointly serve 15% of the total population by 2019 (with the remaining population to be served by onsite sanitation).

The government’s plan to provide universal access by 2019 envisages rapid scale up of all technologies, including community-scale systems managed by community-based organisations. In order to meet the government’s target for community scale systems, around 100,000 new systems would need to be installed by 2019. Our research estimates that since 2003, about 13,000 such systems have been funded for installation across the 500 cities and regions of Indonesia.

Whilst there are multiple funding pathways for these systems from donors, central and local government, they share the same community empowerment objective, and therefore rely on a train-the-trainer kind of model: technical and social facilitators receive training and in turn train and advise communities who are given responsibility firstly to build and/or oversee system construction, and secondly for ongoing operation and maintenance. This governance model undermines the potential of the systems to function well in the long term.\(^\text{16}\)

With such massive scale up envisioned in community scale sanitation, it is critically important to learn from the experience to date, in order to ensure that the systems installed are able to provide effective long-term sanitation services. This topic has been the focus of a 3 year transdisciplinary action research project, funded by Australian Aid, and conducted through a partnership with the national Indonesian planning agency and in close collaboration with AKSANSI, the association that supports community-based systems, and BORDA, the original instigator of community-scale systems in Indonesia. The research is focused on improving the governance of these systems to ensure their long-term success in technical, financial, management, and societal terms.

4 Reflective praxis on the sanitation MDGs in Indonesia

Our transdisciplinary project has highlighted two reasons why the actual progress towards a goal of improved separation of people from fecal pathogens in Indonesia may be less than the MDG indicators progress for improved sanitation suggest.

Firstly, the effectiveness of community-scale sanitation systems in reducing pathogens in Indonesia is unknown and likely limited. By ‘unknown, we mean that our research showed that around 80% of installed systems have no monitoring whatsoever. Around 20% of installed systems are intended to have a single post-construction survey of effluent quality. Just 2% of the systems have been monitored for effluent quality, and in most cases, this is a single sample – very few systems have longitudinal monitoring. Whilst the Department of Environment does undertake watershed monitoring, including pathogens, we have been unable to identify any monitoring of pathogens in effluent discharge. Furthermore, change in human health as a result of system installation is not monitored beyond occasional ad hoc questionnaires.

By ‘likely limited’, we mean that the chosen treatment units are not designed for

pathogen removal. The community scale systems used in Indonesia are anaerobic baffled reactors, similar to septic tanks. They capture and store excreta only to settle and digest the solid fractions of sewage, while significant pathogen loads remain in the liquid fractions. The standard approach globally for septic tanks is to design pathogen removal into the following treatment unit e.g., soil adsorption trench or similar. In Indonesia, for both septic tanks, which cover about 2/3 of the population, and for community scale systems, this second treatment stage is generally absent, even though these systems typically discharge effluent into surface water channels. Eligibility criteria for funding through the central government’s ‘special allocation fund’ for community-based sanitation require that the site should have access to water channels for effluent discharge, but it has no specifications regarding treatment standards or effluent quality.

Secondly, while an impressive number of community scale systems have been installed and each is intended for use by 50-100 households, the actual coverage seems to be significantly less than planned and reported. Our research, which covers systems installed under all of the main project delivery mechanisms, indicates that coverage of individual systems may be on average as little as half what was planned. Our research has revealed many potential reasons: planned household connections to the treatment system cannot be completed due to poor design, inadequate project finance to fund the full extent of the planned system, or complications in the construction governance mechanisms. Finding ways to utilize the ‘spare’ treatment capacity post-construction can significantly increase the number of people being served by these systems at little additional cost. However, measures of progress against the sanitation MDGs do not encourage post-construction monitoring of usage and therefore optimization of existing investments.

5 Insights through use of systems analytical tools

While humans have made great advances in understanding our complex interconnected world by reducing problems into smaller components that can be considered in isolation, systems thinking provides an essential complement to this approach, restoring holistic thinking in terms of connectedness, relationships and context. It enables extending the boundary of sanitation beyond the sanitation service chain to consider interactions with other human activity systems that highlight fresh opportunities for sustainable development. There are several helpful systems analytical tools for considering connections, relationships and context in structured ways to improve understanding of complex situations. In this section we focus on the use of systems analytical tools in our research.

Our use of the influence-diagramming tool (Figure 3) helped identify key factors in the design of sanitation programs and governance that inadvertently lead to contamination of drinking water and the environment, thus preventing public health outcomes. For example, the funding mechanism may not pay for pumps or household connections; or the design may not include sufficient institutional support to enable the community either to collect sufficient fees or to set fees at a rate that would reach cost-recovery. The outcome is, for example, that either the system falls into disrepair, or the system is personally subsidized by individual community members involved in its management. Either way, the the operational longevity is severely compromised.

Iterative application of the tool also helped identify several other technical factors that prevent community-scale systems from achieving the desired outcome of separation, such as improperly disconnected septic tanks, unconnected households in the same watershed, malfunctioning technology, etc.
6 Improving outcomes through a focus on the ultimate goal for sanitation

The MDGs and SDGs with their specific goals for individual countries are the outcome of lengthy political negotiations and compromises, towards the collective achievement of a higher goal: a more just and sustainable world. It is also typically agreed that the monitoring of the goals needs to be pragmatic. However, as discussed above, overly simplistic indicators can sometimes drive unhelpful outcomes, poor investment decisions and even stranded assets that are at odds with the intended goal.

In the case of sanitation, we submit that it is imperative to bring the ultimate goal of achieving separation of people and pathogens through the sanitation service chain through to the indicators. A simplistic interpretation of the goals through the indicators can lead to perverse outcomes because the focus is on construction and not the entire service chain. For example, in Indonesia there are cases dwellings are being
constructed above septic tanks in some parts that prevent access for emptying the tank when full 20. Homeowners have had to be encouraged to drill holes in their kitchen floors to enable emptying of their tanks 21. In addition, in our experience of Indonesia and Vietnam, it is not unusual for facilities to be built with no physical access for maintenance or collection for/transport to treatment, or have situations where improved toilets drain directly to the environment without any treatment 22,23. Instead, if indicators were designed with a focus on the ultimate goal of fecal pathogen treatment across the service chain, programs and governance arrangements seeking to help achieve the goal would be more appropriately designed. For example, perhaps building regulations/standards would require construction of facilities to include allowances for access to empty tanks and appropriate land reservations, so future infrastructure upgrades would not become prohibitively expensive.

21 Ibid.
23 Mitchell, C., Ross, K., Abeyesuriya, K., Puspowardoyo, P., Wedahuditama, F. 2015, Effective governance for the successful long-term operation of community scale air limbah systems: Mid-term Observations Report. Prepared by the Institute for Sustainable Futures, University of Technology Sydney, as part of the Australian Development Research Award Scheme.
In order to communicate the fundamental purpose of sanitation and stimulate discussion about the apparent failure to meet that purpose – of ongoing separation of people and pathogens for improved health – we have developed the concept of a ‘pathogen flow diagram’ (Figure 4). In reality, the lack of monitoring means that no one knows the exact levels of pathogen removal or contamination across the various system scales (from septic tank to centralized). Our hope is that the pathogen flow diagram may catalyze monitoring what actually matters.

7 Implications for the existing sanitation SDGs of integrating all three principles

The SDGs present a fresh opportunity for global collaboration in enabling long-term social and economic development within the biophysical capacity of the planet. In Section 2 we discussed the contribution of reflexive practice on the MDG experience to the shaping of the SDGs. We then explored the situation in Indonesia to reveal how the three principles (reflexive practice, systems thinking, a long-term focus) can drive better outcomes on the ground. To conclude, we apply our three principles to the question of: what might be the form of a sanitation SDG that is embedded within the idea of a safe and just operating space for the planet?  

There is increasing awareness of the need for human activities to operate within planetary boundaries at a global scale (Rockström et al. 2009; Steffan et al. 2015) while at the same time enabling all people to have their fundamental human rights met (Raworth, 2012; Rockström and Raworth, 2015), such as the right to dignity through access to adequate sanitation. Rockström et al.25 and Steffan et al.26 identify nine key planetary sub-systems that are critical for maintaining the planet in a condition that allows humans to continue thriving. They argue that crossing the boundary thresholds of these subsystems can shift them to new states that have ‘deleterious or potentially even disastrous consequences for humans’.

Sanitation, especially the dominant paradigm of water-based sanitation, has significant potentially positive and negative connections to five of these nine critical and interlinked planetary sub-systems: global fresh water use, which is inextricably linked to climate change on the supply side through changing weather patterns and on the demand side through the energy intensity of current water and sewage systems; biogeochemical flows relating to phosphorus and nitrogen cycles in particular; problematic novel entities because of their addition to the liquid waste stream either from manufacturing or through human excreta, and therefore the broad scale of distribution through aquatic ecosystems; which in turn links to biosphere integrity, and the impacts of other forms of aquatic pollution.27 A recent update of the planetary boundaries shows that two of these – biogeochemical flows and biosphere integrity – are already well beyond the global boundaries, and for a third sub-system, water, the boundaries can only be locally determined, and there is increasing evidence of local extensions beyond boundaries.28,29

Our point here is that a safe operating space perspective on sanitation would drive a very different form of sanitation SDG. In essence, it would extend the focus beyond safe separation and treatment to include resource use and recovery as mandatory considerations. This is in contrast with the current proposition30, where the endpoints of sewage management are re-use or return to the environment, but both sit outside the monitoring boundary. This would have profound implications for the choice of technologies (scale and form) and governance systems. Energy-intensive long distance water distribution systems to supply water-based sanitation might be replaced by local

recycling, or by no/low water sanitation. Treatment systems would be replaced by manufacturing systems. Single sewerage systems that combine all waste would be replaced by smaller scale systems with more control over inputs in order to optimise resource recovery. This kind of path represents a significant diversion from the approach in place in most developed countries today.

The sanitation SDG has a very significant role to play in ensuring that the 2016-2030 period opens up possibilities to ‘leap frog’ to sanitation options that embed the biophysical and social safe operating space concepts, rather than limiting options to systems that fail to align with these bold and necessary new frames. At the same time as developing technological concepts, there is need for new markets, new regulations and new institutions. While there is a sense of urgency to provide universal access by 2030, care is needed that such urgency does not prevent the necessary investments in time to build up the knowledge and experience in new systems. Investments in sanitation systems tend to last for decades, if not centuries. Locking in paths that forego the safe operating space concept are a false economy that neither society nor the planet can afford.

The ‘organised complexity’ of the relationships between these rising global challenges requires them to be tackled together using systemic approaches to guide actions to improve the situation. According to Checkland, the performance of a system for addressing global challenges should be evaluated against a set of criteria that include

- **Efficacy**: whether the intended outcome is being achieved – are people separated from pathogens vs are toilets installed;
- **Efficiency**: whether minimum resources are used to achieve the outcome – life cycle cost of separation vs capital cost per toilet installed; and
- **Effectiveness**: whether the performance is aligned with long-term or higher level aims – universal access to safely managed, resource recovery sanitation vs sustainable access to basic sanitation.

Based on the evaluation, controlling action is taken to steer the system towards improving performance. The combination of extending the goal to include resource intensity considerations, and bringing a soft systems perspective to deal with the inherent social and biophysical complexity would lead to very different kinds of indicators.

8 Concluding remarks

As things stand, whether sanitation will meet the overarching objectives of the SDGs around ‘poverty eradication, changing unsustainable and promoting sustainable patterns of consumption and production and protecting and managing the natural resource base of economic and social development’ remains questionable. The principles of taking a reflexive practice stance when monitoring progress in achievement of the SDG goals, of strengthening a systemic analysis stance to continue to improve the relevance of the

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indicators, and of keeping a strong eye on the end game offer the potential to improve the situation.

9 References


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