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REVIEW ARTICLE

Sustainable development goal 6: two gaps in the race for indicators

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Abstract
Monitoring national-level progress of Sustainable Development Goal (SDG) 6 through internationally agreed indicators has been the focus of intense scrutiny and considerable resourcing by international organisations and national governments, suggesting a 'race for indicators' has begun. However, in the eyes of many water experts, SDG 6 indicators are far from perfect. It is important to systematically identify and prioritise the gaps and weaknesses in the SDG 6 indicator framework to address them effectively. This paper identifies two potential gaps: first, between the aspirations captured in SDG 6 targets and what will be measured by the relevant indicators; and second, between what is being measured in 'means of implementation' indicators and what the key means of implementation achievements of many countries are expected to be under SDG 6. Three existing mechanisms—complementary indicators, international support and an integrated approach—are briefly described, and it is proposed that they may potentially be harnessed to assist national governments to address the two types of gaps identified for SDG 6. There is also an opportunity for stakeholders to help erase the gaps in a comprehensive review of SDG indicators, though how open and participatory the full review process will be is not yet clear.

Keywords 2030 agenda · Sustainable development goal 6 · Monitoring · SDG indicators · WASH

Introduction

Water is a foundation of life and livelihood and is key to sustainable development. Access to adequate drinking water and sanitation have been declared a human right by the United Nations (2010). Moreover, successful, integrated water management serves as a foundation for the achievement of many of the 17 Sustainable Development Goals (SDGs), as well as for the 'water goal', SDG 6: *to ensure availability and sustainable management of water and sanitation for all*.

Sustainable Development Goals are the results that the framework of the 2030 Agenda for Sustainable Development agreed internationally in 2015 (see United Nations 2015). SDG 6 comprises six core targets and nine core indicators, as well as two means of implementation (MoI) targets and indicators. Indicators for SDG 6 will be monitored and reported on at an international level by United Nations (UN) custodian agencies under the UN-Water managed Integrated Monitoring Initiative for SDG 6 (IMI),[1] although national data and results will form the basis of all monitoring and reporting. UN-Water have outlined four stages to SDG 6 progress: first, adapting enabling environments to act as a means of implementation; next, making progress through implementation; then, measuring progress through monitoring and evaluation; and finally, evaluating progress, with follow-up and review (UN-Water 2016a), as shown in Fig. 1. Stage 3 is split into two parts in this figure; as discussed in depth later, indicators 6.a and 6.b are part of measuring progress but functionally they monitor the means of implementation (stage 1), while indicators 6.1–6.6 measure implementation (stage 2).

In 2015, the Sustainable Development Solutions Network (2015, p. 7) wrote that robust indicators will do two things: enable the SDG targets to act as a management tool to help countries and the global community create evidence-based implementation strategies and allocate resources accordingly; and act as a report card to measure SDG progress.

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[1] See www.unwater.org/what-we-do/monitor-and-report/.

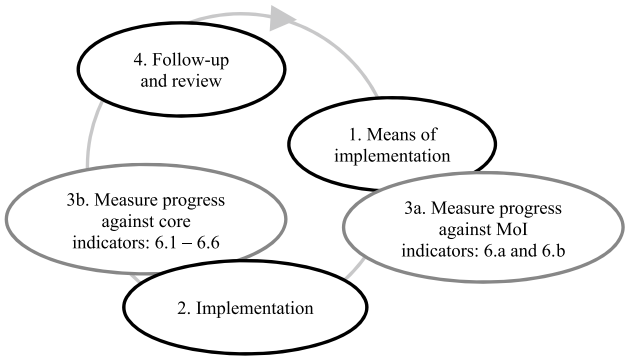

Fig. 1 Stages for achieving SDG 6 targets and indicators Source: adapted by authors from UN-Water 2015

This may summarise the purposes of 3a and 3b in Fig. 1, respectively. It has also been noted that for UN agencies, credible data are perceived as a basis for investment, advocacy and political commitment (Hering 2017).

Measuring SDG progress has been the focus of intense scrutiny and considerable resourcing by international organisations and national governments. Much has been written about SDG 6 targets and indicators (for example, Bhaduri et al. 2016; UN-Water 2016a; United Nations 2016a), with the UN Secretary General stating that 'data demands relating to the Sustainable Development Goals are unprecedented' (United Nations 2016b: para 128). The need to prepare monitoring and reporting systems has been a priority for the United Nations system and many national governments. This intensified in 2017 as SDG 6 is one of six goals to be highlighted for follow-up and review by the High Level Political Forum in 2018.[2]

However, some experts contend that the experience of being measured and compared on an international stage during the Millennium Development Goal (MDG) era left a legacy of mistrust and 'deep ambivalence' around monitoring by and reporting to UN mechanisms (Donald and Way 2016). It may be that national governments are prioritising indicator monitoring to prevent perceived MDG problems from recurring. Attention being focused on monitoring and reporting in some countries may currently be outstripping attention being paid to other concerns, including preparations for and implementation of SDG 6, suggesting a 'race for indicators' has begun. There is already some concern that complex and expensive indicator frameworks will divert already-scarce resources from SDG implementation, and that data as a management tool and as a support for decision-making is already receding into the background (Hering 2017).

Given these contexts, the UN agencies leading the global monitoring and evaluation initiatives for SDG 6 are facing a high level of pressure from many quarters to produce robust, accurate and comprehensive monitoring and evaluation systems, methodologies, mechanisms and reporting protocols. However, SDG 6 indicators are far from perfect in the eyes of many water managers and experts. The terms and definitions used are of fundamental interest for many countries, which will be compared with one another on report cards and dashboards available to all.

It is therefore important to identify and prioritise the types of gaps and weaknesses in the SDG 6 indicator framework and to develop effective solutions to address these. Without this process, it will be difficult for international initiatives, including the global Integrated Monitoring Initiative (IMI) for SDG 6,[3] to be confident that reporting on SDG 6 indicators accurately reflects the real status of sustainable water-related development in a given country. It will also be difficult for UN Member States to develop their own indicators and their own monitoring and reporting mechanisms that best complement global monitoring for SDG 6.

This paper proposes and addresses two potential gaps. The first is a gap between the aspirations captured in core SDG 6 targets and what will be measured and reported on—the core indicators. The second is a gap between what will be measured with means of implementation (MoI) indicators and what countries need to achieve to adapt enabling environments to act as means of implementation for SDG 6.

This paper does not critique the national and international initiatives that are developing monitoring, evaluation and reporting systems for the water goal, nor does it discuss the many kinds of gaps that may be identified, for example, in processes and content of the Voluntary National Reviews, or within High Level Political Forum mechanisms and content.

This paper also does not imply that monitoring water-related indicators and targets through the MDG and SDG eras were not or are not of critical value. Instead, this paper argues that there is an opportunity to step outside the current race for indicators to systematically assess and address critical gaps. The assessment presented in this paper aims to provide knowledge that may assist national stakeholders to more effectively design and adapt national and international SDG 6 plans, priorities and policies.

SDG 6: two gaps

Agencies, frequently under the umbrella of UN-Water, have released several documents in recent years outlining the extensive peer review processes and ongoing expert discourse that are informing what will be monitored and how progress against targets can be reported globally (for example, see Harlin and Kjellen 2015; UN-Water 2016a, b,

[2] See sustainabledevelopment.un.org/hlpf.

[3] See www.unwater.org/what-we-do/monitor-and-report/.

c; World Health Organisation [WHO] and United Nations Childrens Fund [UNICEF] 2017c). This paper references documentation from different stakeholders to reflect on what is being measured.

There is also some discussion of what will be measured in the future and, to an extent, how indicators are being measured. The SDGs have been in force since 2015 and it is important to ask, at this juncture, how the gaps identified in this paper are being or could be transparently debated and effectively reduced to improve monitoring for all.

However, this paper focuses on the two gaps proposed: the first, between core SDG 6 targets and core indicators, and the second, between what will be measured with means of implementation (MoI) indicators, and what countries need to achieve to adapt enabling environments to act as means of implementation for SDG 6.

Table 1 summarises the discussion of the two potential gaps that follows and captures key points in this context. The authors acknowledge that this context is still dynamic, and indicators are still being debated and adapted to different contexts, which makes a summary difficult. The authors also do not claim to comprehensively address all possible issues in SDG 6 indicators, but will focus only on the two noted gaps that will need, or are already undergoing, further scrutiny by international and national stakeholders.

The definitions used and much of the discussion in Table 1 are informed by step by step methodology papers that are available for each SDG 6 indicator.[4] These are not referenced formally in this paper as some are still in draft and many are still being changed, but they are available from the UN-Water website.

One important consideration for SDG 6 monitoring is that all SDG indicators were new when agreed, reflecting a newly comprehensive development agenda as noted in the introduction. Only SDG targets 6.1 and 6.2 in part reflect previous MDG targets, and even for these there are significant differences between the ambitions of the MDGs and SDG 6. Nevertheless, this partial progression does mean that methods and monitoring systems for WASH (water, sanitation and hygiene) are well advanced compared to the other SDG 6 themes.

While SDG 6.4.2 and 6.5.1 are now tier 1 indicators, in general indicators under targets 6.3–6.6 have proven to be more difficult to monitor globally. For example, the recently released SDG 6 Synthesis Report on Water and Sanitation indicates that for SDG 6.3.2—proportion of bodies of water with good ambient water quality—data are available for only 30 countries on open water bodies, 35 on rivers, 25 on groundwater and 22 on all three (United Nations 2018). For SDG 6.6.1—change in extent of water-related ecosystems over time—although global Earth observation data are available to measure national spatial extent of open water bodies for 188 countries, "limited nationally derived data make it difficult to determine progress" (United Nations 2018, 34); and, for 6.5.2 for which a monitoring mechanism and data portal does exist, there are limited data on transboundary aquifers available nationally or internationally, and "47 countries that share transboundary waters have not responded to the initial SDG 6.5.2 reporting exercise" (United Nations 2018, 33).

A lack of data and a lack of methodologies and systems to enable data collection and management are not addressed further in this paper. However, they are of critical concern to many water experts and policy makers; and this concern may lend impetus to a comprehensive review process that aims to reduce or eliminate the gaps that are addressed here. This review is discussed in the later section on Addressing two gaps: existing and potential mechanisms.

Gap one: poorly understood linkages between core targets and their indicators

The first potential gap, between the core targets and their indicators of SDG 6, means that achieving the indicator will not necessarily lead to the achievement of the aspirations enunciated in the target or, indeed, SDG 6. This type of gap can be seen, to some extent, in all the core SDG 6 targets, as summarised in Table 1. At the date of writing, only 6.4.2 and 6.5.1 are tier I indicators.[5] However, as SDG targets 6.1 and 6.2 in part reflect the MDG targets 7.8 and 7.9, documentation and discourse on SDG 6.1 and SDG 6.2 is currently the most mature and discussion here will focus on these two targets. The key publication used to present what is monitored under SDG indicators 6.1.1 and 6.1.2 is the Progress on Drinking Water, Sanitation and Hygiene 2017 Update and SDG Baseline report (WHO and UNICEF 2017b) released by the Joint Monitoring Programme for Water Supply, Sanitation and Hygiene (JMP), which is responsible for the international monitoring and reporting of 6.1 and 6.2.

Although the following descriptions of gap one for targets 6.1 and 6.2 may be considered semantics by some, in the MDG era this class of gap led to contested claims and much debate over what was achieved on the ground. For example, although the proportion of a population covered by a water

[4] http://www.sdg6monitoring.org and http://www.unwater.org/publication_categories/integratedmonitoring/.

[5] Tier I indicators have an established methodology and standards, and data are regularly produced by countries; tier II indicators have an established methodology and standards, but data are not regularly produced by countries and tier III indicators lack established methodology and standards (see unstats.un.org/sdgs/iaeg-sdgs/tier-classification/for definitions and www.unwater.org/publications/sdg-6-indicators-tiering-system/ for up to date tier classifications for SDG 6).

Table 1 Potential gaps between targets (aspirations) and indicators

Target	Indicator	Tier	Potential gap
6.1 By 2030, achieve universal and equitable access to safe and affordable drinking water	6.1.1 Proportion of population using safely managed drinking water services *Definition* Population using a basic drinking water source ('improved' sources of drinking water used for MDG monitoring) which is: i) located on premises (dwelling, plot or yard); ii) available when needed; and iii) free of faecal and priority chemical contamination	II	*Universal access* Methodology does not yet comprehensively define how water will be measured in schools, health centres, workplaces and other public spaces *Equitable access* Methodology does not yet clearly and explicitly define how equity is measured under the indicator *Safe* 'Safely managed' has been defined primarily as the absence of faecal indicator bacteria and optionally, fluoride and arsenic, which will not be adequate to prove water is safe to drink in many parts of the world *Affordable* Methodology does not yet clearly and explicitly define how affordability is measured under the indicator
6.2 By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations	6.2.1 Proportion of population using safely managed sanitation services, including a handwashing facility with soap and water[4] *Definition* Population using a basic sanitation facility at the household level ('improved' sanitation facilities used for MDG monitoring) which is not shared with other households and where excreta is safely disposed in situ or treated off-site *Definition* Population with a handwashing facility with soap and water at home	II	*Universal access* Methodology does not yet clearly and explicitly define how sanitation will be measured in schools, health centres, workplaces and other public spaces *Hygiene* Can include handwashing, menstrual hygiene and food hygiene, but only handwashing with soap and water is noted *Adequate and equitable* Methodology does not yet clearly and explicitly define how adequacy and equity are measured under the indicator *Needs of women and girls* Are not included in the indicator *Needs of those in vulnerable situations* Are not included in the indicator
6.3 By 2030, improve water quality by reducing pollution, eliminating dumping and minimising release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally	6.3.1 Proportion of wastewater safely treated *Definition* Household wastewater relies on definitions from 6.2.1. Industrial and commercial are defined as productive industries and processes and both public and private industrial and commercial sources. Wastewater sub-indicators from these sites are under discussion	II	*Recycling and safe reuse* Neither is included in the indicators *Wastewater treatment* There is some opacity about the level of wastewater treatment to be considered 'safely managed' as national standards in some countries may not be in line with treatment-specific reuse options. *Wastewater type* Current approach considers municipal wastewater as a combination of household, institutional, commercial and industrial wastewater collected in sewers and treated at wastewater treatment plants. This approach/assumption is not in line with wastewater management in many countries. *Wastewater* It is not clear how agricultural wastewater will be measured and reported in the current monitoring methodology
	6.3.2 Proportion of bodies of water with good ambient water quality *Definition* Includes the note that basic, core parameters selected are not direct measures of water quality for ecosystem or human health, but are included to characterise the water body and because deviation from normal ranges may be symptomatic of impacts on water quality	III	*Proportion of water bodies* Current methodology recognises that monitoring all water bodies (including groundwater) will not be possible in most countries, acknowledging that countries should select 'key' water bodies at first. The initial selection of water bodies will greatly influence the outcomes reported to 2030. *Ambient water quality* 6 'core' parameters are suggested for water quality assessment initially; however, in reality this will not be enough to report confidently on water quality in many contexts, even without considering emerging water quality threats—for example, pharmaceuticals and microplastics.

Table 1 (continued)

Target	Indicator	Tier	Potential gap
6.4 By 2030, substantially increase water use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity	6.4.1 Change in water use efficiency over time *Definition* The value added per water withdrawn, over time of a given major sector	II	*Water use efficiency* Only defined from an economic perspective, such that concepts including water productivity are not included *Water use efficiency* Including the monitoring of rainfed agriculture is currently difficult
	6.4.2 Level of water stress: freshwater withdrawal as a proportion of available freshwater resources *Definition* The ratio between total freshwater withdrawn by all major sectors and total renewable freshwater resources, after having taken into account environmental water requirements	I	*Withdrawals* Some measures used, particularly outflows and return flows, are not yet well agreed upon in the international community and amongst countries. *Withdrawals* Withdrawal is synonymous with abstraction in current methodology; in many contexts, water consumption measures would also be needed to improve evaluation of water scarcity and human impact on water availability *Water scarcity* Although calculations quantifying water stress are well understood, bringing water to people in need is only addressed in the target, not the indicator. There is a logical gap between reducing water stress nationally and reducing suffering due to scarcity for a particular population or vulnerable group *Environmental water requirements* It is not yet clear how this will be measured in a way that allows countries to be compared and that offers robust results acceptable to different stakeholders
6.5 By 2030, implement integrated water resources management (IWRM) at all levels, including through transboundary cooperation as appropriate	6.5.1 Degree of integrated water resources management implementation (IWRM) *Definition* IWRM is a process that promotes the coordinated development and management of water, land and related resources to maximise the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems. 'At all levels' covers both the degree of implementation and the different administrative or geographical levels	I	*At all levels* This is missing from the wording of the indicator, though the methodological notes write that it is implied. *IWRM* Comprises four components in this methodology: enabling environments, institutions and participation, management instruments and financing. Some experts will argue that monitoring these components using the survey designed is not sufficient to answer to the described aim of indicator 6.5.1, which is: a means of achieving the three key dimensions of sustainable development: Economic efficiency to use water resources in the best way possible; social equity in the allocation of water across social and economic groups; and environmental sustainability to protect the water resource base, as well as associated ecosystems.
	6.5.2 Proportion of transboundary basin area with an operational arrangement for water cooperation *Definition* Transboundary basins are basins of any surface waters or groundwaters which mark, cross or are located on boundaries between two or more states; and whether these areas are covered by cooperation arrangements that are "operational", described as whether the arrangement(s) indeed provide an adequate basis for cooperation in water management	II	*Transboundary cooperation* Measuring cooperation is difficult and monitoring the operational status of transboundary agreements has been used as a proxy measure. However, it may then be difficult to capture what success has been achieved. *Proportion of transboundary basin area* Defining the extent of operational arrangements may become particularly complex when one country has different agreements for different transboundary waters that are at different stages of operation. The metadata states also that 'in situations where more than two riparian countries share a basin, but only some of them have operational arrangements, the indicator value may mask the gap that a riparian country does not have cooperation arrangements with both its upstream and downstream neighbours'

Table 1 (continued)

Target	Indicator	Tier	Potential gap
6.6 By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes	6.6.1 Change in the extent of water-related ecosystems over time *Definition* Change in the spatial extent of surface water-related ecosystems; Change in quantity of water stored in rivers and open water bodies; and change in quality of water in rivers and open water bodies	III	*Protect and restore* the indicator does not measure whether the ecosystem is protected, how well it is protected (through regulation, law or other mechanisms) or whether it is being restored. The current methodology states that the measure goes beyond spatial extent to include the quantity of water contained in the ecosystem, the quality of water, and the health of the ecosystem, but the latter particularly is optional as yet. *Change* Measures of change will be influenced heavily by the baseline reference chosen. The interim 'SDG baseline reference' is a first survey carried out for this target in 2017 or soon after; many experts will argue that measuring change against a natural or historical reference would more adequately demonstrate ecosystem restoration. This is recognised in the current methodology but is recognised as being difficult for many countries to manage. *Water quality* measures will be dependent on monitoring data for 6.3.2. However, that data are limited to a small number of variables (DO, EC, pH, OrthoP and TON) for surface water which, while being the relevant from a generic pollution point of view, will not inform or monitor many situations where poor water quality is a contributor to poor ecosystem condition. *Mountains, forests and other water-related ecosystems* the indicator will only consider vegetated wetlands, open water and groundwater aquifers

See http://www.sdg6monitoring.org/indicators/target-65/indicators652/

supply system was measured in MDG 7.8, whether that system was fully operational was not captured. This was a significant challenge for some contexts. For example, although there may be as many as 60,000 new hand pumps being constructed in Africa per year, it has been estimated that one-third of rural boreholes with hand pumps in sub-Saharan Africa are non-functional, while hand pump functionality in some countries may be even lower—the Rural Water Supply Network in 2010 suggested as many as only two out of three installed hand pumps were working at any given time (Fisher et al. 2015; RWSN 2010). In addition, poor maintenance of water supply systems are a looming problem in many low- and high-income countries. For example, the capital investment needed to maintain ageing water infrastructure in the USA will reach an estimated US$195 billion in 2040, but if current funding trends continue, needs will be underfunded by US$144 billion (American Society of Civil Engineers 2011). Given these statistics, reporting on the presence of improved water sources was, in many contexts, overestimating the proportion of people who had access to safe, reliable and adequate improved water.

The rollout of global monitoring will often engage with more complex measures than is implied from the wording of indicators and definitions of indicators shown in Tables 1 and 2. For example, 'monitoring ladders' or service ladders have been proposed, or are referred to, for indicators 6.1.1, 6.2.1, 6.4.1, 6.4.2; and 'progressive monitoring' has been proposed for indicators 6.3.1, 6.3.2, 6.6.1.[6] The monitoring of service ladders and the emerging monitoring of households and health centres are demonstrations of how the JMP and custodian agencies are already working to plug gaps between SDG target 6.1 and indicator 6.1.1. However, as this paper focuses on the indicators rather than the monitoring process per se, these complexities will not be further discussed except if they directly impact the two gaps proposed.

Gap one unpacked—SDG 6.1 and 6.2

SDG target 6.1 is by 2030, achieve universal and equitable access to safe and affordable drinking water. The first gap between target 6.1 and indicator 6.1.1 is that the target calls for universal access for all, which implies water supplies in public spaces and at institutions including health-care facilities, schools and workplaces. Despite this, the indicator only measures water available at dwellings, that is, at household level.

Despite this limitation in the official indicator, the JMP has developed methods to monitor and report on schools and health-care facilities Although data for these were not included in the 2017 baselines assessment, the JMP write that monitoring data for schools and health-care facilities may be available from 2018 and for other settings in future assessments (WHO and UNICEF 2017d). The proposed indicators are, respectively, the proportion of schools and of health-care centres with 'basic' drinking water, where a basic service is an improved water source available on site (WHO and UNICEF 2017d).

Despite this ambition, there are many challenges in tracking even this limited indicator, as outlined in the 2017 JMP report (WHO and UNICEF 2017b).

The next potential gap in indicator 6.1.1 relates to equity and affordability. A study into potential methodology means that water, sanitation and hygiene (WASH) data can be disaggregated by wealth proxies in approximately 80 countries to date (Martel 2016). Moreover, metadata indicates that disaggregation of WASH data using other measures of equity (gender, disadvantaged groups, rural versus urban populations and so on) will "be made where data permit" (United Nations Statistics Division [UNSD] 2017a, p. 3) and when analytical methodologies are developed (Martel 2016). However, exactly how those data can or will represent equity in access to drinking water at national levels is not yet clear. The JMP is collaborating with the World Bank and will engage further with other stakeholders to develop a monitoring methodology and country guidance to track affordability for future use. Yet, even if the disaggregation of data based on water equity and affordability proxies become more clearly defined, there has been no success in drawing them into the core of monitoring for target 6.1. The UN Special Rapporteur on the human rights to safe drinking water and sanitation wrote in an open letter that, "affordability and equality should be treated as an integral part of the indicator's definition of 'safely managed' services and not as an additional, complementary aspect of monitoring" (Heller 2017).

It is also not yet clear to what extent 'safely managed' drinking water will be 'safe'—that is, uncontaminated (United Nations Secretary-General's Advisory Board on Water and Sanitation [UNSGAB] 2015). Recent metadata shows that safety is currently being determined by only three water quality parameters: faecal indicator bacteria (*E. coli* or thermotolerant coliforms) and, where available and relevant, arsenic and fluoride (WHO and UNICEF 2017a). Although these parameters will give an indication of the safety of water sources in many contexts, some populations access water polluted by contaminants that will not be flagged under this methodology. For example, the World Health Organisation lists 91 contaminants, of both natural and anthropogenic origin, in its Guideline values for chemicals that are of health significance in drinking water (WHO 2017). Finally, the 2017 JMP Report defines availability as, "sufficient water in the last week or available for at least 12

[6] See www.unwater.org/publications/integrated-monitoring-guide-sdg-6/.

Table 2 Potential gaps between target and MoI themes, and between targets and indicators

Target	Indicator	Tier	Potential gap
6.a By 2030, expand international cooperation and capacity building support to developing countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies *Definition* "International cooperation" implies aid (most of it quantifiable) in the form of grants or loans by external support agencies; and "capacity building support" implies development and strengthening of human and institutional resources; both only to countries eligible to receive official development assistance (see http://www.oecd.org/dac/stats/daclist.htm)	6.a.1 Amount of water- and sanitation-related official development assistance that is part of a government-coordinated spending plan	I	*Target and theme* *Developing countries* Only relevant to 'developing' countries 'officially' recognised on the DAC (The OECD Development Assistance Committee) list of ODA recipients *Water- and sanitation-related activities and programmes/ODA* are likely to impinge on work for other SDGs that are linked to SDG 6, but it is not clear if inter-indicator or inter-goal management will be monitored *Hygiene* is missing *Target and indicator* *Cooperation* Although UN-Water definitions argue that international cooperation implies that it can be defined solely as aid, there is obviously a large range of activities and programmes that can be defined as international cooperation and will be important in implementing SDG 6. The same can be said for the definition offered for capacity building support *Aid* is narrowly defined as ODA (itself narrowly defined) that is part of a government spending plan, which may often leave out substantial non-DAC support from and to key stakeholders *Capacity building support* is missing from the indicator
6.b Support and strengthen the participation of local communities in improving water and sanitation management *Definition* Participation implies a mechanism by which individuals and communities can meaningfully contribute to decisions related to water and sanitation planning that may affect them	6.b.1 Proportion of local administrative units (LAU) with established and operational policies and procedures for participation of local communities in water and sanitation management	I	*Target and theme* *Local participation* It is not clear which theme local participation is linked to *Hygiene* is missing *Target and Indicator* *LAU* only participation at the local government unit is recognised, even though participation can occur at every government level and outside of government structures *Policies and procedures* much of local participation can occur without government endorsed policies and procedures. This will perhaps be most important in failed and fragile contexts, or in complex emergencies and states where the government is a party to conflict.
6.a + 6.b combined	6.a.1 and 6.b.1 combined		*Target and theme* *Finance is addressed (though described as cooperation),* but other means of implementation, as defined under SDG 17, are all missing *Local community participation* is included, but is not a key MoI theme as defined

hours per day", focusing on the amount of time when water is available rather than the amount of water available, except in a qualitative sense (WHO and UNICEF 2017b, p. 24).

The definition and measurement of adequate availability and sustainable water supply system functionality can be complex (Rouse 2014; Fisher et al. 2015). First, the JMP indicates that availability has been sourced from drinking water regulators and utilities, despite arguments that monitoring system availability will only partially, at best, measure what users need and want (Thomson and Koehler 2016). The JMP has a second source of availability data, which is household surveys. These surveys may relatively easily collect subjective data on water sufficiency. However, water availability can be strongly influenced by the continuity and

reliability of service and temporal changes in water availability, which is often a function of seasonal changes that are much harder to capture in household surveys (WHO and UNICEF 2006).

Second, although monitoring programmes must be feasible, it is not water availability but water access that is the target aspiration. Access can be influenced by a wide range of social, health, environmental and political factors, particularly for poorer and more vulnerable households (Guppy 2014). Although any monitoring of water access is a significant step forward from MDG monitoring, the measure of availability, which is in use, will still fail to capture real levels of adequate and equitable water access.

SDG target 6.2 is by 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations. The first potential gap between target 6.2 and indicator 6.2.1 repeats the gaps already discussed between target 6.1 and indicator 6.1.1—the target calls for universal access for all, but the indicator measures only sanitation available at household level. The JMP has developed methods to monitor and report on schools and health-care facilities, and although data for these were not included in the 2017 baseline assessment, the JMP writes that monitoring data for schools, health-care facilities and other settings will be made available in future assessments (WHO and UNICEF 2017d), though no date is specified.

Next, the JMP use three main criteria for a safely managed sanitation service. At a household level, the facility should be improved, not shared with other households, and excreta should either be treated and disposed in situ, stored temporarily and then emptied and transported to treatment off-site, or transported through a sewer with wastewater and then treated off-site. It is not yet clear how in situ and transported excreta will be measured as effective or safely managed. The JMP does comment that key data for sewer systems only note whether systems are installed, not whether the systems are adequate—operational, reliable and accessible (WHO and UNICEF 2017a). This raises the question of whether sanitation coverage will be overestimated in some contexts, in a similar way that improved water coverage was overestimated in some settings during MDG reporting.

Adequate and equitable access is a potential gap evident between the target and indicator of SDG 6.2. The interpretation used by the JMP refers to adequate treatment as described above, as well as equity, which "implies progressive reduction and elimination of inequalities between population sub-groups" (WHO and UNICEF 2016, p. 2).

In contrast, Flores Baquero et al. (2017) note that in terms of adequacy, quality and safety issues are a top priority for characterising service levels from a human rights perspective. Quality includes technical safety and hygienic safety for all. They add that equitable access means facilities that are always physically accessible for all, safely located, secure and easy to use, as well as reliable.

Flores Baquero et al. (2017) also write it is "remarkable" that affordability and acceptability are not core aspects of the sanitation challenge in the SDG era. It is true, however, that these can be difficult to measure and compare across countries due to their context-based nature.

Finally, indicator 6.2.1 makes no mention of women, girls and vulnerable groups. Recent guidance referenced in the online SDG Indicator Repository also makes no mention of women and girls, except to repeat the advice given for indicator 6.1.1: that disaggregation of data by "stratifiers of inequality (subnational, gender, disadvantaged groups, etc.) will be made where data permit" (UNSD 2017b, p. 3). The draft of the tool designed by the JMP to calculate sanitation services for indicator 6.2.1 also makes no mention of women, girls or vulnerable groups (see WHO and UNICEF 2017a).

Some normative interpretations from the JMP does include gendered needs. For example, the needs of women and girls "implies reducing the burden of water collection and enabling women and girls to manage sanitation and hygiene needs with dignity" (WHO and UNICEF 2016, p. 2). However, this is not adequate to cover the large gap evident. The UN Special Rapporteur on the human rights to safe drinking water and sanitation wrote, "equality and 'special needs' should be integrated in the definition of 'safely managed sanitation services' identified in its indicator" (Heller 2017), not placed in the margins.

Integration is particularly relevant for gendered issues that cannot be captured by simply disaggregating data. For example, menstrual hygiene management must be a central issue within 'safely managed hygiene services' if the needs of women and girls are to be recognised. Yet, despite its importance, menstrual hygiene management is not measured under indicator 6.2.1. There are references to including menstrual hygiene in future JMP monitoring of hygiene in schools and health-care centres, but the inclusion of safe, socially and culturally acceptable services that include facilities to dispose of menstrual products with dignity is entirely missing in current monitoring systems. This lack was a key criticism of the UN Secretary General's Advisory Board on Water and Sanitation at the end of the MDG era. Their final report stated that facing the taboos around menstrual hygiene management "deserves to be addressed as a priority" by the UN system and by national governments (UNSGAB 2015, p. 8). If SDG target 6.2 monitoring is focused too narrowly, the sanitation and hygiene needs of women and girls in LMICs will, particularly in reference to access to adequate facilities at home, continue to be poorly understood and, too often, poorly met.

Gap Two: poorly understood linkages between MoI indicators and desired outcomes

The second potential gap occurs between what the indicators for means of implementation measure and what countries need to achieve to prepare for SDG 6 implementation.

In the context of the 2030 Agenda, MoI is described under SDG 17 in 5 themes: finance, technology, capacity building, trade and systematic issues, which specifically includes policy and institutional coherence, multi-stakeholder partnerships and data monitoring and accountability. Some authors have added the creation of national enabling environments to implement the 2030 Agenda (United Nations Technical Support Team 2014; UN-Water 2017). The 2030 Agenda itself refers to these topics and also emphasises the implementation of existing, related regional and international action plans, partnerships between diverse stakeholders and the role of the UN system in implementation (United Nations 2015). MoI is therefore a set of interacting, complex and multi-scale themes that should be monitored and reported so that, for example, countries not only know what they are achieving, but how they are achieving the core indicators of SDG 6; where gaps and weaknesses are across these themes and if gaps are adequately addressed over time; whether current progress towards implementation is adequate; and whether progress is sustainable—in terms of building enabling environments that lead to environmental, social and economic progress and in terms of not only achieving core indicators for SDG 6, but ensuring that success is maintained to 2030 and beyond.

However, Bartram et al. (2018) write, "there is generally weak evidence linking the MoIs to outcomes; they are imperfectly conceptualised and inconsistently formulated"; and Elder et al. (2016) write, "The approach to MoI in the SDGs is not carefully thought out or systematic". Therefore, although this section is approached in the same way as the section describing gap 1, gaps in this class will, in general, be larger in scope and scale. There may also be more uncertainty around how this type of gap can be addressed. This is, in part, because MoI for SDG 6 are to be measured both by indicators under SDG 17 and by indicators under SDG 6 (6.a.1 and 6.b.1).

SDG 17 is to strengthen the means of implementation and revitalise the global partnership for sustainable development. It is based on the five themes previously noted. UN-Water has written a document outlining how themes of SDG 17 are key for the implementation of SDG 6 (UN-Water 2015). UN-Water makes clear that all themes do link, in different ways and with different degrees of relevance, to each SDG 6 target. Despite this, it is not yet clear how indicators under SDG 17 can or will be modified to monitor water-related development. For example, UN-Water (2015) emphasise that securing adequate finance is critical to implementing SDG 6. Yet, the relevant indicators range from 17.1.1—total government revenue as a proportion of GDP, to 17.5.1—number of countries that adopt and implement investment promotion regimes for least developed countries. These are not indicators that can be directly applied to monitor SDG 6 for all countries and there is little literature as yet on how SDG 17 can be put into practice to monitor SDG 6.

Additionally, even when SDG 17 indicators are adapted to a water context, it is not clear that achieving indicators under SDG 17 will ensure that means of implementation for SDG 6 will be comprehensively assessed, monitored and reported. King (2016, p. 16) wrote that targets under SDG 17 in general are "unstructured, incomplete and uninhibited by any conceptual framework". King continues by writing that the implementation of SDG 17 at national levels may be problematic to evaluate and report on, in part because indicators only weakly link to and support the achievement of SDG 17 targets and its aspirations overall.

Indicators under SDG 17 may also suffer from the fact that MoI targets and indicators were not included in the MDGs. Therefore, defining meaningful and measurable indicators for MoI is a much greater challenge for both national and international stakeholders. Although there is yet little evidence available to base discourse on, it is likely that many countries do not systematically collect and use data on the effectiveness of their enabling environments for sustainable development. UN-Water writes "Data availability on effectiveness of enabling environment and partnerships is limited, and systems for monitoring MoI have yet to be established in most countries", (UN-Water 2017). It is perhaps particularly LMICs or fragile states that do not have systems for monitoring MoI or coherent plans to build them.

These points are also relevant to the MoI indicators under SDG 6, which are 6.a.1 and 6.b.1, shown in Table 2. Definitions and other details in the table are taken from documents on the UN-Water website (UN-Water 2016b, 2017).

It is clear that the 6.a.1 and 6.b.1 MoI indicators do not cover all the themes of means of implementation as defined in the 2030 Agenda and under SDG 17 and that MoI cannot be monitored comprehensively using these indicators. Therefore, Table 2 notes not only potential gaps between the SDG 6 MoI targets and indicators, but also between the themes of MoI and the target.

For completeness, it should be noted that additional information related to enabling environments will be collected under SDG 6.5.1, which focuses on Integrated Water Resources Management (IWRM). However, as this indicator encompasses primarily management for IWRM, and not management for all SDG 6 targets and indicators, it has not been discussed in detail here.

Table 2 shows significant potential gaps in terms of scope and scale. Draft metadata for 6.a and 6.b emphasises that currently, there is little global level, systematic data that will

allow comprehensive and direct monitoring of the SDG 6 MoI indicators, particularly 6.b.1 (UN-Water 2017). In addition, supporting indicators are being developed, but as yet are in early stages and "it is likely that the data sources and methodology for these indicators will continue to evolve during the SDG period", (UN-Water 2017).

Although there is little information on how 6.a and 6.b are being rolled out at national levels, there is some analysis of the Voluntary National Review (VNR) process that implies enabling environments and means of implementation are, as yet, not well assessed, understood or implemented for SDGs. A recent independent review of 2017 VNRs concludes that most countries have not costed SDG implementation yet; that the most common challenges reported are data availability and monitoring progress, but there is not enough information specifying concrete problems to enable action or to close gaps; and that most countries still need to identify critical gaps in existing policies and strategies, in order to prioritise efforts and to set out baselines from which to measure progress (Canadian Council for International Co-operation 2017).

These points are critical because strengthening means of implementation for SDG 6 will be complex, expensive and slow in many countries, perhaps particularly for LMICs, and mistakes may be costly.

Addressing two gaps: existing and potential mechanisms

There are three existing mechanisms that can be harnessed to fill the gaps identified here, and a fourth process—a comprehensive review of SDG indicators—that may have the potential not to fill gaps, but erase them.

First, as has already been touched on, national governments can define their own SDG 6 indicators for monitoring and evaluation. The 2030 Agenda for Sustainable Development (United Nations 2015, para 75) states that globally agreed and adopted indicators will be 'complemented' by indicators that are developed by Member States themselves. If governments systematically recognise gaps between indicators and targets (gap one) and design their own indicators to address them, monitoring and evaluation to track national water-related sustainable development may be strengthened.

The obvious difficulty for all Member States will be to monitor 232[7] indicators across all 17 SDGs. SDG 6 itself expands requirements for monitoring considerably from the MDG era: this is likely already significantly challenging many low resource countries and is also likely imposing redundant burdens on many countries that have pre-2015 monitoring systems designed to report to existing inter- or supranational mechanisms (Hering 2017). To add more indicators will further burden countries, even if WASH was a high-level political consideration—which it often is not.

Addressing gap two with complementary indicators may be harder, as this gap is less recognised in literature and in practice so far. There is also relatively little guidance on norms, standards and methodology in this context as yet—for example, there does not appear to be any systematic advice for national governments on how to design and select complementary indicators for means of implementation. This may mean that it will also be more difficult for countries to assess and report on the baseline and current scale, scope, and significance of gaps in this class for SDG 6. However, once a comprehensive analysis has been done at a country level, nationally driven, complementary indicators may be the most practical way towards monitoring, managing and reporting on enabling environments and MoI. This is, in part, because as Elder et al. (2016) note, when drawing up the 2030 Agenda the chasm between low- and high-income countries meant few international actions around means of implementation were agreed upon. Perhaps, national action will be more palatable than international agreement for some countries.

The second mechanism is the provision of support from international agencies and institutions to national partners. In a recent, unpublished UN-Water inventory,[8] it was noted that for SDG 6, 19 UN-Water member entities were convening stakeholders; 18 were supporting capacity development and technical assistance; 17 were providing policy advice and thought leadership; and more were supporting data collection and analysis, normative and direct support and service delivery.

Despite this positive activity on the international stage, it is not at all certain that these efforts are all coherent and synergistic. Neither do they all offer concrete tools, systems or recommendations that are directly usable for national governments, nor have they systematically recognised the two gaps described in this paper or demonstrably assisted countries to address them. More analysis is needed to understand the impact of international organisations in this context. However, at least one tool is currently being trialled to support national governments—the SDG Policy Support System has been designed to draw existing tools together to assess and monitor six MoI components for SDG 6 (see http://inweh.unu.edu/sdg-policy-support-system/).

The third mechanism—integrated implementation—is still emerging. There is a growing discourse around the

[7] with nine indicators repeated under two or three different targets, there is a current total of 244.

[8] UN-Water Inventory, 15 January 2018, used with permission from UN-Water.

integrated implementation of SDGs. Interlinkages between SDG 6 and other goals and between means of implementation and core goals, targets and indicators are being emphasised. An integrated approach may lead to a better recognition of the two gaps and lead to more effective and efficient ways to address them.

In terms of the first two points—interlinkages between SDG 6 targets and interlinkages between SDG 6 and other goals—Nilsson et al. (2016a, p. 320) write that "If countries ignore the overlaps and simply start trying to tick off targets one by one, they risk perverse outcomes". Despite this, the SDG framework itself does not show how countries should recognise and address interlinkages.

An assessment by UN-Water states that understanding linkages between SDG 6 targets and indicators and those of other SDGs means that countries can build on synergies and work to minimise potential conflicts (2016c), which can result in a more effective and efficient means of implementation. UN-Water concludes that the former is more important, as the majority of interlinkages between SDG 6 targets and other targets have been assessed as reinforcing (2016c). At least one tool has been designed to map interlinkages between SDG targets and it is currently being trialled (see Nilsson et al. 2016a, b).

Referring to links between core and MoI targets and indicators, Elder et al. (2016) write that "most SDGs are in fact means themselves" and that the current "artificial and unhelpful" distinction between MoI and core goals and targets should be rethought to better realise SDG success. If countries are seeking to assess, and then address and monitor, their means of implementation and do find gap two, then adapting perspectives to utilise other, existing indicators to support MoI monitoring may reduce the number of new indicators that must be created and reported on. This may be particularly apt for SDG 6, as SDG 6.5.1 could be used more formally as a complementary MoI indicator, with agreed adaptation. However, there are no examples of this approach shown in literature yet.

Finally, there is a mechanism that will change the indicators themselves. As previously touched on, there is concern voiced in some national and international fora that it is difficult to measure or create monitoring methodologies particularly for SDG targets 6.3–6.6 and the MoI indicators and targets. One solution recommended by Bartram at el. (2018) in their discussion on SDG 6.a and 6.b is the possibility of rewording, adding or changing indicators.

Two comprehensive reviews of SDG indicators are planned for 2020 and 2025. A report from the Inter-agency and Expert Group on SDG Indicators (IAEG-SDG) meeting of March 2017 reports that reviews "could include the addition, deletion, refinement or adjustment of indicators" (United Nations 2017). These changes would be dependent on, for example, acknowledgement that "the indicator does not map well to the target" or "additional indicator(s) is needed to cover all aspects of the target" (United Nations 2017, para IIIC). As an example, the 2018 Synthesis Report on Water and Sanitation writes that for target 6.3, including a sub-indicator on reuse during the 2020 revision would "address the target more completely" (UN 2018, 62).

However, during 2017 only one revision of SDG 6 was proposed: to add an indicator to SDG 6.4 that measures the number of individuals who experience water stress or water shortages.

Part of the comprehensive review will be an open consultation, when parties who consider that the indicators of SDG 6 should be re-written can contribute. In part, stakeholders will have a responsibility to contribute to changing SDG 6 indicators where there is a recognised need to do so.

Conclusions

This paper describes two gaps that potentially affect the comprehensiveness and usefulness of the global monitoring system to contribute to real, water-related sustainability. The first potential gap is between the aspirations captured in core SDG 6 targets and the indicators that will be monitored. The second potential gap is between what MoI indicators are measuring and what the key achievements of many countries might and should be, to adapt enabling environments as a means of implementation for water-related sustainable development.

The JMP has produced the first baseline assessment of SDG 6.1 and 6.2 (WHO and UNICEF 2017b). This document and others recognise many of these potential gaps. However, there needs to be more effort made to systematically assess and address these gaps where they impact national-level SDG 6 progress and the development of a strong MoI.

Three ways forward, based on existing mechanisms and one emerging approach, have been briefly proposed. Complementary indicators, international support and an integrated approach may assist the national governments to address these two types of gaps. If initiatives are coherently designed and coordinated, they could add substantial value to the monitoring initiatives that are formally taking place for SDG 6 within the UN system.

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