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The Critical Role of Water in Achieving the Sustainable Development Goals: Synthesis of Knowledge and Recommendations for Effective Framing, Monitoring, and Capacity Development

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Note:

Much of the work on this paper has been done by Douglas Merrey, an Independent Consultant. Seleshi Bekele Awulachew (UN-DESA) has provided guidance and many substantive comments that have been used in developing a revised version of the paper. Davison Saruchera and Jonathan Lautze (IWMI) provided important inputs related to indicators linked to water and sanitation targets. This version is the preliminary version of the publication and is circulated in a limited number of copies and posted on the DESA website at https://sustainabledevelopment.un.org/?page=view&nr=1157&type=13&menu=220 to stimulate discussion and critical comment before finalization of the publication.

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This version is a draft report for review, not to be quoted.

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Acronyms

AMCOW	African Ministers' Council on Water
BAU	Business as usual
CGIAR	Consultative Group on International Agricultural Research
CSD	Committee on Sustainable Development
DESA	Department of Economic and Social Affairs (United Nations)
FAO	Food and Agriculture Organization of the United Nations
GDP	Gross domestic product
GEMS	Global Environmental Monitoring System (United Nations)
GLAAS	Global Analysis and Assessment of sanitation and drinking-water
GWP	Global Water Partnership
HDI	Human Development Index
HLPE	High Level Panel of Experts
IEA	International Energy Agency
IEAG	Independent Expert Advisory Group on a Data Revolution for Sustainable Development
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute
IMPACT	International Model for Policy Analysis of Agricultural Commodities and Trade
IPCC	Inter-governmental Panel on Climate Change
IRENA	International Renewable Energy Agency
IRF	Independent Research Forum
IRWS	International Recommendations for Water Statistics
IWMI	International Water Management Institute
IWRDM	Integrated Water Resources Development and Management
IWRM	Integrated Water Resources Management
IWSM	Integrated Watershed Management
JMP	Joint Monitoring Program for Water Supply and Sanitation
LDC	Least Developed Countries
MDG	Millennium Development Goal
OECD	Organization for Economic Cooperation and Development
PPP	Purchasing power parity
SDC	Swiss Development Cooperation
SDG	Sustainable Development Goal
SEEA-Water	System of Environmental-Economic Accounting for Water
SEI	Stockholm Environmental Institute
SMART	S Specific; M Measurable; A Achievable; R Relevant; T Time-bound
SSA	Sub-Saharan Africa
UN	United Nations
UNCED	United Nations Conference on Environment and Development
UNCTAD	United Nations Conference on Environment and Development
UNDG	United Nations Development Group
UNDP	United Nations Development Program
UNEP	United National Environmental Program
UN-HABITAT	United Nations Human Settlements Program
UNICEF	United Nations Children's Fund
UNOSD	United Nations Office for Sustainable Development

UN TF-IMR	United Nations Water Task Force on Indicators, Monitoring and Reporting
UNTT	United Nations System Task Team
UNU	United Nations University
USD	United States Dollar
WA+	Water Accounting Plus
WASH	Water Sanitation and Hygiene
WCED	World Commission on Environment and Development
WEF	World Economic Forum
WHO	World Health Organization
WLE	Water, Land and Ecosystems (Program of the CGIAR)
WSSCC	Water Supply and Sanitation Collaborative Council
WSSD	World Summit on Sustainable Development
WWAP	World Water Assessment Program
WWDR	World Water Development Report

Summary of Recommendations

This paper has four objectives: 1) to synthesize the major lessons learned regarding the role of water based on a review of existing knowledge on water and sustainable development; 2) to analyse the multi-sectoral integration of water-energy-food as well as the linkages to poverty-resilience-peace and security-climate change [i.e. broadly defined "nexus"]; 3) to review the proposed Sustainable Development (SDG) Goal 6 ("ensure availability and sustainable management of water and sanitation for all") and target areas with potential tools and methods for monitoring progress and indicators as well as the means of implementation; and 4) based on the review, to offer recommendations on how water and sustainable development can be better integrated into national development agendas, with special reference to the implications for policies, institutional arrangements, and capacities. The paper reviews experiences and lessons learned from implementing the MDGs, promoting water management for development, and the proposals for the future sustainable development agenda. It draws on emerging evidence regarding threats to the critical planetary systems on which humans depend. The paper concludes with 18 recommendations under four headings. These are 1) the proposed Goal 6 (ensuring availability and sustainable management of water and sanitation for all); 2) the linkages of water and other SDGs; 3) water and nexus issues; and 4) capacity strengthening. The explanations for these recommendations are provided in the text.

The MDGs as originally formulated did not prioritize water. They were retrofitted in part after the Earth Summit in 2002 to give water more emphasis. In formulating the future sustainable development agenda, the critical importance of water and sanitation is receiving more attention. Nevertheless, given the fundamental roles that water plays in all aspects of life, the large number of people who do not have access to an adequate water supply for domestic and productive uses, and the growing threat to water global water systems, the currently proposed SDGs and associated targets need further work to strengthen recognition and attention to water.

Recommendations for the Proposed Goal 6, "ensure availability and sustainable management of water and sanitation for all"

1. This recommendation is to confirm the specific water goal as expressed by the Open Working Group, "ensure availability and sustainable management of water and sanitation for all". The independent goal on water and its six target areas with two means of implementation-related targets represent significant progress compared to the MDGs. However, the proposed targets and indicators need to be further refined; clear definitions of terms need to be specified and agreed; and consideration needs to be given to highlighting the critical roles of water for achieving other SDGs, as recommended below.

2. Water professionals need to develop a clear consensus on how to give higher priority to investments in water and sanitation in ways that strongly support the most fundamental Goal (1), to "end poverty in all its forms everywhere", make strong efforts to integrate water interventions into the sustainable development agenda, and support the member states through the articulation of interventions.

3. The UN system, particularly UN-Water and its task teams, in consultation with member state partners should use the available background documents as the basis for finalizing the dedicated water goal and targets, and improving the specificity and measurability of indicators. This should include a stronger emphasis on the links between the proposed Goal 6 and economic growth, especially *access* to water for agriculture and nutrition; a firmer grounding in the planetary challenges context (e.g. climate change, water security); and more attention to a monitoring system that would learn lessons to inform adaptive management processes. Further, while the indicators understandably emphasize progress toward achieving targets, they do not measure the *rate* of progress toward achieving universality – a fundamental characteristic of the sustainable development agenda. As discussed above, many terms need to be defined in precise and measurable ways, and those proposed indicators that are not measurable should be dropped to avoid compromising their viability.

4. An important gap in the indicators for the Open Working Group Targets 6.1 (water services) and 6.2 (sanitation services) must be addressed: ensuring the long-term sustainability and continuous improvement of measures to achieve universal and equal access to water, sanitation and hygiene. Specific water and sanitation services sustainability indicators need to be adopted.

5. Consider making use of an Equity Index that is designed to measure the rate of convergence toward equality, thus addressing an issue – progressive realization – that is fundamental to human rights. A similar Equity Index can be developed for other SDG targets.

6. Indicators that measure changes in *access* to water for agriculture and other productive purposes in rural and peri-urban areas at household level should be adopted.

7. Identify specific indicators for Target 6.5 on IWRM and transboundary basin management that can measure both the elements of IWRM (e.g. decentralization of water management and existence of stakeholder participation) and the *effectiveness* of transboundary cooperation.

8. Agro-ecosystems should be included in the list of water-related ecosystems in Target 6.6 on protection of water-related ecosystems, and appropriate indicators should be developed.

9. This recommendation refers to Target 6.6a (international cooperation and capacity building. It is to do more work to identify practical and measurable indicators, focusing on *outcomes*, not only inputs. On the other hand, this target could be subsumed under the broader SDG goal (17) of strengthening global partnerships for sustainable development.

10. This recommendation is focused on Target 6.6b which aims to “support and strengthen the participation of local communities for improving water and sanitation management”. It is to develop a precise measure of the effectiveness of participation, for example, the existence of mechanisms for participation in every catchment/ community, actual empowered roles of women and youth in decision-making, and flows of benefits broken down by gender and age.

The lack of reliable and credible data on water management has put water resources management at a political disadvantage. This is reflected in the relative invisibility of water linkages in the other proposed SDGs. This leads to a vicious cycle: water is not given high priority, therefore collecting and using water data is low priority, leading to further deterioration of the quality and credibility of water data.

11. Water professionals must make a concerted effort to achieve a virtuous cycle where water data contribute significantly to policy, leading to a higher priority in terms of funding, which will enable better quality data to be collected. Use of recent technologies such as remote sensing, radar shuttle and isotop technologies could help transforming water data in developing countries if the data of these technologies could be accessible. Efforts to improve the availability of data must be nationally led and must meet the specific needs of each country while also contributing to the global system. However, the UN and other agencies can and must play critical roles. A strong effort must be initiated to harmonize various water data initiatives and focus on assisting countries to improve their capacities to collect reliable, consistent raw data and convert it into useful information. Development and implementation of a unified program to build national capacities to collect and process water data is recommended, linked to broader efforts aimed at strengthening the evidence base for implementation and monitoring of the proposed SDGs. An example is support for peer-to-peer programs in which developing countries with more experience assist other countries to strengthen their capacities.

Water and the Other SDGs

12. As part of the process of finalizing the targets and indicators for the other SDGs, investments in water as an enabler and entry point for equitable and sustainable socio-economic development should be explicitly included along with measurable indicators. **Enhancing access to water for productive use should be strongly emphasized in addition to access for domestic use and ensuring ecological sustainability.**

"Promote sustainable agriculture" is tacked onto the proposed Goal 2, "end hunger, achieve food security and improved nutrition …." This is inadequate given the critical role water plays in agriculture, and the importance of improving agricultural productivity to reduce poverty. However, by itself 'sustainable agriculture' is not enough; food insecurity is only partly a result of production shortfalls. In essence it is a result of a food system in which a large percentage of what is produced is wasted, and of an economic system that condemns people with very low incomes to hunger.

13. This recommendation has two parts. A) Change "sustainable agriculture" to "sustainable agriculture and food systems". Goal 2 would then read "end hunger, achieve food security and good nutrition, and promote sustainable agriculture and food systems". B) Refine the eight proposed targets for Goal 2 to explicitly recognize the critical roles of water, and to include specific measurable indicators of the role of water.

14. The water professional community must work with other colleagues to ensure that water is explicitly included where appropriate in the final SDG targets, and that appropriate indicators be included for these targets.

A Nexus Approach

A nexus perspective draws attention to the multiple interdependencies among water, energy, food security, and the underlying natural resources – water, soil and land and related ecosystems. There are potentials for conflicts, synergies, trade-offs and resource use efficiencies. This perspective also draws attention to the need to adopt an integrated landscape or socio-ecological perspective, and the need for a broad conceptual framework linking water to the larger sustainable development agenda. The "Green Economy" has been proposed to provide broad guidance for addressing critical long term threats to humanity and the planetary systems on which humanity depends for survival.

Reviewing the proposed SDG targets and indicators through a nexus lens suggests that a nexus perspective has not been adopted in their framing. The proposed SDG targets fail to take a nexus perspective, i.e. they fail to recognize there are inherent trade-offs but also potential synergies among the proposed SDGs and their targets. Addressing all of the challenges simultaneously is probably not possible without drastic changes in human behaviour, supported by radical reforms in policies and institutions from the global to the national and local levels.

15. This recommendation also has in two parts. A) Frame a broad but easily communicated conceptual integrative framework for the sustainable development agenda that draws attention to critical nexus issues. This should include specific linkages to planetary and social boundaries by combining the "safe operating space within planetary boundaries" concept with the concept of "social boundaries" as a way of creating a safe and just place for humanity to thrive. B) Use this conceptual nexus framework to critically analyse all of the proposed SDGs and targets in order to identify both those areas with serious trade-offs, and those areas where there are potential synergies. A pragmatic approach is critical and possible. There are clear tensions among some of the proposed SDGs, but there are also practical opportunities to address many of them effectively.

16. Identify measurable useful indicators that can be used to monitor *systemic* rather than only sectoral progress.

Capacity Strengthening

There is a substantial gap between current institutional and human resource capacities and the requirements for achieving the SDGs. This observation applies to all levels and sectors – not only governments but civil society as well.

17. A review of MDG experiences shows that implementation capacities of most developing nations are limited, including integration, inclusiveness and cohesion. Capacities to integrate the three dimensions of sustainable development into the national development policies, plans, strategies and programmes are important. The UN should encourage governments, their financial partners, and the private sector to ramp up investments in strengthening capacities, especially in the early stages, even if this requires transferring resources from implementation. *An up-front investment in capacity strengthening will pay rich dividends in the long run.* To obtain the full

benefit, these investments must be in both institutions and human resources, and should include attention to the requirements for long-term sustainability.

Institutional innovation is equally and perhaps more important than technological innovation. Indeed, there are potential synergies: more equitable and just institutions could enhance the uptake and impacts of new technologies, while new technologies offer opportunities to promote institutional change.

18. The design and implementation of the sustainable development agenda should be explicitly based on reforming, transforming and strengthening governance structures, institutional arrangements, and policies.

Achieving a higher degree of equality in access to basic services and in opportunities for improved wellbeing will require empowerment of those currently having little power, and a higher degree of accountability. One way forward is to reframe the proposed Goal 16 on peaceful and inclusive societies and accountable institutions to focus on achieving these transformations. Implementing this recommendation will be extremely challenging, as there are strong vested interests and considerable inertia in the current institutional systems at global, national, and local levels. However, implementing the ambitious sustainable development agenda through the current institutional frameworks will severely limit the outcomes and only postpone reforms that are necessary conditions for success. Institutional transformation is a necessary condition for ending poverty and hunger, ensuring healthy lives and wellbeing, and achieving equality.

The Critical Role of Water in Achieving the Sustainable Development Goals: Synthesis of Knowledge and Recommendations for Framing, Monitoring and Capacity Development

Paper prepared for UN DESA

1. Introduction: Purpose and Outline

1.1 Background

Despite impressive progress in reducing poverty and hunger and improving health of people during the past couple of decades, humanity still faces enormous socio-economic and sustainability challenges. Ensuring the sustainable provision of equitable access to sufficient good quality water for people, productivity and the environment is a necessary condition for ending poverty and hunger, and achieving all the other ambitious goals being proposed for the post-2015 sustainable development agenda. Water permeates all aspects of life. It is not only people who require a basic supply of reasonably good quality water in order to survive; water is essential for the survival and productivity of all life and all ecosystems, including agro-ecosystems – and therefore all ecosystem services for people. Humans depend on a wide range of ecosystem services for multiple biological, economic, social and cultural needs. Water is essential not only for basic drinking, cooking, hygiene and ecosystem functioning, but for producing food, energy, and indeed all the material products needed for daily life. It also plays a critical role in the spiritual and aesthetic lives of billions of people. Water also plays negative roles through floods, drought, and as a sink for pollutants that cause damage to economic development, health and overall human wellbeing.

The challenges are profound and rapidly becoming more urgent. The natural distribution of water is highly variable geographically and seasonally: some areas have huge amounts of water while others have little or none; and seasons of extremely high rainfall are often followed by long periods with no rain. These patterns of inequity, variability, extremity and unreliability are worsening in many areas because of the impacts of climate change – especially in those areas occupied by the poorest and least resilient communities. Many scientists agree we have now entered a new era in the history of the earth, the “Anthropocene”. This is the first era in which humanity constitutes a major source of change in our planetary system. It may be characterized by abrupt large-scale changes in the biosphere. Its defining features include accelerated climate change that is associated with increased levels of greenhouse gases, altered biogeochemical and hydrological cycles, and extensive loss of habitat and biodiversity (Schoeman, Allan and Finlayson 2014). Adapting to these changes will require effective management of water both to enhance resilience to shocks, and to provide sufficient freshwater for human development and the wellbeing of the anticipated nine billion or so people expected to be living on the planet by 2050 (Rockström et al. 2014). Further, the impacts of the natural distribution of water availability are made more extreme by prevailing socio-economic inequalities: water scarcity, like poverty and under-development, is a socio-economic fact more than it is a product of nature. This means that improving access to water for multiple purposes can only be achieved with the right policies, institutional arrangements and investments.

The agenda for sustainable development over the next couple decades, currently under discussion, must be set with a full recognition of the larger global challenges facing humans on planet earth. The current draft of this agenda outlines 17 goals and 169 targets (Open Working Group 2014). It is an extremely ambitious and wide ranging agenda. While the number of goals and targets to be specified as the global Sustainable Development Goals (SDGs) may be reduced to a more manageable number, all of those proposed are indeed important and of high priority. An important part of this process has been to extract lessons from the experience in trying to achieve the Millennium Development Goals (MDGs) since about the year 2000.

Many reports and papers have been produced during this process. It must be acknowledged that humanity faces a very large number of high-priority challenges that are in a sense "competing" to be addressed by the new SDGs. Nevertheless, there is broad agreement on the critically important role that water has played in trying to achieve the MDGs and will play in the future SDGs. However, most water professionals also agree that water has not received as much attention as is needed to fully achieve the MDGs and their targets; therefore, the role of water in achieving the future sustainable development agenda must be enhanced. One proposed SDG focuses explicitly on "ensur[ing] availability and sustainable management of water and sanitation for all" (proposed Goal 6). However, the availability and productive use of good quality water is essential to achieving many other proposed SDGs. Further, and very important, there is a growing recognition of the multiple interdependencies or "nexus" among the various goals, for example water and sanitation, food and nutrition security, energy, environment and the various ecosystems on which humans depend, human settlements, peace and security, and climate change. Achieving the central SDG – "end poverty in all its forms everywhere" – will be a function of how well the global community tackles all of the other SDGs. Addressing the growing challenges of water scarcity and availability will also be critical for success. This will require a systematic, sophisticated, prioritized global program supporting multiple national and local development strategies that are based on specific local conditions and priorities.

1.2 Objectives and outline of the paper

The objectives of this paper are:

- To review the existing body of knowledge on water and sustainable development and synthesize the major lessons learned regarding the role of water;
- To analyse the multi-sectoral integration and nexus of poverty-water-energy-food-resilience-peace and security-climate change [i.e. broadly defined "nexus"];
- To review the currently identified water and sanitation goal and target areas with potential tools and methods for monitoring progress and indicators as well as the means of implementation; and
- Based on the review, to offer recommendations on how water and sustainable development can be better integrated into the national development agendas, with special reference to the implications for policies, institutional arrangements, and capacities.

Sub-section 1.3 briefly discusses the challenges of substantially reducing or eliminating poverty, hunger and malnutrition in the context of both the critical drivers that are leading to serious resource constraints facing humans and our home planet, and nexus issues. Section 2 sets out the context of water and sustainable development, and linkage to various intergovernmental and global

processes. It emphasizes the critical role of water in reducing poverty and achieving food and nutritional security. Section 3 selectively reviews the experiences, lessons learned, and views expressed by countries, major global institutions and researchers regarding what has been achieved broadly, and specifically vis-à-vis water in implementing the MDGs. Section 4 then analyses the current proposed water and sanitation SDG and its targets, potential indicators, methods of assessments, and tools. Section 5 assesses the potential roles of water management in achieving other proposed SDGs and target areas, identifying potential synergies and gaps. Section 6 discusses the growing consensus on the importance of basing future sustainable development programs on a clear recognition of the interdependencies – nexus – of water, energy, food and indeed other sectors, in the context of climate change. Finally, Section 7 offers specific recommendations that emerge from the review in the previous sections.

1.3 Sustainable development in the Anthropocene Era

1.3.1 Global trends and drivers

The central goal of the MDGs was to reduce poverty and some of its worst features – hunger and malnutrition, child mortality, lack of access to clean water and basic sanitation, and others. This nearly single-minded focus on poverty reduction also characterizes the proposed sustainable development agenda to 2030, but with more ambitious goals and targets (Open Working Group 2014). The proposed Goal 1 is to "End poverty in all its forms everywhere". Other supporting goals propose to "end hunger", "achieve food security", and "ensure healthy lives", among others. Implicitly, the 17 proposed goals and associated targets are based on the recognition that to achieve the central goal of ending poverty, action is required in many sectors. This section of the paper carries this point further: to 'end poverty' in a way that is sustainable and provides a foundation for future economic growth and continuously improving well-being of people, investments and interventions must be based on a recognition of global mega-trends and how they may impact longer term sustainable trajectories. The reference to "*Sustainable*" Development Goals must be taken seriously. Trying to 'end poverty' by 2030 at the expense of sustainability will not do.

A complete review of the drivers of global change is not possible here. However, a brief review will provide the context for the remainder of this paper. There is widespread agreement on the major drivers of global change. These include climate change (Box 1.1); population growth; rapid urbanization accompanied by a growing middle class, leading to rising demands for food and material goods; increasing socio-economic inequity; and in the context of these kinds of drivers, rising demand for water and other natural resources and for energy. Water and other natural resources are degrading in quality. These challenges cannot be met using the same measures that have been used in the past. These and other drivers interact with each other, in ways that amplify their impacts, potentially leading to a vicious spiral.

The business community has recognized these and other drivers of change as sources of major risks in the future (KPMG International 2014; 2030 Water Resources Group; World Economic Forum [WEF] 2014, 2015). Water scarcity is singled out as a major source of stress. For example, the World Economic Forum (WEF) carries out annual surveys of its member institutions on their perceptions of the major global systemic risks. The survey published in 2014 ranked 31 possible risks according to the level of members' concerns, their likelihood and potential impacts, and the interconnections among them (WEF 2014). Water crises ranked third; failure of climate change mitigation and

adaptation and greater incidence of extreme weather events were fifth and sixth, respectively; and food crises ranked eight. The seventh and tenth were both governance risks (Table 1.1). The report implies that WEF members vary in how optimistic they are regarding the likelihood these risks will be addressed successfully. The most recent survey (WEF 2015) ranks water crises as the top global risk in terms of *impact*, while ranking it eighth in terms of likelihood in the next 18 months.

Box 1.1 Excerpts from IPCC Key Messages for Policy Makers

Climate change will amplify existing risks and create new risks for natural and human systems. Risks are unevenly distributed and are generally greater for disadvantaged people and communities in countries at all levels of development. *{2.3}*

Climate change is a threat to sustainable development. Nonetheless, there are many opportunities to link mitigation, adaptation and the pursuit of other societal objectives through integrated responses (*high confidence*). Successful implementation relies on relevant tools, suitable governance structures and enhanced capacity to respond (*medium confidence*). *{3.5, 4.5}*

Climate change exacerbates other threats to social and natural systems, placing additional burdens particularly on the poor (*high confidence*).

Strategies and actions can be pursued now which will move towards climate-resilient pathways for sustainable development, while at the same time helping to improve livelihoods, social and economic well-being, and effective environmental management.

Source: IPCC 2014.

Table 1.1 Ten Global Risks of Highest Concern to WEF Members, 2014

Number	Global Risk
1	Fiscal crises in key economies
2	Structurally high unemployment/underemployment
3	**Water crises**
4	Severe income disparity
5	Failure of climate change mitigation and adaptation
6	Greater incidence of extreme weather events (e.g. floods, storms, fires)
7	Global governance failure
8	Food crises
9	Failure of a major financial mechanism/institution
10	Profound political and social instability

Source: WEF 2014: Table 1.

A recent academic study offers a rather pessimistic view of the future. It applies a human population dynamics model to which is added data on the impacts of accumulated wealth and economic inequity and resource-use trends. It uses historical data on the collapse of past civilizations to test the model, and extrapolates to trends characterising the earth today (Motesharrei et al. 2014). The authors demonstrate its applicability to past collapses of human societies, then carries out "thought experiments" to examine possible future scenarios. Their results indicate that either over-exploitation of natural resources or extreme economic stratification can independently result in social collapse. When the two occur together, as is the case in modern times, there is a large increase in the likelihood of catastrophe. Although they state collapse is avoidable, their conclusions are not optimistic that these trends — resource depletion and growing economic inequity – will be reversed. The assessments of global trends by business institutions (KPMG International, WEF) also emphasize the risks posed by growing economic inequality and over-exploitation of natural resources.

Other recent academic studies raise serious concerns about the future from a different perspective – modelling of the trends in our planetary system. The earth is now in an era when human activity is a dominant factor affecting global climate, hydrological and biosphere systems — a view the IPCC also shares (IPCC 2014). Rockström et al. (2014:1250) "argue that the evidence of rising water-related shocks and interactions in the Anthropocene requires the emergence of a deeper social-ecological resilience-based approach to integrated land and water-resource management, if we are truly to confront the water challenges facing humanity."[1] Water is critical to the resilience and functioning of ecosystems and communities – indeed of all life. As "the bloodstream of the biosphere" (ibid.), water is a prerequisite for human health, food production and all ecosystem services. However, the combination of climate change and over-exploitation of water is a growing threat to our future survival. Producing enough food for a growing and wealthier human population is especially challenging, as food production is by far the largest user of water (approximately 70% of all water used). Radically changing the governance of water will be a necessary condition to eradicate poverty and hunger, the first two of the proposed SDGs. Schewe et al. (2014) come to a similar conclusion based on a study integrating multiple hydrological and climate change models: although there is a significant degree of uncertainty, their study shows that climate change is likely to severely exacerbate national and regional water scarcity, possibly increasing the number of people living under water scarcity (<500 m^3 per capita per year) by 40%. This could well lead to rising socio-economic inequality as well – a potentially critical vicious cycle.

"… the evidence of rising water-related shocks and interactions in the Anthropocene requires the emergence of a deeper social-ecological resilience-based approach to integrated land and water-resource management, if we are truly to confront the water challenges facing humanity."

1.3.2 Water-food security-energy-peace and security-climate change nexus

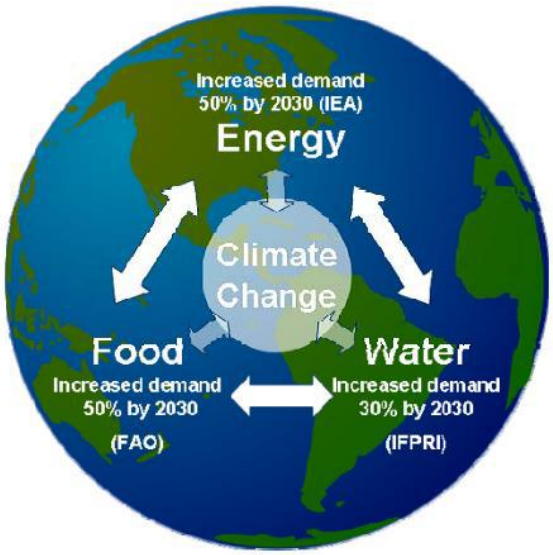
Traditionally, researchers, policymakers, and investors operate within narrow institutional and cognitive frameworks. Ministries, government departments, and academic disciplines generally focus on their specific area of concern with little attention to the interdependencies with other areas. Such silo mentalities have until recently characterized those dealing with energy, water for drinking and sanitation, food production, environmental sustainability, and even peace and security. There is a long-standing literature on the critical importance of water for food security in the context that water scarcity is a threat to meeting future food demands unless major improvements in agricultural water productivity can be achieved (e.g. Molden, ed. 2007). There had also been some early academic work on water-energy linkages. Better known are the often-cited concerns that extreme water scarcity relative to demand could lead to conflict and "water wars" (Katz 2011). However, the global food crisis and financial and economic setbacks in 2007-2009 prompted stronger concerns within a "scarcity narrative". A much-quoted paper by John Beddington, then Chief Scientific Adviser to the British Government, referred to the water-food-energy-climate nexus as "the perfect storm" (Beddington 2009). Figure 1.1 illustrates Beddington's argument. Section 6 discusses nexus issues and their relationship to the future sustainable development agenda.

[1] See Steffen et al. for an updated discussion of the Planetary Boundaries concept.

1.3.3 Possible future global scenarios

A report by Galopin (2012) explores five global long-range "stylized" or qualitative scenarios as a contribution to the preparation of the fourth World Water Development Report (WWDR4 -- WWAP 2014). Scenarios are not projections or predictions; they are plausible stories given certain conditions. They are useful as planning tools. The scenarios are for 20 to 40 years, i.e. 2030-2050, and are driven by the same drivers of global change discussed above. Nine dimensions are proposed as crucial: 1) **water stress**; 2) well-being (quality of life, poverty, equity); 3) population growth; 4) values and lifestyles; 5) economic growth; 6) technological development; 7) climate change; 8) ecosystem health; and 9) global cooperation.

Figure 1.1 The Perfect Storm Scenario



It is predicted that by 2030 the world will need to produce around 50 per cent more food and energy, together with 30 per cent more fresh water, whilst mitigating and adapting to climate change.

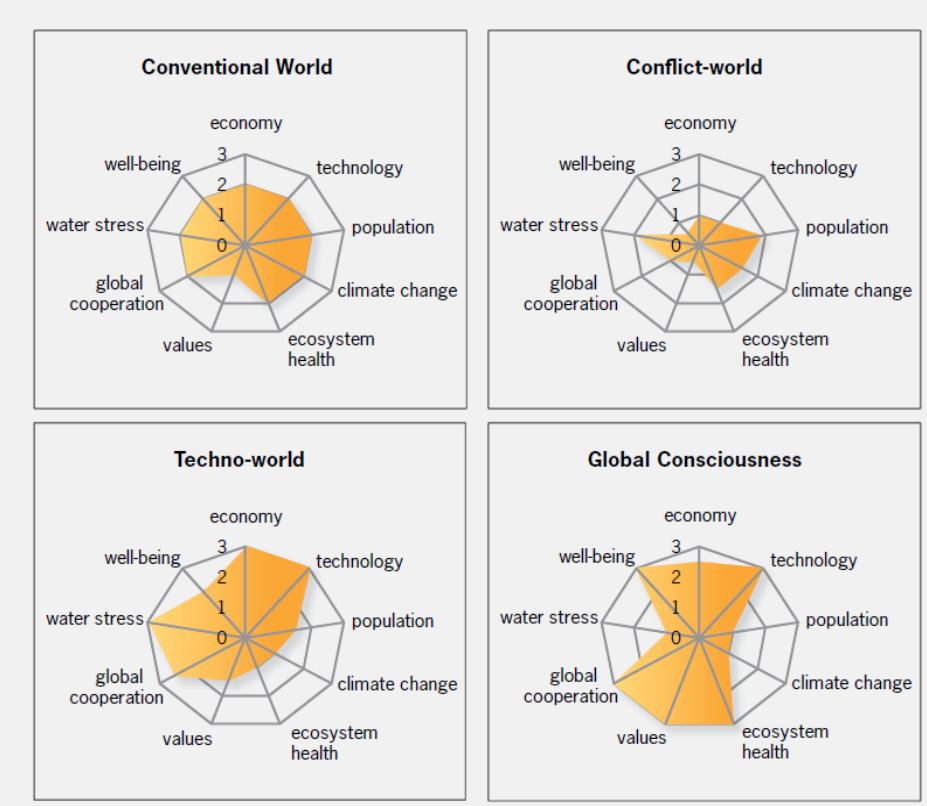
Source: Beddington 2009: 8, Figure 7.

These are used not as "determinants" but as fundamental indicators to evaluate the desirability and sustainability of alternative futures — in this case, five scenarios (Figure 1.2). These scenarios vary considerably in terms of desirability. The worst scenario is 'Conventional World Gone Sour', with the lowest well-being, high water stress and high climate change. This is followed by 'Conflict-world'. The 'Conventional World' scenario, if it were even feasible, would lie in a middle ground, but is not likely to be sustainable. The 'Global Consciousness scenario' represents the highest level of well-being and is probably the most sustainable. However, achieving it would require major transformations in governance, policies, values and behaviour. This conclusion is consistent with those emerging from the other studies reviewed here. The post-2015 sustainable development agenda must be designed and implemented to initiate these transformations, as others have also emphasized (e.g. IRF 2013; Stakeholder Forum 2014).

1.3.4 Concluding remarks

It is clear that we are now living in a new era for planet earth and its inhabitants. Human beings now dominate the planet and have become a major force driving planetary system trends such as climate

Figure 1.2 Five Global Scenarios



Note: Depending on the dimension, higher figures may be better or worse regarding sustainability goals.
Source: Galopin 2012: 10, Figure 4.

change, loss of biodiversity, and resource degradation – including growing water scarcity. We are increasingly dependent on each other – the era of relatively autonomous and isolated communities is finished. This means that the actions of some people, for example those who are relatively wealthy and consuming a lot of resources, are affecting those who are not so well- endowed. It also means that as global citizens, we all must accept responsibility for the future of the earth and its inhabitants. While the world community has made important progress in reducing poverty and hunger during the past few decades, we have also seriously damaged the planetary systems, natural resources such as water, and the ecosystems on which life depends. In addition, human societies are characterized by very high levels of socio-economic inequity, among and within countries. *The design and implementation of the sustainable development agenda over the next few decades must*

be explicitly based on governance structures, institutional arrangements, and policies that recognize these profound interdependencies. Achieving water security will be central to success: a necessary if not sufficient condition for long term sustainable development.

2. Water and Sustainable Development

2.1 Global water challenges and opportunities

2.1.1 Water supply and demand

The demand for water already exceeds the available supply in many regions and river basins, especially in parts of Asia, North Africa and the Middle East, and sub-Saharan Africa – where the vast majority of poor people live and where the population is growing most rapidly. Global fresh water withdrawals have been growing at a rate of about 1% annually since the 1980s, almost entirely in developing countries. Global water demand (withdrawals) is expected to increase by 40% by 2030 and 55% by 2050 (2030 Water Resources Group 2009; WWAP 2014). This increased demand will come from growth in industrial and domestic use, energy production, and agriculture in developing countries.

The current annual global water withdrawals are about 4,500 billion m^3 (or 4.5 thousand cubic kilometres). By 2030 with average economic growth and no changes in efficiency, this is projected to grow to 6,900 billion m^3 – 40% above current accessible, reliable supply (including return flows, and environmental reserves). This global figure obscures huge variation: about a third of the 2030 population, mainly in developing countries, will reside in river basins where the gap between demand and supply will be over 50%. Agriculture currently accounts for approximately 3,100 billion m^3, or 71% of annual global water withdrawals. This will increase to 4,500 billion m^3 by 2030 (a slight decline to 65 percent of global water withdrawals) if efficiency does not improve. This is a 45% increase in agricultural water demand[2].

The water challenge is therefore a food production challenge as well as a challenge for meeting other social goals. Agricultural water demand is especially high where some of the poorest subsistence farmers live: India (projected annual withdrawals of 1,195 billion m^3 by 2030), sub-Saharan Africa (820 billion m^3), and China (420 billion m^3). Industry, including power generation, currently accounts for 16% of today's withdrawals; this will grow to about 22% by 2030, largely in China. Demand for domestic water will decrease slightly as a percentage but in absolute terms it will grow significantly in some major river basins in developing countries (2030 Water Resources Group 2009). Ringler et al. (2014) estimate an additional 900 km^3 per year of water will be needed for domestic and manufacturing uses by 2050.

Meeting this growing urban and industrial demand is often achieved by withdrawing water from agriculture, especially from irrigation, which is perceived by many as "wasting" water (Molle and Berkoff 2006). This is leading to growing water scarcity in countries dependent on irrigated

[2] FAO has a lower figure but is referring specifically to irrigation. It estimates current global irrigation withdrawals at 2,761 km^3 per year of water, of which about 50% is consumed (Alexandratos and Bruinsma 2012: 118, Table 4.11). It projects only a 6% increase in global irrigation withdrawals by 2050, with no significant improvement in global water use efficiency. This seems too low. See Amarasinghe and Smakhtin (2014) for a review of the accuracy of water demand projections.

agriculture for their food security and for the employment of millions of people. Population growth combined with changing food consumption patterns means that food production must be substantially increased to meet future demands — and this will require additional water for production and processing of food. In general, the productivity of water, i.e. the amount or value of food produced per unit of water applied or consumed, is far below its potential in both irrigated and rainfed agriculture. However, getting the right combination of incentives, technologies and knowledge in place to increase water productivity on a large scale is a daunting challenge.

Some major river basins already face severe water scarcity, especially in Asia, North Africa and the Middle East. In addition, major aquifers are being pumped dry in a number of highly productive "breadbasket" regions including northern China, northern India, Pakistan, Iran, Mexico and south western USA. The problem is further compounded by the rising levels of water pollution from untreated urban and manufacturing waste and runoff of agricultural chemicals. Polluted water is a threat to human health as well as to ecosystem services. The costs of treating urban and industrial wastes produced currently in developing countries far exceed the available investment funds. Solving this problem will require new technologies and business models (e.g. IWMI 2014; Molden, ed. 2007).

2.1.2 Water security

Achieving "water security" is considered a prerequisite to long-term sustainable development. However, most definitions of "water security" are imprecise and qualitative. At household level, water security is generally defined as "access by all individuals at all times to sufficient safe water for a healthy and productive life". This includes three key dimensions: water availability, access and usage, similar to the food security concept (Ringler et al. 2015 [forthcoming]). Water security at the national level has been defined as "the availability of an acceptable quantity and quality of water for health, livelihoods, ecosystems and production, coupled with an acceptable level of water-related risks to people, environments and economies" (Grey and Sadoff 2007). The Global Water Partnership (GWP) has a similar definition (GWP 2000, cited in Lautze and Manthrithilake 2014). Those countries and regions within countries that have not achieved water security are typically the poorest and most vulnerable. Failure to minimize risks posed by water-related disasters – floods and droughts – leads to cycles of serious economic loss compounded over time. Reducing those risks and ensuring a basic supply of water for productive and other purposes creates a firmer foundation for development. Box 2.1 provides the definition of "water security" as used by UN agencies.

Box 2.1 UN Water Definition of "Water Security"

Water security is defined as the capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability (UN Water 2013: 2).

Source: UN Water 2013.

Lautze and Manthrithilake (2014) attempt to develop a quantifiable water security index with five dimensions: basic human needs, agricultural production, the environment, risk management, and national security or independence. They test their index using data from Asia-Pacific countries and suggest packaging these dimensions into a single concept or index is of limited value. Nevertheless,

the concept continues to be used. For example, a recent study by the International Food Policy Research Institute (IFPRI) reinforces the critical important of achieving "water security" as a prerequisite for achieving the sustainable development agenda (Ringler et al. 2014, 2015 [forthcoming]; Veolia no date). The study estimates that in 2010, 36% of the world's population (some 2.4 billion people), 39% of grain production, and 22% of global GDP were already at risk because of water insecurity — defined as withdrawal levels in excess of 40% of the available water resource. The study models four scenarios with three economic growth assumptions using a global model of water and food (IMPACT)[3]. Key results are summarized in Table 2.1, below. Basically, if current water management practices and low levels of water productivity continue, by 2050 over half of the global population (some 4.8 billion people), half of global grain production, and nearly half of the estimated global GDP, will be at risk from water insecurity. However, if the global community invests in improving water productivity and access, there is a significant potential to benefit an additional billion people, substantially increase total global GDP, and reduce child malnutrition significantly.

2.1.3 Water and food-nutrition security

Water is essential for all forms of agriculture and therefore food production, and indeed for the functioning of all terrestrial ecosystems including agricultural ecosystems. Inadequate amounts or variability in the availability of water in crop root zones at critical times in the growth cycle can have devastating impacts on yields. The regions of the world with the largest number of poor people also face the most serious challenges in terms of the availability of water for food production. These are sub-Saharan Africa and southern Asia. Investments in irrigation in the past fifty or so years, especially in Asia, have made it possible to dramatically increase food production while also enabling millions of small farmers to achieve a degree of prosperity and food security. This is especially so in Asia; in sub-Saharan Africa irrigation still accounts for only a small fraction of the total cultivated area. On average, rainfed agricultural yields are less than half those of irrigated agriculture, but there is enormous variability (Rockström et al. 2010). In the arid and semi-arid regions of Asia and Africa, rainfed agriculture is a very risky business. Crop failures are common and devastating at household level as well as regional and national levels. Indeed, annual GDP growth rates vary with rainfall in many African countries, and large-scale crop failures have long term impacts on economic growth, the wellbeing of poor people, and the nutritional status of children.

Investing in the extension or improvement of access to agricultural water for small farmers can make a huge contribution to improved food security, economic growth, and reduction of poverty.

There is very strong evidence that investing in the extension or improvement of access to agricultural water for small farmers can make a huge contribution to improved food security, economic growth, and reduction of poverty (e.g. Castillo et al. 2007; IFAD 2010; Namara et al. 2010; Burney and Naylor 2012; Giordano et al., eds. 2012; Hagos et al. 2012; Giordano and de Fraiture

[3] IMPACT is a partial equilibrium model of the agricultural sector. It represents a competitive agricultural market for crops and livestock and incorporates a water simulation model to assess water supply and demand and respective impacts on food supply and demand, and the impacts of climate change on water availability and irrigation demand.

2014; de Fraiture and Giordano 2014). For example, in southern Asia, the expansion of irrigation has led to high levels of national food security as well as household food security and poverty reduction for millions of people. Overall, irrigation water can have critically important job- and wealth-creating impacts. This is so despite the risks of negative impacts through waterlogging and salinity resulting from poorly designed or managed irrigation. The rapid expansion of private pump irrigation using

Table 2.1 Global Water Security: Four Scenarios

Scenarios	2050 Outcomes
"Business as usual" (BAU) scenario • Continue current trends moderate improvements in water productivity • Energy demand increase at ~19% in OECD and +110% in Non-OECD countries, with corresponding water use while energy mix slightly shift towards renewable energy mix (IEA "new policy" scenario)	• Baseline scenario, with medium GDP growth 52% of the global population, 45% of GDP, and 49% of global grain production, will be at risk due to water stress by 2050
"Grey" scenario • Focus on increasing production at all costs, no investment in improving water or energy productivity • Energy demand growing by ~20% in OECD and +130% in Non-OECD countries, with corresponding water use, while energy mix shift to nuclear and thermos electrical power generation (IEA current scenario)	• Compared to BAU, results in a significant increase in water stress with an additional 450 million people and USD 5.6 trillion GDP at risk by 2050 (an increase of 5% and 4%, respectively)
"Low carbon" scenario • Low-carbon energy mix impacts water productivity in terms of higher usage of biomass but also higher energy efficiency (IEA Green Energy "450" scenario) • A low- carbon energy scenario has slightly lower water productivity than BAU (the water impacts of biomass (some irrigation) and hydropower (evaporation) from reservoirs outweigh water savings from efficiency gains)	• A low carbon scenario does not necessarily reduce water scarcity impacts • On balance, water stress in a low carbon world is similar to levels obtained under BAU, as water savings from energy efficiency balances increases in water use due to biomass cultivation. However, this only holds if 2nd and 3rd generation biomass will become available • Under "high growth" scenario, 60% of global population and 58% of global economy will be in water-scarce regions—threatening the continuation of high growth
"Smart Blue" scenario • High improvements in leakage reduction and water efficiency gains in domestic sector; also aim at reaching the rural and urban poor with clean drinking water and sanitation; majority of water productivity potential achieved in industry • Energy demand growing at ~19% in OECD and +110% in Non-OECD; high share of renewable energy increasing from ~19% (2008) to 29% (2030) with biomass produced from waste material or otherwise without water impacts (IEA —New Policy Scenario with higher productivity)	• About 1 billion people and about USD 17 trillion GDP less at-risk due to high water stress as compared to BAU • High growth with increased water productivity essential for reduction in child malnutrition (21% reduction in child malnutrition compared to BAU if linked with higher investments in rural water supply and sanitation, and female secondary education) • For some high-growth regions e.g. India, the "blue" scenario helps but is insufficient—these countries face difficult water allocation decisions

Notes: All GDP figures in 2000 USD.
Source: Ringler et al. 2014.

groundwater in southern Asia has also freed millions of small farmers from poverty, again notwithstanding the second generation issues resulting from over-pumping of aquifers (Shah, Burke and Vilholth 2007). The linkages between water and poverty in rural Asia and sub-Saharan Africa are complex but meaningful, as demonstrated by recent studies done by FAO and IFAD (Faures and Santini, eds. 2008; Khanal, Santini and Merrey 2014). These studies use livelihood zone mapping to identify where agricultural water interventions could have the largest impacts on rural poverty.

However, there is also strong evidence that increasing agricultural production by itself does not necessarily lead to improved nutritional outcomes. This emerges clearly from a detailed review of recent studies examining the connection between agricultural interventions and nutrition outcomes (Webb 2013, and references therein). There are many reasons for this, including cultural beliefs about diets and child rearing, and inequitable access to food within households. The pathways from food production to nutritional impacts are not well understood, and vary considerably. There are also major casual linkages between the availability of clean water for consumption, the availability and use of adequate sanitation facilities, hygiene, and malnutrition (e.g. HLPE Committee on World Food Security 2015 [forthcoming]). People, especially children, become ill because of intestinal infections and are unable to digest food well, leading to malnutrition. Malnutrition, especially being deprived of critical micro-nutrients, reduces the capacity of the body to resist disease – and so on in a vicious cycle. Malnutrition in small children has life-long impacts on productivity and well-being.

Water of a reasonable quality is a critical ingredient in the entire food chain, from production to processing to consumption. Ensuring its availability in an equitable and timely manner is therefore a prerequisite for achieving the sustainable development agenda.

2.1.4 Water for ecosystems

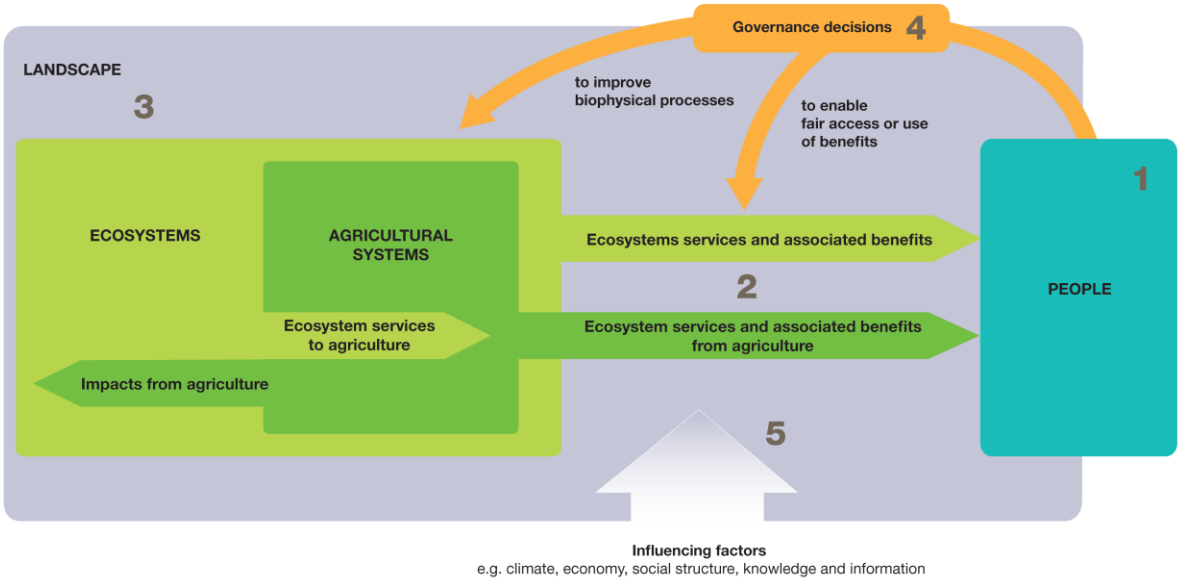
The rapid depletion of a wide range of natural resources in the Anthropocene is a result of a narrow focus on increasing or production of specific commodities without consideration of the consequences in other sectors. Recognition of this issue has in recent years led to a major paradigm shift among agricultural and natural resources scientists. Agricultural scientists have traditionally had a single-minded focus on increasing production of crops without considering the impacts on soils, biodiversity and water resources. It is now widely recognized that this paradigm is not sustainable. The emerging new paradigm is based on the concept of *ecosystems*, defined as a dynamic complex of plant, animal, and microorganism systems in a non-living environment interaction as a functioning unit (CGIAR Research Program on Water, Land and Ecosystems [WLE] 2014:2). Agricultural systems are human-modified ecosystems that provide food and other raw materials as ecosystem services. Adoption of this paradigm is leading to major shifts in the types of agricultural research being conducted by the CGIAR and others.

Ecosystem services can be defined as "the combined actions of the species and physical processes in an ecosystem that perform functions of value to society", i.e. provide benefits to people (ibid.). The benefits provided by ecosystems are classified into *provisioning* (e.g. food, water, raw materials), *regulating* (e.g. nutrient cycles, water flows and purification, erosion prevention), *habitat* (e.g. natural vegetation, maintenance of the gene poll), and *cultural* services (e.g. aesthetic, spiritual, recreational) (Millennium Ecosystem Assessment 2005)[4]. Human social systems are intimately linked to ecosystems as drivers and consumers of services. The concept of *socio-ecological systems*

[4] Led by UNEP. See http://www.unep.org/maweb/en/Reports.aspx (accessed January 14, 2015).

captures this interdependency. This paradigm shift is sometimes characterized as a "landscape approach" (e.g. Sayer et al. 2013) and is now wide accepted and promoted (e.g. Boelee, ed. 2013; WWAP 2014 [Chiramba et al. 2014]; WLE 2014). The ecosystems services and resilience framework recently adopted to guide the CGIAR's Water, Land and Ecosystems Program is reproduced in Figure 2.1. It seeks to show how managing ecosystem service flows through an agricultural landscape can improve the health, security and economic benefits to people.

Figure 2.1 WLE's Framework for Agricultural Ecosystem Services



Source: WLE 2014:6, Figure 2.

How to ensure adequate supplies of quality water and food to all people all of the time is at the core of the sustainable development agenda.

This approach to agriculture seeks to restore or harness a wide range of ecosystem services for production goals while also conserving the full range of ecosystem services. Water flows are a critical element to all of these ecosystem services in all agro-ecological systems. The availability of adequate supplies of water of reasonable quality depends on healthy ecosystems and therefore may be considered a critical ecosystem service, critical not only for agriculture but for energy, drinking water and other needs. The concepts of 'ecosystem services' and 'socio-ecological systems' provide a conceptual framework for addressing the range of 'nexus' issues, and for solving one of the most critical challenge facing humans: how to ensure adequate supplies of quality water and food to all people all of the time. This is at the core of the sustainable development agenda.

2.1.5 Concluding remarks

This section has emphasized the challenges of achieving full water security and meeting the water requirements of people currently and into the future. It has also outlined the challenges created by the critical linkages between water and food as well as nutritional security. It has briefly characterized conceptual frameworks such as "socio-ecological systems" and "ecosystem services" that offer a way to envision future directions for research and for implementing the sustainable

development agenda, including moving toward a greener economy. One critical weakness in all of these frameworks is that while reforming governance and institutional arrangements is acknowledged as very important, it is taken for granted, as if it will happen somehow automatically. As will emerge in later sections, there are important opportunities to improve the availability of water for multiple purposes, increase access to adequate water to meet basic human needs, and increase the productivity of water. But governance reform will be critical for success.

2.2 Brief history: From Rio to Rio+20 to the present

2.2.1 Pre-1992 milestones

Most reviews of the origins of the MDGs begin with the major conference on sustainable development held in Rio de Janeiro in 1992 (UNCED 1992). However, there were many important antecedents, of which two deserve to be mentioned here. First, poverty reduction was not central to the global development agenda in its first decades (i.e. mid-20th century); the focus was largely on promoting economic growth based on agricultural and industrial development, modelled on the presumed histories of European and North American economies. The assumption was that economic growth would lead automatically to poverty reduction. In September 1973, the then President of the World Bank, Robert McNamara, addressed the Board of Governors of the Bank at a meeting in Nairobi (McNamara 1973). After reviewing the success of his first five-year plan to substantially increase Bank lending, he focused on the issue of "absolute poverty". He provided a cogent and passionate analysis of the roots of absolute poverty and the responsibility of the global community to reduce it, and committed the Bank to invest its resources in poverty reduction as well as economic growth. Noting that economic growth by itself was not enough to reduce poverty, he pledged to reorient the Bank's resources to achieve a more equitable distribution of the benefits of development than had been seen in the past, and urged national governments to reorient their own policies in this direction. As part of this reorientation, he also argued for setting clear operational targets and measuring progress to achieve these targets. He advocated a "socially oriented measure of economic performance", for example measuring the changes in income of the poorest groups in society. He also argued for a reorientation of investments to assist small scale rural farmers as the most effective way to promote equitable economic growth. These were radical ideas at the time.

The second milestone was the publication in 1987 of the Brundtland Report, "Our Common Future" (WCED 1987). This report was prepared by the independent World Commission on Environment and Development (WCED) established by the UN Secretary-General to study the global issue of increasing environmental degradation in the context of development. Led by Gro Harlem Brundtland, this Commission forever linked the terms "development" and "sustainable" with its famous definition: "*Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs*." Among others, the report made detailed recommendations for multilateral cooperation as well as national actions to re-orient development programs to be environmentally sustainable. Chapters addressed topics that remain salient today: food security, species and ecosystems, urbanization, industrialization, the global economy and population. Although there were certainly other important contributions before 1992, these two milestones – McNamara's poverty speech and Brundtland's sustainable development report – were especially critical.

2.2.2 Agenda 21 and follow-up

In June 1992, just five years after the Brundtland Report, 178 countries met in Rio de Janeiro, Brazil, at the UN Conference on Environment and Development (UNCED). They adopted a non-binding voluntary action plan for sustainable development, referred to as "Agenda 21" – 21 refers to the 21st century (UNCED 1992). It was designed as an agenda that could be executed at local, national and global levels. The 178 countries agreed on the need to emphasize sustainability while also committing the global community to combat poverty and conserve natural resources. Chapter 18 outlines a program on freshwater resources[5]:

1. Integrated water resources development and management;
2. Water resources assessment;
3. Protection of water resources, water quality and aquatic ecosystems;
4. Drinking-water supply and sanitation;
5. Water and sustainable urban development;
6. Water for sustainable food production and rural development; and
7. Impacts of climate change on water resources.

This chapter established the foundation for nearly all the work done since then by international organizations on water and development. For each of the bullet points above, the chapter provided a set of targets, activities, and means of implementation (including finance, capacity, etc.) to achieve these targets. For example, Agenda 21 endorsed a goal of universal water supply coverage by 2025[6]. The section on water and food security endorsed an FAO "International Action Program on Water and Sustainable Agricultural Development". It dealt with integrating water supplies for food production, fish, livestock and safe water for domestic use. It also emphasized stronger attention to preventing pollution, for example from inland fisheries, and minimizing the environmental impacts of irrigation development. UNCED was already addressing the impacts of climate change on water resources years before the IPCC legitimized this concern. Overall, the chapter set out a remarkably detailed program whose elements remain relevant today.

The UNCED 1992 conference was followed by two others: Rio + 5 and Rio +10. Rio +5 was a special meeting of the UN General Assembly in 1997 to review progress since 1992. It noted that progress had been "uneven" and focused on trends such as globalization, growing inequity and continued environmental degradation; and re-committed the members to address these problems. More important was the so-called "Rio + 10", the World Summit on Sustainable Development (WSSD) held in Johannesburg South Africa in 2002. Also referred to as the "Earth Summit 2002," it was convened by the UN to discuss sustainable development, and was attended not only by governments but by representatives from business, NGOs, and civil society. The Summit adopted the Johannesburg Declaration on Sustainable Development (WSSD 2002a) and the Plan of Implementation of the World Summit on Sustainable Development (WSSD 2002b).

The eight MDGs had been adopted following the "Millennium Summit" held in 2000 at the headquarters of the UN. At this Summit, world leaders adopted the "Millennium Declaration", a

[5] Its full title is: "Protection of the quality and supply of freshwater resources: Application of integrated approaches to the development, management and use of water resources".

[6] The World Summit for Children, in September 1990, called for universal access to water-supply and sanitation by 1995, but the Rio 1992 conference recognized this would be unrealistic.

broad statement of goals for the 21st century. The importance of WSSD was, first, to reaffirm the strong commitment of the world community to the goals of Agenda 21 and the recently-adopted MDGs. Second, water gained more prominence than had previously been the case. It is notable that there was no specific Millennium Development Goal on water. Water appears under Goal 7, to ensure environmental sustainability, as Target 7C ("halve, by 2015, the proportion of the population without sustainable access to safe drinking water and basic sanitation"); and is included as a dimension of Target 7A ("Integrate the principles of sustainable development into country policies and programs and reverse the loss of environmental resources").

WSSD was accompanied by a major parallel side-event on water, called the "Water Dome – No Water No Future". This event offered opportunities for hundreds of organizations to participate in or host conferences, workshops, launches of new initiatives and exhibitions, with each of the six days devoted to a different theme. This was the only WSSD event in which Nelson Mandela participated (he officially opened it). This event was also the first time that water was recognized as central to sustainable development and to reducing poverty. The Water Dome highlighted the linkages of water, sanitation and poverty. The Water Sanitation and Hygiene (WASH) campaign of the Water Supply and Sanitation Collaborative Council (WSSCC) was launched at the Water Dome (Mwanza 2005). In its Implementation Plan, the WSSD emphasized the water and sanitation target (WSSD 2002b: paragraph 8). Indeed, following WSSD, what had been the third target under MDG 7 on environmental sustainability has been treated almost as one of the MDGs. The Implementation Plan also strongly emphasized integrated land and water management for increasing agricultural production (paragraph 40), though this was never incorporated into the MDGs. In essence, WSSD was a critical milestone in the effort to make water a more central focus of the sustainable development agenda.

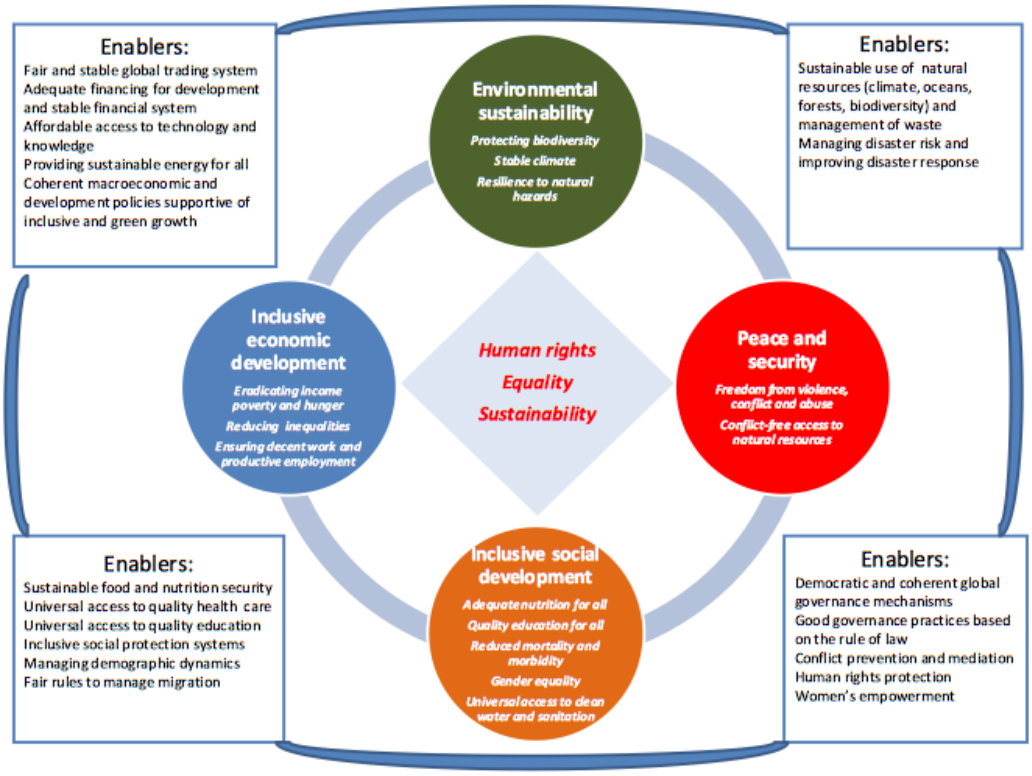
2.2.3 Rio + 20

In June 2012, the UN hosted a Conference on Sustainable Development, attended by most governments of the world, international organizations, and a large number of civil society organizations. Rather than being a celebration of progress since the Rio meeting in 1992, this Conference renewed the commitment of the world community to completing the unfinished sustainable development agenda. In preparation for Rio+20, and following on the outcome of the 2010 High-level Plenary Meeting of the General Assembly on the MDGs, the UN Secretary-General established the UN System Task Team (UNTT) in September 2011 to support UN system-wide preparations for the post-2015 UN development agenda, in consultation with all stakeholders. The UNTT delivered on four dimensions of sustainable development, building on the key strengths of the MDGs, to provide a more holistic approach to sustainable development. The four dimensions are: 1) inclusive social development; 2) inclusive economic development; 3) environmental sustainability; and 4) peace and security (UNTT 2012). These four dimensions are depicted in Figure 2.2. It is not yet clear whether this framework will be adopted by the global community by the end of 2015. It seems likely the six pillars recently put forward by the Secretary General in his report of December 2014 will be adopted. The latter is discussed in Section 4, below.

The final Conference document, "*The Future We Want*," covers many of the same topics that were covered in the previous conferences, often with similar phrases (UN Conference on Sustainable Development 2012). However, it is notable that achieving the water and sanitation MDG target received greater prominence than before. Indeed, the critical importance of water is mentioned

frequently throughout the document: it explicitly recognizes "*that water is at the core of sustainable development*" (UN Water 2014). Another critical difference from previous documents is the explicit recognition of water and sanitation as basic human rights. In addition, a close reading of the document demonstrates the growing recognition of the importance of water for addressing many issues: food security and nutrition and sustainable agriculture; sustainable cities and human settlements; health and population; biodiversity and ecosystem services; floods, drought and water scarcity; desertification, and land degradation (ibid.).

Figure 2.2 The Sustainable Development Framework Proposed by UNTT



Source: UNTT 2012: 24, Figure 1.

As part of the process of preparing for Rio +20, the UN worked with about 70 countries to prepare national reports on progress and lessons learned from the MDGs; a report was then prepared synthesizing the key lessons from 60 of these countries (UN-DESA and UNDP 2012). The study found that implementation of sustainable development remains a critical challenge, with many governments perceiving environmental sustainability as important to economic growth. It identified *integration* of the three dimensions of sustainable development, *inclusion* of all stakeholders and actors, *coherent* planning and decision making at various levels, and thus *implementation* itself to be critical issues. The study distilled five key priorities from the national reports (Box 2.2). Regarding water, many countries noted the need for improved integrated water resources management to address the conflicts among priority water uses, including agriculture, energy, drinking water, irrigation, ecosystem services and flood control. An analysis of the role of water in these country reports confirmed the four key challenges: lack of integration, inclusion, coherence and implementation (UN-DESA 2014a).

2.3 Concluding remarks

This Section has briefly reviewed the historical evolution of the sustainable development agenda and has highlighted the growing challenge of bridging the gap between water supply and demand. The estimated 40% global shortfall between water supply and demand by 2030 masks huge variations. In general, those areas where the vast majority of poor people live face the most severe levels of water insecurity. This affects all aspects of their lives. Without improving their access to water, it will not be possible for them to escape poverty and hunger. This Section has also briefly reviewed the growing recognition by the global community of the critical role of water in meeting the sustainable development agenda. This is a promising development. The next Section reviews the lessons learned from implementing the MDGs as a foundation for proposing ways to ensure that water management is appropriately incorporated into the future SDGs.

Box 2.2 Key Priorities for Implementing Sustainable Development

The national reports prepared for the Rio +20 Conference identified five key priorities for implementing sustainable development. They are:

Key priority 1: Strengthening institutions and governance systems and building capacities for collaboration and coordination at all levels while overcoming institutional fragmentation.

Key priority 2: Unpacking and operationalizing the "green economy" in a way that moves beyond concerns with trade-offs to achieving win-win outcomes.

Key priority 3: Reinforcing the connection between the Sustainable Development Agenda and the MDGs, especially integrating social issues such as health and education with economic and environmental issues.

Key priority 4: Meaningfully engaging stakeholders at all levels, including civil society.

Key priority 5: Measuring development progress in a way that looks across the three pillars of sustainable development.

Source: UN DESA and UNDP 2012.

3. Review of Lessons from MDG Experiences

3.1 The MDGs: What has been achieved?

The UN annually reports on the progress towards achieving the eight MDGs using 21 (or 23 in some versions) measurable targets and 60 indicators. The latest published report was produced in 2014 (UN 2014a). Table 3.1 lists the MDGs and targets and indicates their current status. In preparing this table it became clear that there are some inconsistencies between the list of targets contained in the 2014 report and the official list provided on the website[7]. In some cases the 2014 report uses a brief summary of the target; and in some cases one but not the other source lists a particular target. These relatively minor disparities are not surprising – the MDG targets evolved to some extent over time. Table 3.1 provides only a brief summary of a rich set of measurements of progress in achieving the MDGs and associated targets. Overall, it can be said that the framing of these goals and their nearly universal endorsement motivated many countries and their development partners to prioritize their achievement. Some targets have been or will soon be achieved; for most targets

[7] http://mdgs.un.org/unsd/mdg/Host.aspx?Content=Indicators/OfficialList.htm, accessed 20 November 2014.

there is at least substantial progress. For a few, such as those related to biodiversity and reversal of the degradation of natural resources, there is no progress at all. Most important, much has been learned that will inform the final version of the future sustainable development agenda.

Table 3.1 Summary of MDGs, Targets and Overall Progress

Goal/Target	Global Progress (UN 2014a)	Notes
1 To eradicate extreme poverty and hunger		
1.A. Reduce extreme poverty by half (proportion of people living on less than USD 1/day –PPP basis $1.25)	This target has been met globally, but not in India or SSA.	The absolute number of people living in extreme poverty is still around 1.2 billion.
1.B. Achieve full and productive employment and decent work for all, including women and young people	"Vulnerable" employment rates remain high, especially for women.	This may not have been a realistic target as desirable as it may be.
1.C. Halve, between 1990 and 2015, the proportion of people who suffer from hunger	The proportion of undernourished people had decreased from 24% in 1990–1992 to 14% in 2011–2013, but progress has slowed in the past decade. Meeting the global target will require an extra effort.	Progress is uneven, especially in SSA and Southern Asia. Despite progress, high levels of underweight and stunted children continue.
2. To achieve universal primary education		
2.A. Ensure that, by 2015, children everywhere, boys and girls alike, will be able to complete a full course of primary schooling	By 2012, 90% of children in developing countries were in primary school.	Progress has slackened considerably in recent years and drop-out rates remain high.
3. To promote gender equality and empower women		
3.A Eliminate gender disparity in primary and secondary education, preferably by 2005, and in all levels of education no later than 2015	By 2012, all developing regions had achieved, or were close to achieving, gender parity in primary education.	Disparities remain high in higher education, and in some regions for primary education.
Women's share of employment	Slow progress being made.	Listed in UN 2014a but not on website.
Women's equal representation in national parliaments	By early 2014, 46 countries had female representation of at least 30%.	Listed in UN 2014a but not on website.
4. To reduce child mortality		
4.A. Reduce by two-thirds, between 1990 and 2015, the under-five mortality rate	Substantial progress but the world is still falling short of the target.	All regions have cut the rate by at least half except SSA and Oceania.
5. To improve maternal health		
5.A.Reduce by three quarters, between 1990 and 2015, the maternal mortality ratio	Much more needs to be done—globally well off target: 45% reduction achieved by 2014.	
5.B. Achieve, by 2015, universal access to reproductive health	Modest progress; but only half of pregnant women have the recommended 4 ante natal visits.	SSA and South Asia lagging far behind.
6 To combat HIV/AIDS, malaria, and other diseases		
6.A. Have halted by 2015 and	Substantial progress but HIV rates	

Goal/Target	Global Progress (UN 2014a)	Notes
begun to reverse the spread of HIV/AIDS	still too high.	
6.B. Achieve, by 2010, universal access to treatment for HIV/AIDS for all those who need it	9.5 million people receiving treatment by 2012—good progress but not universal yet.	
6.C. Have halted by 2015 and begun to reverse the incidence of malaria and other major diseases	Good progress reported—UN 2014a expects the target to be met by 2015	Between 2000-2012 estimated 3.3 million lives saved from malaria, of which 3 million were children; 1995-2012 estimated 22 million lives saved from tuberculosis
7. To ensure environmental sustainability		
7.A. Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources	Deforestation, global greenhouse gas emissions continue at high rates. Renewable water resources are becoming more scarce.	Water resources depletion especially high in North Africa, Arabian Peninsula, Western, Southern and Central Asia.
7.B. Reduce biodiversity loss, achieving, by 2010, a significant reduction in the rate of loss	Terrestrial and marine protected areas increasing. Biological diversity is decreasing.	
7.C. Halve, by 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation	The water supply target had officially been met by 2010 (2.3 billion more people got access), but not the sanitation target; 1 billion people gained access to sanitation but 2.5 billion still have no access. It is unlikely the sanitation target will be reached.	Globally 89% have access to improved water supplies according to figures used by the UN. Rural people have less access than urban people to improved water and sanitation. Oceania and SSA show the greatest gap between achievement of water supply and the target.
7.D. By 2020, to have achieved a significant improvement in the lives of at least 100 million slum dwellers	The target of improving the lives of 100 million slum dwellers has been met, but the number of slum dwellers is growing.	Slums are characterized by the absence of basic services, such as improved drinking water and adequate sanitation, along with insecure tenure, non-durable housing and overcrowding (UN 2014a). Number of slum dwellers was estimated at 760 million in 2000; in 2012 the estimate was 863 million.
8. To develop a global partnership for development		
8.A. Develop further an open, rule-based, predictable, non-discriminatory trading and financial system	ODA has recovered and is at its highest level. Modest progress on trade liberalization.	Includes a commitment to good governance, development and poverty reduction - both nationally and internationally.
8.B.& 8.C. Address the special needs of the least developed countries, landlocked developing countries and small island developing States	Aid is shifting away from the poorest countries, especially from SSA.	
8.D. Deal comprehensively with developing countries' debt	Debt burden of developing countries stable at about 3%. Debt burden is lower than in 2000 but is	

Goal/Target	Global Progress (UN 2014a)	Notes
	not changing.	
8.E. In cooperation with pharmaceutical companies, provide access to affordable essential drugs in developing countries	No data in UN 2014a.	
8.F. In cooperation with the private sector, make available the benefits of new technologies, especially information and communications	Use of modern communication technologies growing rapidly: by 2014, 3 billion (40% of global population) on line, 7 billion with mobile phone subscriptions.	

For a complete list of targets and indicators see: http://mdgs.un.org/unsd/mdg/Host.aspx?Content=Indicators/OfficialList.htm (accessed 2 December 2014).

Source: UN 2014a.

3.2 Lessons learned from implementing the MDGs

A recent report prepared by the United Nations Office for Sustainable Development (UNOSD) of UN-DESA and the United Nations University (UNU), in collaboration with the Stockholm Environment Institute (SEI) and the Global Water Partnership (GWP), has identified the most important lessons learned from implementing the MDGs (UNU and UNOSD 2013). One lesson is that setting goals and targets through a public consultative process can lead to prioritization of policies and investments to achieve these targets. However, this makes it imperative that the targets be meaningful in achieving the broader goal of eliminating extreme poverty and hunger in a way that is sustainable and provides a foundation for continuing progress. The MDGs had the advantage of being few in number, clear and inspiring, and ambitious but feasible. However, UNU and UNOSD (2013) observe that the focus remained narrow; the MDGs never effectively addressed long-term sustainability or their relationships to economic growth. Their quantitative and deadline-driven nature provided a way to measure progress globally, but resulted in ignoring inherent inequalities; therefore the poorest and most disadvantaged people were neglected as targets would have been more difficult to achieve — in other words, countries focused on “easier” low-hanging fruits.

The inadequacy of data for measuring progress is another issue raised. The effort to find cost-effective and credible indicators and data to enable measurement of progress has also led to substantial improvements over time in data collection and analysis. Nevertheless, tracking and measuring progress in a way that is meaningful remains a big challenge. Table 3.2 summarizes the overall strengths and weaknesses of the MDGs as identified by UNU and UNOSD (2013). The next sub-section focuses in more detail on the achievements and lessons learned related to the water and sanitation targets, and the application of integrated water resources management.

3.3 Water and sanitation: Achievements and lessons learned

3.3.1 MDG 7 on environmental sustainability

The water and sanitation target comes under MDG 7 on achieving environmental sustainability. UNU and UNOSD (2013) summarize key lessons learned from implementing MDG 7 on environmental sustainability as follows:

- Challenges with monitoring at the country level as a product of inadequate data, weak institutional frameworks, and insufficient capacity;

- Weak links between MDG 7 and other MDGs and in articulating the linkages between environmental sustainability and poverty;
- Fragmented by diverse targets (e.g. there seems to be no rationale for locating the drinking water target under MDG 7);
- Lack of commitment to adequate investments; and
- Lack of coordination among national authorities.

On the positive side, MDG 7 was based on the recognition that environmental integrity and ecosystem services are critically important to eradicating poverty and achieving greater social justice.

Table 3.2 Summary of the Strengths and Weaknesses of the MDGs

Strengths	Weaknesses
Attributes: • Ambitious but realistic • Simple • Long-term (beyond electoral cycles) • Integrated • Partnership focused • Quantified and deadline driven	**Attributes:** • Donor-led with little attention to local context • Based on average progress at national or global level • Messy goal structures and data poverty • Weak environmental targets • Focus only on developing economies
Outcomes: • Mobilised public and high-level political support for development • Increased aid pledges and aid commitments • Increased international attention to poverty • Increased priority given to poverty reduction by developing countries • Helped to advance policy debates, spur advocacy • Greater coordination of international development and development implementation • Production of poverty-related data • Increased focus on social dimensions (but not multi-dimensional)	**Outcomes:** • Failed to deal with inequalities, neglect of the poorest and most vulnerable • Neglect of how growth can contribute to development outcomes • Missed dimensions including climate change, the quality of education, human rights, economic growth, infrastructure, good governance and security • Lack of accountability • Not multi-dimensional • Missed the opportunity to discuss sustainability at the global level for all countries

Source: UNU and UNOSD 2013: 12, Table 1.1.

3.3.2 Water and sanitation coverage: The official figures

The WHO/UNICEF Joint Monitoring Program (JMP) for Water Supply and Sanitation publishes annual reports on progress toward achieving Target 7C, "reducing the number of people without sustainable access to safe drinking water and basic sanitation by half by 2015 (from a 1990 baseline)". The most recent report, published in 2014, covers the period through 2012 (WHO and UNICEF 2014). Table 3.3, below, summarizes the indicators used to measure access to both drinking water and sanitation. Annex 1 of that report explains the JMP methodology in some detail. The JMP depends on data from individual countries which are not necessarily comparable; therefore it has to use various statistical and other methodologies to enable international comparisons. This means that in some cases national data differ from JMP data. Further, in the process of implementation the original criterion of "safe" was modified to "improved". Essentially, an improved drinking water source is defined as one constructed in a way that adequately protects the source from outside contamination, particularly faecal matter. An improved sanitation facility is one that hygienically separates human excreta from human contact (WHO and UNICEF 2014: 48, Annex 1). The JMP

envisions the categories in Table 3.3 as a "ladder": reading from the bottom of the table toward the top, there is a progressive improvement in the quality of access to drinking water and sanitation.

Table 3.3 Water and Sanitation Improved and Unimproved Categories Used by JMP

Drinking-water source categories	**Sanitation categories**
"Improved" sources of drinking-water:	**"Improved" sanitation**:
Piped water into dwelling	Flush toilet
Piped water to yard/plot	Piped sewer system
Public tap or standpipe	Septic tank
Tubewell or borehole	Flush/pour flush to pit latrine
Protected dug well	Ventilated improved pit latrine (VIP)
Protected spring	Pit latrine with slab
Rainwater	Composting toilet
	Special case (flush/poor but to unknown place)
"Unimproved" sources of drinking-water:	**"Unimproved" sanitation**:
Unprotected spring	Flush/pour flush to elsewhere
Unprotected dug well	Pit latrine without slab
Cart with small tank/drum	Bucket
Tanker-truck	Hanging toilet or hanging latrine
Surface water	No facilities or bush or field (various types of "open defecation")
Bottled water (classified on a case-by-case basis)	

Source: http://www.wssinfo.org/definitions-methods/watsan-categories/ (Accessed 24 November 2014). The website provides specific definitions of each type.

Over the past two decades, significant progress has been made globally in improving access to clean water and to a lesser extent sanitation services. The JMP estimates that between 1990 and 2012, some 2.3 billion people gained access to an "improved" water supply, bringing global coverage to 89%. This is a remarkable achievement and exceeds the MDG target (though this definition does not specify whether it is adequate and safe). However, this is likely to be under-estimated for a number of reasons, including poor operation and maintenance of water services after construction, lack of information on the actual quality of water delivered, and actual usage patterns[8]. The High-Level Panel on the Post-2015 Development Agenda estimates that perhaps two billion people do not have access to safe water; and the number whose right to water is not satisfied is even greater, perhaps as much as 3.5 billion. The latter figure is arrived at by using more precise data on the quality of piped water (Onda et al. 2012; WWAP 2014). A recent analysis by the UN Water "Global Analysis and Assessment of sanitation and drinking-water" ("GLASS"), using data from 94 countries and 23 aid agencies also presents a sobering picture: half of the rural poor who have gained access to improved water and sanitation are still using unregulated sources having no guarantee of safety (GLAAS 2014).

[8] For example, see the report of the South Africa Human Rights Commission (2014).

Fewer than half the countries even monitor progress in extending water and sanitation services to the poor.

According to official data, since 1990, sanitation coverage has increased by 21% in developing regions, such that 57% now have access to improved sanitation facilities. This means that in spite of substantial improvements, the sanitation MDG target will not reached at the global scale. About 2.5 billion people still have no such access, about 7% fewer than the number with no access in 1990 (2.7 billion). About a billion people, 15% of the global population, continue to practice open defecation. The global figures mask the large variations and inequities among and within countries, between rural and urban communities, and between genders and other social groupings. The JMP report discusses these inequities in detail (WHO and UNICEF 2014), as does the GLAAS (2014) report. This section briefly highlights a few of the most important inequities, while Box 3.1 summarizes results from a recent study showing that the apparent lag in achieving the sanitation goal is a result of a measurement problem.

Box 3.1 Comparing Progress on Water and Sanitation Using Equivalent Measures

The official and nearly unanimous perception is that while there has been substantial progress toward meeting the target of reducing by half the number of people with no access to safe water, there is a significant lag in reaching the same target for access to sanitation services. However, a recent study demonstrates that this perception comes about because equivalent measures are not being used: the benchmark for drinking water is community-level access while for sanitation it is household access. Therefore, a pit latrine shared between households is not counted towards the MDG target. When the data are re-formulated to compare household level access to drinking water and to sanitation and to compare community-level access to water and to sanitation, a different result emerges. Using equivalent measures, the deficit for both water and sanitation is similar – indeed sanitation progress exceeds that for water.

Future targets should be made equivalent to emphasize the interdependencies. Since household-level access to water and sanitation produces greater benefits than community-level access, the future SDG targets for both should be framed at household level. This would also allow for a combined target.

Source: Cumming et al. 2014.

The lowest levels of drinking water coverage are in sub-Saharan Africa (SSA): only 64% have access to a basic improved water supply compared to the global figure of 89%. Most SSA countries as well as several Central Asian countries are not on track to meet their MDG target. Forty three percent of the people who still have no such access live in SSA. Most of the growth in access to improved water supply was in provision of piped water in East, Southeast and Western Asia, Northern Africa, and Latin America and the Caribbean; there was almost no progress in provision of a piped water supply in SSA. However, as the JPM report notes, this apparent lack of progress is in part because SSA countries are beginning from a low base and are characterized by rapid population growth. Since 2000, nearly a quarter of the population has gained access to an improved water supply, i.e. on average 50,000 people per day for 12 years in a row. By this measure, progress is quite impressive even if it falls short of the MDG targets.

The pattern for progress in achieving improved sanitation also varies considerably by region: in 46 countries, fewer than half the population has such access. These countries are largely concentrated in southern Asia and SSA, though the rate of improvement in southern Asia is far higher than in SSA. Nevertheless, 40% of the people with no access to improved sanitation facilities live in southern Asia.

But even these regional inequities mask those found within regions and countries. The JMP report (WHO and UNICEF 2014) devotes a chapter to this topic, using a variety of surveys and other sources. The data to track inequities, especially within countries, are not universally available but are indicative. The report discusses the cases of Mozambique and Ethiopia. Open defecation is practiced by 40% of the population of Mozambique, compared to 25% for SSA as a whole. Within Mozambique, provinces vary from 2% to 75% open defecation. Urban rates (15%) are far lower than the rural average (50%). But this figure also masks large inequities based on wealth: the poorest 20% of urban dwellers have nearly the same rate of open defecation as is found in rural areas, and in rural areas, 96% of the poorest quintile practice open defecation compared to 13% of the richest quintile. In contrast, Ethiopia has reduced the rate of open defecation by half since 2000, and this steep decline characterizes all 11 provinces despite wide variations in wealth, ethnicity and other socioeconomic characteristics.

Overall, there are widespread inequities in access to improved water supply and sanitation.

The JMP report discusses the continuing wide disparities between rural and urban coverage in developing countries. In addition, within both rural and urban areas, wide disparities in access based on wealth have continued and in some cases increased. Using a sample of countries where wealth data are available, the report finds that while most countries have reduced inequities within urban areas (i.e., progress was greater in poor urban communities), for rural sanitation the opposite is the case: wealthier people have gained access more rapidly than poor people. Data on access by gender, ethnicity, and education is more anecdotal, but overall there are widespread inequities in access to improved water supply and sanitation based on these criteria – again with some individual country exceptions.

The GLASS report provides an explanation of the underlying reasons for this continuing inequity despite well-intentioned policies (GLAAS 2014). The study found that two thirds of the 94 countries surveyed have national legislation recognizing access to drinking-water and sanitation as a human right; and 80% of the countries, regardless of their income levels, have policies of universal access and special measures to provide this access to the poor. However, only a few of these countries have monitoring systems to track the extension of services to the poor (a range of 31% to 45%); and even fewer consistently apply financial measures to reduce the disparity between the rich and poor (a range of 13%-21%). Regulators and engineers are in short supply, and monitoring remains a serious challenge for many countries.

3.3.3 Water and sanitation in the MDGs: Gaps and lessons

Over the past decade, the shortcomings in terms of the way that the overall role of water is framed in achieving all of the MDGs have been identified, as have specific gaps and lessons from the

implementation of Target 7C on water and sanitation. The report by UNU and UNOSD (2013) has identified the most important gaps and lessons for the future , as follows:

- Despite its importance, hygiene was not explicitly included in the target, though it has received considerable emphasis in recent years.
- There have been significant shortfalls in terms of monitoring of progress, institutional and regulatory frameworks, and capacities at the national level.
- Setting a global goal in terms of percentages to be achieved led to an understandable emphasis on targeting those most easily reached, rather than the poorest and most disadvantaged people. This is the inequality challenge: as noted above, in many regions and countries inequities in access to basic water and sanitation services have actually increased. In the future, especially with the recognition of water and sanitation as a human right, the focus must shift to achieving universal coverage.
- Dimensions of safety, reliability and sustainability are not reflected in the proxy indicators used to track progress. It is therefore likely the number of people with access to "safe" water is less than the official number with access to "improved" water — a point emphasized by other studies and acknowledge by the JMP. The JMP use of the "sanitation and drinking water ladders" partially but not fully addresses this point.
- Recent studies show a statistically significant link of water and sanitation to most of the other MDG indicators. Given the critical importance of water and sanitation to human health, the cross-sectoral linkages need to be fully acknowledged in future. A recent meta-study of 27 studies of the impacts of water, sanitation and hygiene interventions adds another dimension: when reviewed jointly from health and development perspectives, the study found evidence of a broader range of impacts than when reviewed from a health perspective alone (Loevinsohn et al. 2014).
- In absolute terms, rapid population growth combined with increasing urbanization has resulted in an increase in the number of urban people without access to improved sources of water and sanitation services, a trend not recognized with the current approach to measurement.
- There is a controversy whether improved drinking water coverage is an indicator or a driver of social and economic progress. This observation points to the need to factor economic growth into the MDG process.
- Finally, in addition to the need to collect more data, there is also a need to analyse it more effectively and use it for more informed decision-making.

3.3.4 Water resources management in the MDGs

Agenda 21 advocated taking an integrated approach to water resources management and development – what has become known as "Integrated Water Resources Management" (IWRM) (UNCED 1992: chapter 18).[9] However, there is no specific MDG goal or target referring to water resources management. It is subsumed under Goal 7 on environmental sustainability but is not an

[9] See also GWP 2014:3, Box 2 and UNEP 2012.

official MDG target. Transboundary water management is also not specifically targeted but could be considered under MDG 8 on global partnerships for development. In reality it is not: the MDG Gap Task Force report on MDG 8 does not even mention the topic (UN 2014b). After the 1992 summit, what had been conceptualized as integrated water resources *development* and management quickly lost the "development" emphasis: the focus of IWRM came to be on managing sector trade-offs and environmental protection. IWRDM morphed into IWRM, and people-centred outcomes were de-emphasised in favour of environmental concerns. No strong connections were developed between water development and management on the one hand, and reducing hunger and poverty on the other. Water resources management became a "poor cousin" to drinking water and sanitation in the MDG context (UNU and UNOSD 2013).

Efforts were subsequently made to link IWRM to the MDGs, most notably at the Earth Summit in South Africa in 2002. The Johannesburg Implementation Plan committed countries to develop IWRM plans within a few years. A UN survey in 2012 showed that 82% of the countries surveyed had implemented reforms of their water laws and were proposing integrated approaches to the development, management and use of water resources. Sixty five percent had developed IWRM plans. In Africa, the African Ministers' Council on Water (AMCOW) had declared "Water for Growth" as its priority in the next decade (UNU and UNOSD 2013). In 2012, with assistance from the UN and others, AMCOW carried out a study on progress by African countries in implementing IWRM; and the UN carried out a similar study on the global level (AMCOW 2012; UNEP 2012). Both studies found that while there was measurable progress in developing IWRM policies, legal frameworks, and plans, as well as in implementation, progress was very uneven. UNEP (2012) noted that progress had slowed, even regressed, in countries with low or medium Human Development Index (HDI) scores since a 2008 survey, and much remains to be done to finance and implement IWRM in these countries. The AMCOW (2012) study highlighted capacity constraints and lack of monitoring data. Nevertheless, both studies confirmed that countries recognize the importance of IWRM and are committed to making further progress in the future. All HDI groups ranked domestic water supply as having the highest priority, with water for cities ranked second. Water for agriculture was ranked as a high priority by the lowest HDI countries, while water for the environment was ranked as high priority mainly by high HDI countries (UNEP 2012).

In recent years there has been a growing critique of the application of IWRM in developing countries. None question the need for an overall integrated approach, but despite good intentions, some researchers have noted that IWRM implementation is very slow and complex; that it has placed too much emphasis on environmental protection and not enough on development of water resources, especially in countries where water resources remain under-developed and poor people lack access to basic water supplies; and even that the emphasis on managing the resource has been at the expense of addressing poverty issues (Merrey et al. 2005; Merrey 2008; Molle 2008; Tortajada 2014; Giordano and Shah 2014; van Koppen and Schreiner 2014; Schoeman, Allan and Finlayson 2014). While some of these and other critiques focus on making IWRM implementation more practical and more focused on human needs, Schoeman, Allan and Finlayson (2014) argue that combining the positive elements of the IWRM paradigm with those of ecosystem-based approaches and adaptive management, while managing tensions inherent in this integration process, could form a new water paradigm more useful in addressing the challenges of large-scale unpredictable systemic planetary system changes. Their proposal is very close to the "ecosystems" approach discussed above in sub-section 2.1.4.

It is clear that the MDGs were not based on a full understanding of the linkages between water and the MDGs, and did not include adequate attention to the role of water in achieving the poverty, food security, nutrition, health and other goals.

It is clear that the MDGs were not based on a full understanding of the linkages between water and the MDGs, and did not include adequate attention to the role of water in achieving the poverty, food security, nutrition, health and other goals. Further, within the water management sector, there is now a better understanding of the multiple roles of water and recognition of the need for new concepts and ideas, for example going beyond the traditional IWRM paradigm. And because water resources are often shared among countries, there is also a need to recognize the importance of managing shared water resources, especially the benefits that can be derived from their use, in equitable, productive and sustainable ways.

3.4 Transitioning from MDGs to SDGs: Enhancing attention to water security

There is widespread agreement that water is a key entry point for achieving the future sustainable development agenda. The question is no longer whether water should be part of the SDGs, or whether it should continue to be focused on water and sanitation as was the case for the MDGs. Rather, *the critical question is how to frame the role of water within the sustainable development agenda, linking it to the many other challenges*. The proposal to enhance the visibility and role of water in the sustainable development agenda should not be seen as competing with other high priorities; rather, it should be perceived as an opportunity and entry point to developing and implementing a coherent integrated programme that will lead to achieving the 'future we want'. This sub-section discusses six lessons learned that could inform the framing of the SDGs.

3.4.1 Need for a conceptual framework linking water clearly to the sustainable development agenda

The fact that water is ubiquitous, i.e. has linkages to, and roles in, all aspects of life and therefore is in some way related to all possible SDGs is both a strength and a challenge. It is a strength precisely because it offers a common shared entry point for achieving many of the goals and targets that will be part of the future sustainable development agenda. It is a challenge because it has proven difficult to develop a conceptual framework that is broad enough to encompass the sustainable development challenges while keeping it simple enough to be easily communicated and used as a practical tool. Two proposed frameworks are reviewed briefly here.

UNU and UNOSD (2013) observe that the 14 proposed water-based goals that had emerged by mid-2013 naturally cluster into three categories: 1) water as a sector; 2) water as an enabler; and 3) water as a supporter (of development and growth). The *water as a sector* cluster of proposals tend to prioritize WASH, water resources management, and water quality, in essence building on the MDG 7 water and sanitation target plus the IWRM agenda that emerged from the 2002 WCCD. Some versions suggest extending and expanding water targets, while others suggest a unified water goal. In these proposals the linkages with the overall sustainable development agenda and economic growth are not explicit. The *water as an enabler* cluster emphasizes the role of water development in promoting agricultural growth, energy production, industry and commerce, and employment generation. Water in this framing makes diverse contributions to the rate and equity of economic growth. This approach to framing water effectively links it to key processes of state implementation including public expenditure and institutional roles, sector-wide approaches and government

reform. It also opens space for the private sector and civil society. The *water as a supporter* cluster of proposals is less focused on water *per se*; its primary goal is to create a broad international development agenda through transformation of the global development assistance framework. Water would support the achievement of an overall global development agenda. The proposals on water and the SDGs are discussed in more detail in Sections 4 and 5, below.

UN Water (2014) acknowledges the fundamental role of water in achieving other goals within the sustainable development agenda, but argues a specific water goal is very important. It therefore advocates for a specific water sector goal, with multiple targets. This proposal emerged from a fairly comprehensive process of consultation and analysis since Rio +20. This consultation process culminated in the "Budapest Water Summit," involving about 1200 participants from governments, civil society, private sector, and others. It issued a statement calling for a "dedicated and comprehensive SDG on water" (UN 2014: 13). UN Water therefore proposes an overarching goal, "**Securing sustainable water for all**", to be supported by a coherent, interdependent and management set of five targets.

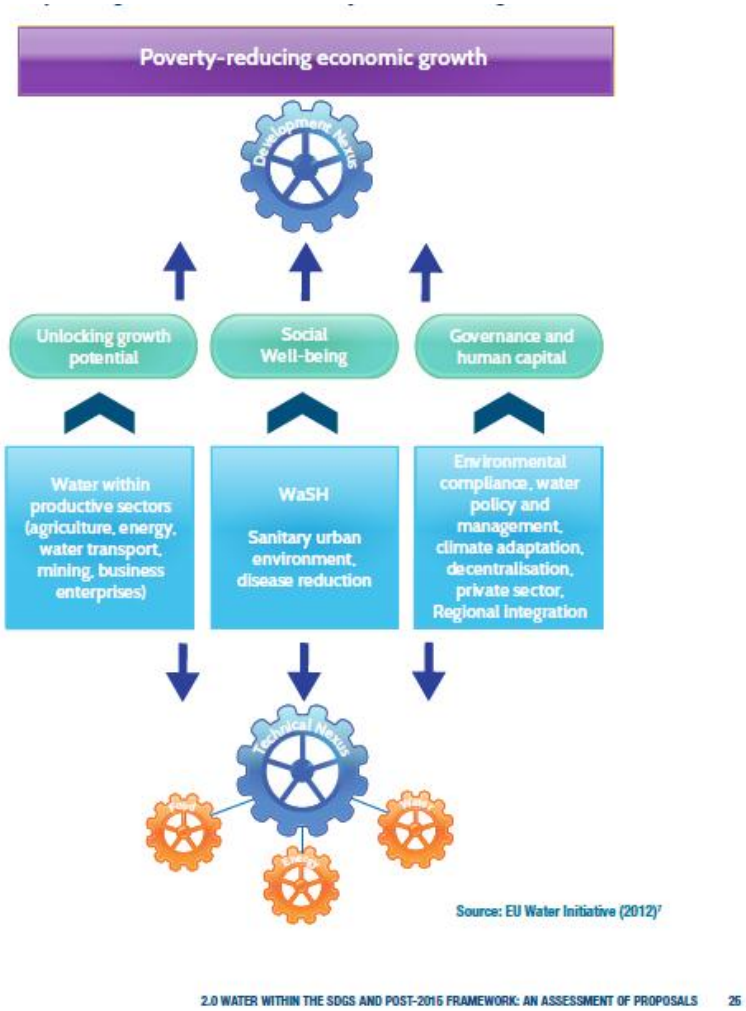
The drawback to considering water as a sector is that the critical linkages to other sectors and indeed other SDGs are invisible or non-existent. For example, improved access to and use and productivity of water is a necessary condition for promoting agricultural and energy production, which will be needed in order to eliminate poverty, hunger and malnutrition. Yet this function gets lost as a sub-category under "water resources management". The 'water as a supporter' cluster focuses on improving the global institutional framework for promoting the development agenda – a worthy and important goal – but it de-emphasizes water as a critical ingredient. The 'water as an enabler' cluster is attractive because it places water at the core of promoting long term equitable and sustainable growth while also achieving core social goals. Figure 3.1 is an illustration of one possible conceptual framework emphasizing water as an entry point to achieving multiple developmental goals. Section 5 returns to this issue of creating a useful conceptual framework to highlight the role of water in the SDGs.

3.4.2 Strong focus on equality and human rights: A 'human development' agenda

There is broad agreement that the MDGs largely ignored human rights and inequalities, and these concerns should be at the core of the future sustainable development agenda (UN Water 2014). In the years since the MDGs were initiated, access to water and sanitation has come to be officially recognized as a human right as defined by the 1948 Universal Declaration of Human Rights. The 2010 UN General Assembly endorsed this right and the Human Rights Council resolution of the same year stated that the right to water and sanitation is based on the right to an adequate standard of living.[10] Box 3.2 provides a specific definition of this human right. The UN Special Rapporteur on the Human Right to Safe Drinking Water and Sanitation argued that water and sanitation should be treated as two separate rights, though this has not been officially adopted (Albuquerque 2012).

Figure 3.1 Water for Poverty-reducing Economic Growth and Social Transformation

[10] See UN Office of the Commissioner of Human Rights, UN-HABITAT, WHO (no date a) for a detailed discussion of the background to the recognition of water and sanitation as a basic human right.



Source: UNU and UNOSD 2013: 25, Figure 2.1, which is drawn from an unpublished European Union Water Initiative Source.

Box 3.2 Definition of the right to water and sanitation

"[I]nternational human rights law entails specific obligations related to access to safe drinking water. These obligations require States to ensure everyone's access to a sufficient amount of safe drinking water for personal and domestic uses, defined as water for drinking, personal sanitation, washing of clothes, food preparation, and personal and household hygiene. These obligations also require States to progressively ensure access to adequate sanitation, as a fundamental element for human dignity and privacy, but also to protect the quality of drinking-water supplies and resources."

Source: UN Office of the Commissioner of Human Rights, UN-HABITAT, WHO, no date a: 3.

The recognition of water and sanitation as a human right (or rights) has important implications for the framing of the sustainable development agenda, as explained by Albuquerque (2012) and the UN Office of the Commissioner of Human Rights, UN-HABITAT, WHO (no date a). First, it means that setting the water and sanitation goal in terms of reducing the number with no access by some percentage, as was the case with the MDG water and sanitation target, is no longer acceptable: progressively achieving universal access must be the goal. Second, it highlights the issue of equality. The way in which the MDG water and sanitation targets were established has incentivized

governments to focus on providing services to the easiest targets — urban areas rather than rural areas for example. As described above in sub-section 3.3, this approach has actually led to amplifying unequal access in many instances.

The right to food is recognized in the 1948 Declaration and has been confirmed by various treaties and agreements since that time, as explained in a separate publication by the UN Office of the Commissioner of Human Rights, UN-HABITAT and WHO (no date b). However, despite the obvious importance of water for production and processing of food, the right to water has to date been defined narrowly as referring to "safe drinking water for personal and domestic uses" (Box 3.1). The UN Office of the Commissioner of Human Rights, UN-HABITAT and WHO (no date b: 12) therefore addresses the question, *Does the right to water extend to water for agriculture or pastoralism? What does it mean in relation to water for the environment?* It concludes that because of the "interdependence and indivisibility" of all human rights, the right to water does ensure priority for water used in agriculture and pastoralism, especially for smallholders, "when necessary to prevent starvation". Linking the right to water to the right to food, especially for poor people, has been discussed numerous times in international forums over the past few decades, as outlined by the draft report from the HLPE Committee on World Food Security (2015 [forthcoming]). This is not yet an officially recognized dimension of the right to water, but it seems likely that in the near future it will be so recognized. Therefore, although it complicates matters, the sustainable development agenda should take this into consideration.

A critically important dimension of equality is gender equality. Including gender equality as a specific SDG as is currently proposed is important but not enough. Women and girls are disproportionally affected by economic, social and environmental stresses. Many development pathways further amplify gender inequality, for example by increasing their work loads. Women and girls are most affected by the lack of easy access to domestic and productive water and to adequate sanitation facilities. The impacts of overexploitation of natural resources like water and of climate change affect women and girls in ways that further exacerbate inequality and undermine women's rights and capabilities. Therefore "socially transformative investments" at the core of the sustainable development agenda are needed to achieve gender equality. This will require overcoming strong political, institutional and social barriers (UN Women 2014).

Water scarcity has traditionally been viewed through a physical or economic utilitarian lens: it is a matter of increasing supply where possible, and/or managing demand. However, water scarcity is not an entirely "natural" phenomenon. It is generated through socio-political processes, i.e. through exclusion, biases, and discrimination. Therefore, as argued by Mehta (2014), the global community should approach the right to water through a broad "human development" approach. This approach breaks down the false distinction between water for domestic and productive purposes, challenges the traditional narrow focus on utilitarianism and efficiency, and directs primary attention to equity and the interests of the poor and marginalized. Table 3.4 summarizes four ways to view water scarcity and the implications for policy and the sustainable development agenda. The point is not that increasing supply or improving efficiency are wrong; rather, that by themselves, they are inadequate to address the fundamental issue of inequitable access to water for productive and domestic uses.

Table 3.4 Four Perspectives on Water Scarcity and their Implications for Policy

	1) Physical/first-order scarcity	2) Economic/ second-order scarcity	3) Third-order scarcity/ adaptive capacity	4) Scarcity arising through socio-political processes
Characteristics	Volumetric quantities; Population growth; Projection of future demand; industrial growth	Inadequate development of water infrastructure; Poor management and institutional arrangements	Social, political and economic context of water management	Scarcity as a product of discursive and socio-political processes; Entitlements failures
Water management Solution	Enhancing supply through storage (for example small vs. large dams debate); Desalination; Extra basin transfer of water	Water reallocation through water markets; water reform; Technological fixes; Pricing; Increasing efficiency	Social adaptive capacity through education, cultural change and lifestyle change	Deliberation; Decision making processes; Equity and reallocation
Access solution	MDGs; Lifelines	Water as an economic good; Pricing; Privatization; Community management/ PPPs	Social adaptive capacity through education, cultural and lifestyle change;	Redistribution/enhancing equity; Instituting entitlements to water (for example human right to water)

Source: Mehta 2014: 61, Table 1.

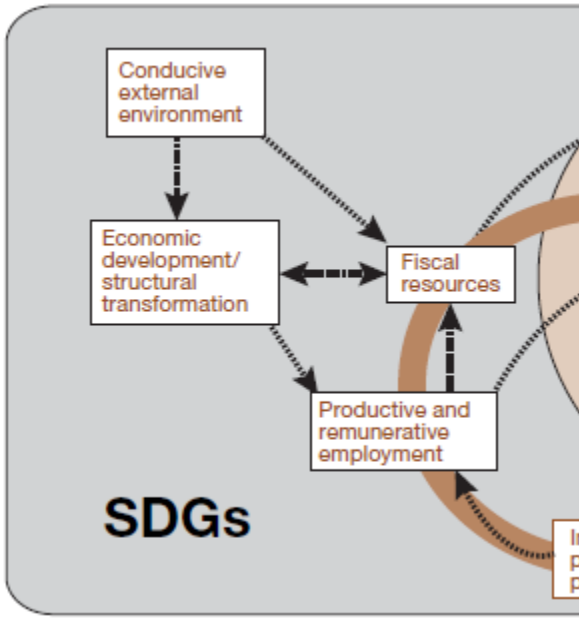
3.4.3 Stronger emphasis on SDGs as drivers of economic growth

A recent report by the UN Conference on Trade and Development (UNCTAD 2014) makes a very compelling case for giving more attention to linking economic development to human development as represented in the MDGs and proposed SDGs. Human development and economic development are closely inter-linked. Human development is the primary objective of economic development and cannot be achieved and sustained without economic development. The fundamental economic development goal of LDCs should be to enhance the productivity of and returns to labour. This can only be achieved through radical structural transformation of their economies. The report takes a nuanced view of such transformations: recognizing that industrialization may no longer be as attractive a path as had been the case in the past, it places a strong emphasis on diversification within as well as among sectors (for example agriculture), and diversification of the rural economy. UNCTAD's position is supported by other recent research on agriculture-led growth that raises labour productivity as a driver for poverty alleviation in developing countries (e.g. Dorosh and Mellor 2013).

UNCTAD (2014) argues that at present, most LDCs are caught in a vicious cycle. Poverty, undernourishment, poor health, and low educational standards reduce potential labour productivity, leading to slow economic growth. Slow economic growth means that job creation is not adequate to raise incomes above poverty levels. Low incomes in turn perpetuate low human development. The MDGs focused on human development without sufficient attention to economic development. This has both retarded progress towards achieving the MDGs and reduced the capacity of LDCs to sustain progress that had been made. The inability of the poorest countries to achieve the MDG goals and targets is partly a reflection of their failure to escape this vicious cycle. For example, a reliable

stream of funding is needed to sustain quality education for all and to operate and maintain water supply infrastructure. This is not possible without substantial economic growth – increasing the size of the economic pie in addition to its equitable distribution. The proposed SDGs are even more ambitious than the MDGs, in a context of uncertainty about global economic trends and finances available for development assistance. The means for achieving and sustaining human development goals needs far more attention. Figure 3.2 illustrates the framework proposed by UNCTAD (2014).

Figure 3.2 Completing the Circle: A Framework Integrating Economic Development and the SDGs



The current trends in the use of water are clearly not sustainable and indeed pose a threat to the entire planetary system as well as specifically to human populations. These trends must be reversed; otherwise the sustainable development agenda will not be achieved.

Source: UNCTAD 2014: 50, Chart 22.

This argument stressing the linkages of economic and human development is relevant for specifying the potential roles of water in achieving the SDGs. A recent UN study of water and the proposed SDGs in 11 countries found that water is not well-integrated into national development plans (UNU 2015 [forthcoming]). First, access to quality domestic water and sanitation is a way of improving health and therefore productivity of labour. Second, enhancing the productive use of water in agriculture will increase the possibility of reducing malnutrition and hunger. Third, better management of water resources including recycling wastewater will contribute to the provision of quality water for domestic and productive uses. But these are all opportunities for promoting economic development and job creation as well. A major benefit of irrigation is enhancing the productivity of and demand for labour (Namara et al. 2010), as well as reducing the risk of crop failure due to erratic climate. Expansion of private pump irrigation contributes to the diversification of rural economies through manufacturing, servicing, spare parts, etc. (de Fraiture and Giordano 2014). For example, communities in Ethiopia having water access through deep well irrigation are 24% less poor compared to their rainfed agriculture counterparts (Hagos et al., 2012). There are also growing opportunities to turn urban waste management into profitable businesses (e.g. IWMI 2014).

3.4.4 Based firmly on sustainability in the context of global challenges

Although "sustainable development" was intended to be at the core of the MDGs, as UN Water (2014) notes, sustainability did not get sufficient attention. As is the case for human rights, most

countries at Rio +20 and other forums agreed that sustainability needs to be a core focus of the SDGs. There are multiple dimensions to "sustainability". The normal reference is to environmental sustainability, especially in the context of global climate change, land degradation, deforestation, water pollution, and growing threats to the Earth's life support systems (for example see UNU and UNOSD 2013). The other dimensions, which have multiple aspects, receive too little attention: the economic, financial, political and social dimensions of sustainability – though these dimensions were acknowledged at the Rio +20 Conference (UN DESA 2014a). Failure to consider these dimensions could lead to failure of the sustainable development agenda. The economic and financial aspects are discussed in sub-section 3.4.3, above. The social and political aspects are addressed in sub-sections 3.4.2, above, and 3.4.5, below. Environmental sustainability, especially with reference to water, has been discussed in multiple sections above. The current trends in the use of water are clearly not sustainable and indeed pose a threat to the entire planetary system as well as specifically to human populations. Threats include rising demand for water that exceeds available supply; the failure to improve productivity of water in agriculture, energy production and manufacturing; the increasing levels of pollution as a result of discharge of untreated wastewater; and the resulting threats to the ecosystems on which all life depends. These trends must be reversed; otherwise the sustainable development agenda will not be achieved.

3.4.5 Prioritize policy and institutional reform and capacity strengthening at multiple levels

There is nearly universal agreement that achieving an ambitious sustainable development agenda while also responding to global systemic challenges will require substantial changes in policies and the institutions that both formulate and implement policies. Changing policies and institutions – in essence changing the incentive structures to encourage certain behaviour patterns and discourage others – is also the most difficult, indeed intractable challenge. For example, many of those involved in the process to specify the future sustainable development agenda explicitly advocate moving toward a "Green Economy". To achieve this, radical changes will be required in regulatory frameworks, tax and trade policies, and consumption patterns to name a few. The resistance to these changes will be fierce. Institutions are characterized by inertia at the best of times; when vested interests are threatened it is normal for them to resist change and preserve their current stream of benefits. Consider the case of management of transboundary water resources. The most successful cases are found in river basins where the participating countries are fairly well-developed and have a broad web of interdependencies, for example in Europe. In the developing world, especially in Asia and Africa, there is real progress in some regions, for example southern Africa. However, in many major basins a long history of conflict reinforces mistrust among the parties, and achieving real cooperation remains a serious challenge. Examples are the Nile in Africa and the Ganges-Brahmaputra and the Indus in southern Asia.

An additional but related challenge is the need for capacity strengthening, as also emphasized in a forthcoming UN report (UNU 2015 [forthcoming]). Capacity strengthening has two important dimensions: institutional and human resources. Institutional capacity refers to the organizational structure, rules and procedures, financial resources, authority and political legitimacy, and incentives needed to enable the people in the organization accomplish the tasks as hand. It clearly also includes the human resource component as well – having the necessary number and types of skills needed. Human resource competencies can be enhanced relatively easily, through educational and training

programs, on-the-job training, etc. But ensuring their institutional home can make good use of their skills is far more difficult, requiring in many cases quite radical reforms in policies and institutions.

3.4.6 Effective monitoring systems linked to adaptive management

Collecting reliable and useful data on a regular basis, converting the data into information that can be used, and communicating the information to decision makers in a way that enables them to use it well is very difficult. It requires considerable institutional and human capacity as well as the financial resources to sustain the process. Data needs to be disaggregated in terms of gender, age, ethnicity, migratory status, geographical local and other relevant dimensions. Another issue is that data may be collected on the same phenomenon from different disciplinary perspectives which complicates comparability and may limit their use. For example, monitoring of water supply programs is often done by a unit of government responsible for provision of water services, but the health outcomes are not monitored as these are the responsibility of a separate unit concerned with health. Such "knowledge silos" can be costly (Loevinsohn et al. 2014). When data are intended to be compared on a global basis another layer of complexity is added: harmonizing among different data collection systems designed for different contexts and purposes than those needed at global levels. Further, it is not enough to simply record outcomes of interventions; it is also critical to know how these outcomes came about, i.e. what was the process, who was involved, and what actions were taken.

Effective monitoring and evaluation of progress and lessons learned in achieving the MDGs has been a big challenge, with no easy solutions. For example, data on access to water and sanitation by the poorest people are especially weak and unreliable (WHO and UNICEF 2014). The JMP report describes improvements that have been made in data collection, and discusses the need to improve it further to enable future SDGs to target these groups effectively. The JMP is currently working on an improved set of indicators (for example to include hygiene) and exploring ways to tap new sources of data. On the assumption that a unified water goal will be adopted as an SDG, the UN agencies are developing a unified water monitoring framework that builds on existing monitoring efforts (e.g. JMP, GEMS-water, Aquastat), and incorporates new sources of data such as from remote sensing. The effort has three objectives: harmonizing monitoring mechanisms, establishing a baseline and tracking system for post-2015, and extending monitoring to cover analysis of inputs and enabling factors (WHO and UNICEF 2014). In essence, this would be an expansion of the JMP to enable analysis of water quality, wastewater, and water resources management.

3.5 Conclusions

Water is a potentially effective and certainly critical entry point to achieve the future sustainable development agenda. In formulating this agenda, the global community can draw on important lessons learned from implementing the MDGs. There are many such lessons, but this section has highlighted the following:

1. A need for a conceptual framework linking water clearly to the sustainable development agenda; a strong focus on equality and human rights — what has been called a "human development" agenda;
2. A stronger emphasis on economic growth and synergies between economic growth and social development; a firm basis in sustainability in the context of global challenges such as climate change;
3. Effective monitoring systems linked to adaptive management; and

4. A very high priority on policy and institutional reform and capacity strengthening at all levels.

4. Ensure Availability and Sustainable Management of Water and Sanitation for All

4.1 The currently proposed SDGs

The Rio +20 Conference mandated an Open Working Group to be established to develop a set of proposed Sustainable Development Goals (SDGs) along with the associated targets and indicators. Unlike the MDGs, the SDGs are intended to be applicable to all countries, not limited to developing countries. The most recent report of the Open Working Group is dated 19 July 2014 (Open Working Group 2014). This document lists 17 Goals and the proposed targets for each Goal. The proposed SDGs are listed in Table 4.1[11].

It is important to note these are not finalized. It is likely that there will be changes made, including a possible reduction to a more manageable number of Goals. However, this is the list of SDGs used in the present report. As this paper was being prepared, the UN Secretary General issued his 'Synthesis Report' on the overall process of moving from the MDGs to the SDGs (UN Secretary General 2014). His report is an important milestone. It commends the work of the Open Working Group and in essence endorses the 17 Goals. However, the Secretary General implicitly recognizes that they need to be further refined; therefore he proposes six "essential elements" to "help frame and reinforce the universal, integrated and transformative nature of a sustainable development agenda" (ibid.: 20). The proposed six essential elements are:

1. *Dignity*: to end poverty and fight inequalities;
2. *People*: to ensure healthy lives, knowledge, and the inclusion of women and children;
3. *Prosperity*: to grow a strong, inclusive, and transformative economy;
4. *Planet*: to protect our ecosystems for all societies and our children;
5. *Justice*: to promote safe and peaceful societies, and strong institutions; and
6. *Partnership*: to catalyse global solidarity for sustainable development.

Table 4.1 Proposed Sustainable Development Goals

Goal 1	End poverty in all its forms everywhere
Goal 2	End hunger, achieve food security and improved nutrition and promote sustainable agriculture
Goal 3	Ensure healthy lives and promote well-being for all at all ages
Goal 4	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
Goal 5	Achieve gender equality and empower all women and girls
Goal 6	Ensure availability and sustainable management of water and sanitation for all
Goal 7	Ensure access to affordable, reliable, sustainable and modern energy for all
Goal 8	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all
Goal 9	Build resilient infrastructure, promote inclusive and sustainable industrialization and

[11] A number of organizations have proposed alternative SDGs with their own targets and indicators. An example is Leadership Council of the Sustainable Development Solutions Network (SDSN 2014). This and other reports remain useful sources of ideas for finalizing indicators.

	foster innovation
Goal 10	Reduce inequality within and among countries
Goal 11	Make cities and human settlements inclusive, safe, resilient and sustainable
Goal 12	Ensure sustainable consumption and production patterns
Goal 13	Take urgent action to combat climate change and its impacts*
Goal 14	Conserve and sustainably use the oceans, seas and marine resources for sustainable development
Goal 15	Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss
Goal 16	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels
Goal 17	Strengthen the means of implementation and revitalize the global partnership for sustainable development

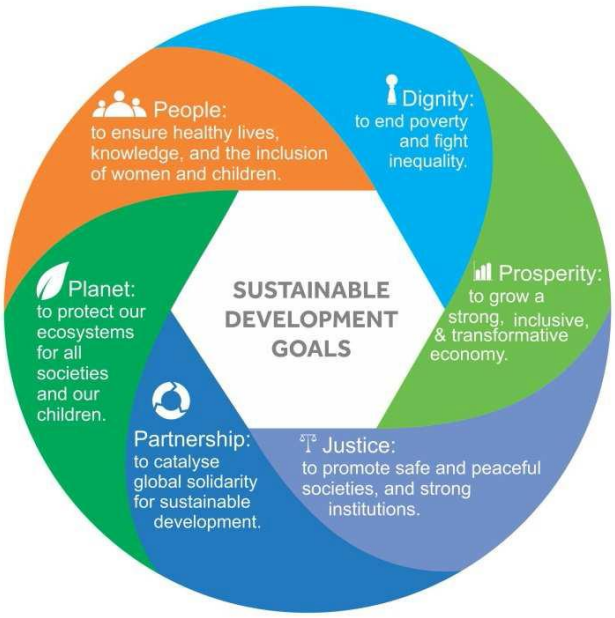
*Acknowledging that the United Nations Framework Convention on Climate Change (UNFCCC) is the primary international, intergovernmental forum for negotiating the global response to climate change.

Source: Open Working Group 2014.

The Secretary General emphasizes the integration of the SDGs as a critical feature, as expressed in Figure 4.1 below. The agenda is broader and more ambitious and inclusive than the MDGs. It is people-focused, and links the sustainable development agenda to larger planetary and ecosystem challenges. It emphasizes the importance of economic growth — but growth that is transformative and sustainable. His report makes no attempt to map the 17 Open Working Groups goals into the six essential elements, though it would not be difficult to do so. An important implication is that if these six "essential elements" become the basis for specifying and communicating the SDGs, the Goals proposed by the Open Working Group may morph into sub-goals or even targets. Finally, it is noted that "water" is mentioned only four times in the entire report.

The rest of Section 4 of this report focuses specifically on the water and sanitation targets.

Figure 4.1 Six Essential Elements for Delivering the SDGs



Source: UN Secretary General 2014:20, Figure 1.

4.2 Assessment of the currently proposed water SDG: The proposed targets

Water is clearly linked to many of the proposed SDGs. Therefore, there has been considerable discussion as to whether the SDGs should include a dedicated water goal, or whether water should appear as an important target incorporated into a number of the SDGs (e.g. the workshop reported in UN-DESA 2013). This is the debate about water as a sector, enabler or supporter (UNU and UNOSD 2013), discussed above in sub-section 3.4.1. A lot of work was done on how to frame water and sanitation goals on which the Open Working Group could draw. UNU and UNOSD (2013) discusses some of these proposals; and UN Water (2014) presents a detailed and comprehensive set of proposals. These are summarized in Table 4.2.

Many of these goal statements, though reflecting critically important water-related challenges (e.g. WASH, wastewater management) are too narrow. Their fundamental flaw is that they do not recognize the integrated multiple uses of water. Separation of domestic water from water for productive uses, water for ecosystems, and water resources management is artificial and does not reflect the reality of the lives of people or of the water cycle. Sanitation and hygiene are also integral components of the water cycle. In addition, agriculture, which uses more than half of all water mobilized by people, and which is critical for food and nutrition security, is either ignored, treated as a threat to other uses, or at best is hidden at the target level. Another drawback is the proposed goals do not clearly reflect linkages to large-scale global trends such as climate change and growing water scarcity – challenges that must be acknowledged with clear linkages in the sustainable development agenda. This could be accomplished through a stronger emphasis on resilience. Finally, critically important challenges such as governance and long term sustainability of services are not addressed clearly.

Table 4.2 Proposed Water and Sanitation Sector Sustainable Development Goals

No.	Proposed Goal Statement	Notes*
1	Safe and sustainable sanitation, hygiene and drinking water used by all	JMP suggests extending the time period of existing drinking water and sanitation targets, and adding a focus on schools and health care settings. Also adding hygiene. Extending time to 2040.
2	Towards a wastewater sub-goal of the goal on water	Aquafed suggests a sub-goal for urban wastewater, main industrial and breeding facilities and agricultural inputs.
3	Manage wastewater wisely – minimize its generation and pollution	Researchers at SEI suggest targets and indicators on wastewater collection, wastewater treatment, and wastewater generation and reuse.
4	Ensure a water secure world for all	AMCOW suggests a unifying goal for water that includes WASH, water resources management, wastewater management and water quality.
5	A Water Secure World	Swiss Agency for Development and Cooperation (SDC) suggests a unifying goal for water that includes WASH, water resources management, wastewater management and water quality.
6	Water and Sanitation for All	UN Global Compact suggests a dedicated goal for water, sanitation and wastewater.
7	“Chapter 18 of Agenda 21”	An option to reinstate the Agenda 21 Chapter 18 on Freshwater, with its overarching aim to attain all freshwater sub-sector targets by 2025.

8	"Water efficiency"	Further proposals may emerge linked to a single goal on water efficiency.
9	Securing sustainable water for all	UN Water (2014) proposal with detailed proposals for targets and indicators.

* Points on summarized for goals 1-8 are from UNU and UNOSD 2013: 23. References are contained therein.

Sources: UNU and UNOSD 2013; UN Water 2014 for Goal number 9.

The UN Water (2014) proposal is an attempt to overcome some of these drawbacks. As noted in sub-section 3.3.1, this proposal emerged from a broad consultation process and from lessons identified in implementing the MDGs. UN Water (2014) argues that water both needs a goal of its own, and needs to be included in the formulation of other SDGs because of its fundamental role in achieving that agenda, and its interdependencies with energy and food. The proposed goal is stated simply: "Securing sustainable water for all". Its proposed targets and indicators draw on existing commitments but integrated them into a wider framework than most other proposals. The proposal also addresses critical enabling challenges such as governance, long term financial and institutional sustainability, equality, and benefits versus costs.

Taking these and other inputs into consideration, the Open Working Group (2014) proposes a dedicated water goal, "Ensure availability and sustainable management of water and sanitation for all" (Goal 6). Water is briefly referenced in targets under proposed Goals 3 (healthy lives), 11 (cities), 12 (sustainable consumption) and 15 (protect ecosystems) in the Open Working Group's proposals. The links between water and the other SDGs are discussed further in Section 5, below. Table 4.3 lists the targets proposed by the Open Working Group for Goal 6. The Open Working Group has not proposed indicators for these targets. Figure 4.2 graphically illustrates the proposed Goal 6 and its proposed Targets.

Table 4.3 Proposed Targets for SDG 6, 'Water and Sanitation for All'

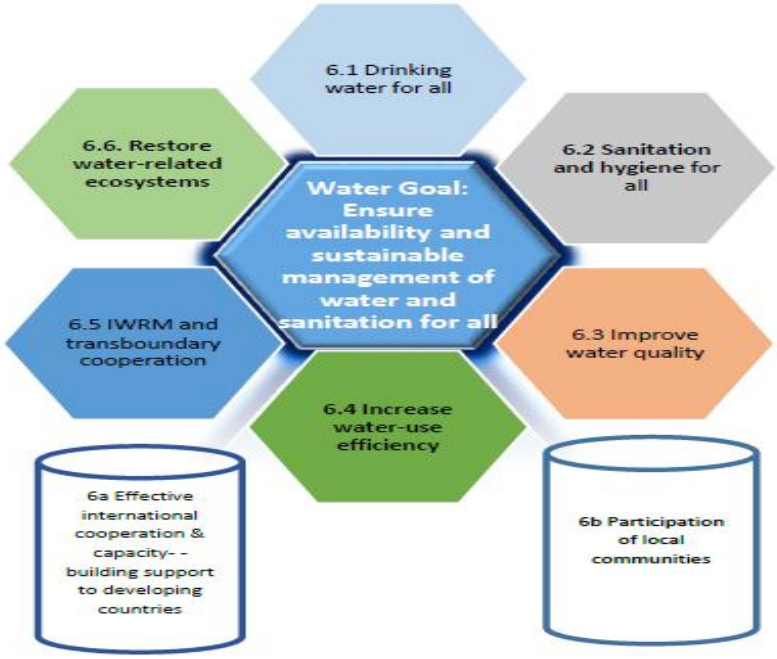
No.	Target
6.1	By 2030, achieve universal and equitable access to safe and affordable drinking water for all
6.2	By 2030, achieve access to adequate and equitable sanitation and hygiene for all, and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations
6.3	By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater, and increasing recycling and safe reuse by x% globally*
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
6.5	By 2030 implement integrated water resources management at all levels, including through transboundary cooperation as appropriate
6.6	By 2020 protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes
6.6a	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
6.6b	Support and strengthen the participation of local communities for improving water and

	sanitation management

* The percentage is yet to be specified.

Source: Open Working Group 2014: 10.

Figure 4.2 The Water and Sanitation Goal, Targets and Means of Implementation

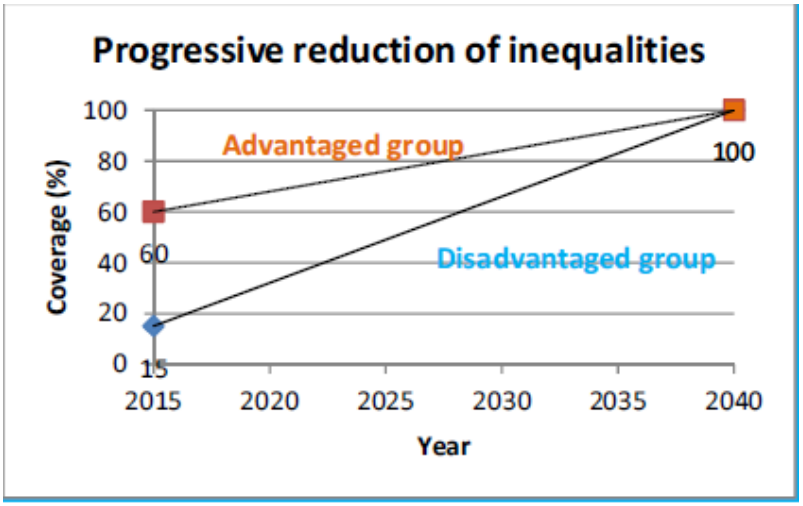


tion goal promotes the MDG target 7C to a full-fledged Goal. The first proposed target advocates "universal and equitable access to safe and affordable drinking water", while the second advocates universal access to "adequate and equitable sanitation and hygiene for all" plus an end to open defecation. These two are the core targets. The other targets, though clearly important, are necessary to support achieving the two "core" targets. The proposal to achieve "universal" access is based on the agreement that water and sanitation are basic human rights. The Open Working Group uses the term "equitable" access. Use of this term has rightly been criticized because it is vague and poorly defined, and therefore difficult to measure. The proposed alternative is to aim for progressively and systematically reducing inequalities between identified population groups, for example urban and rural, rich and poor, and men and women. The ultimate goal is to achieve *equal* access to water, sanitation and hygiene (Albuquerque 2012). The implication is that these services need to be equivalent in quality as well. Figure 4.3 illustrates this point.

The ultimate goal is to achieve *equal* access to water, sanitation and hygiene (Albuquerque 2012).

Access to safe drinking water and access to adequate sanitation and hygiene are in essence necessary conditions to achieve several of the other proposed SDGs, especially: end hunger, achieve food security and improved nutrition (Goal 2), ensure healthy lives (Goal 3), and end poverty (Goal 1). They also contribute directly to other proposed SDGs, for example achieving gender equity (Goal 5), promoting equitable economic growth (Goal 8), and cities and human settlements (Goal 11).

Figure 4.3 To Achieve Equality, Progressive Reduction of Inequalities



Source: Working Group UNICEF-WHO Joint Monitoring Programme. No date.

"Hygiene" was not included in the MDG target; it began receiving substantial attention after the 2002 Conference in South Africa and is now recognized as a critical dimension of sanitation for achieving positive health outcomes. Similarly, open defecation had not been singled out as a major public health issue when Target 7C was formulated. Its elimination is now seen as critical to achieving good sanitation and improved environmental and health outcomes.

The remaining proposed water and sanitation targets can be classified as "enabling" rather than core targets. They are aimed at either environmental or resource conservation, or at creating the institutional framework needed for successful implementation. Three proposed targets address environment/conservation: water quality (6.3), water use efficiency (6.4), and water-related ecosystems (6.6). Three others address policy, institutions or means of implementation: promoting IWRM including transboundary cooperation (6.5), expanding cooperation and capacity building (6.6a), and supporting local community management (6.6b). Indeed 6.6a and 6.6b are explicitly considered to be means of implementation. With one partial exception, all of these targets are framed in vague and un-measurable terms, opting for terms like "improve water quality", "substantially increase water-use efficiency", and "protect and restore" water-related ecosystems. The partial exception is in target 6.3: "halving the proportion of untreated wastewater, and increasing recycling and safe reuse by x% globally". Even this target would be difficult to measure with currently available data. Given their importance to human wellbeing, it is surprising that agro-ecosystems are not included in the list of water-related ecosystems. The environmental targets each have multiple dimensions; it would be difficult if not impossible to monitor progress effectively.

Finally, there are two important gaps that need to be addressed. These are: 1) ensuring the long-term sustainability and continuous improvement of measures to achieve universal and equal access to water, sanitation and hygiene; and 2) water for food security and nutrition. New water and sanitation services must be operated, maintained, and periodically either replaced or upgraded. Lack of finance for scheme operation and maintenance has been a huge challenge and this will continue. Observers as diverse as the Special Rapporteur on the human right to safe drinking water and sanitation and UNCTAD have emphasized this challenge (Albuquerque 2012; UNCTAD 2014).

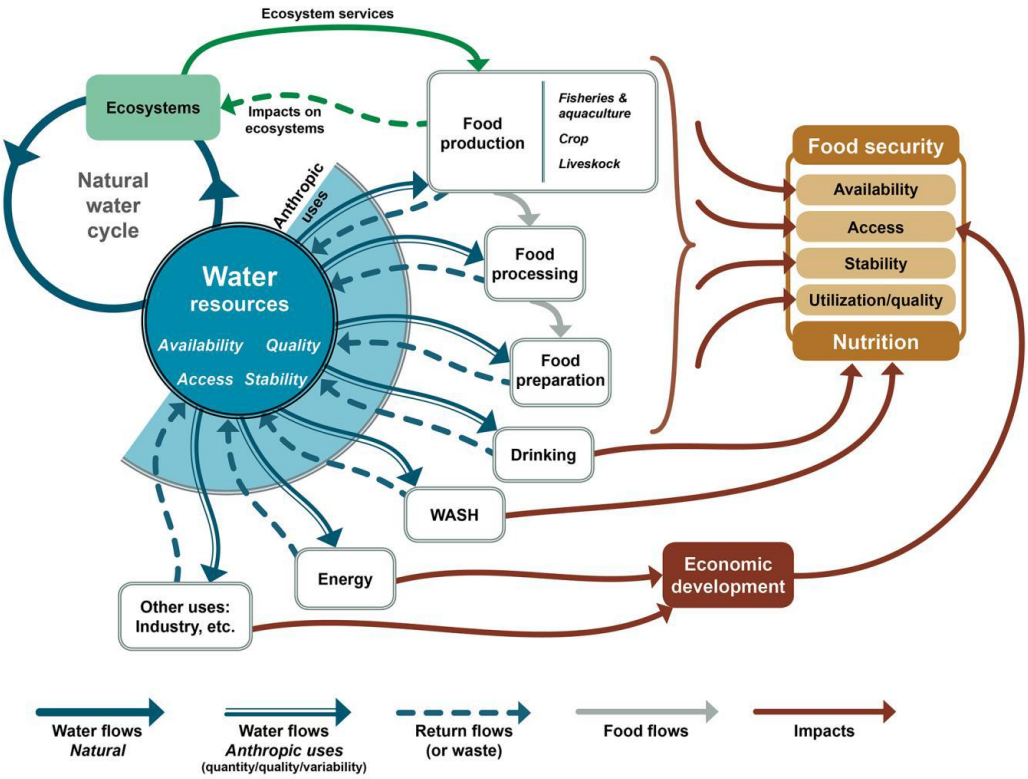
The silence on water for food security and nutrition is especially surprising. First, "water for food security and nutrition" here refers to the water needed for the entire set of processes, "from farm to

mouth", to produce, process, prepare, and consume food. These processes occur at multiple levels, and at household and individual levels are linked to water and sanitation as well. Food production accounts for over 70% of all the water that is used by people. Large amounts of water are also used in processing food; and a considerable amount of water is lost through leakages and waste of already-produced food products. Scarcity of water, whether through over-use, mis-allocation, or degradation of its quality, is a major threat to achieving and sustaining a food-secure world. The paradigm shift in agricultural research to improving the range and sustainability of services produced by agro-ecosystems is an important step in achieving a water- and food-secure world; similar transformations will be needed in food processing and consumption patterns in the next decades. Figure 4.4 is a representation of the multiple links between water and food and nutrition security.

4.3 Unpacking the indicators and monitoring progress

The Open Working Group identified a set of targets, discussed above, but did not propose any indicators. However, others have proposed a variety of possible indicators for each of the targets. Here, the proposed targets as stated by the Open Working Group are taken as given, and indicators that have been proposed for each of them are briefly examined in terms of their strengths, weaknesses and gaps. The full set of proposed indicators for each target is found in Appendix 1 to this report. The following boxes are drawn from that Appendix[12]. This sub-section briefly discusses the main proposed indicators.

Figure 4.4 Multiple Linkages of Water with Food and Nutrition Security



Source: HLPE Committee on World Food Security 2015 [forthcoming]:9, Figure 1.

[12] Davison Saruchera and Jonathan Lautze (IWMI) developed the material in Appendix 1 as a contribution to this report. See that Appendix for the references used in the boxes.

4.3.1 *Target 6.1:* by 2030, achieve universal and equitable access to safe and affordable drinking water for all

This target is dominated by indicators that focus on universal access to water. The health implications of unsafe drinking water cannot be overstated, so it is understandable that five of the eight proposed indicators in this category recommend universal access. However, none of the proposed indicators specifies an objective measure of "access". Access to water varies with the type of settlement – rural or urban, formal or informal. A more clearly defined measure of access would therefore be useful. In South Africa for example, national water policies demand that a water point be at most 200m from a household. Such a specific measure would be important to measure progress for the target. Further, none of the proposed indicators offers a way to break down "access" (however defined) in terms of social categories such as gender, age, rural-urban, rich-poor, etc. To address this, Luh, Baum and Bartram (2013) propose an Equity Index to measure progressive realization of the human right to water and sanitation. The Equity Index is composed of one structural, one process and two outcome indicators, and its efficacy is demonstrated using available data. This index does not measure level of achievement as most proposed indicators do; rather it measures the rate of convergence toward equality, thus addressing an issue – progressive realization – that is fundamental to human rights. A similar Equity Index can be developed for other SDG indicators.

Proposed Indicators for Target 6.1

1. Safe drinking water in every household by 2030, and in every school and health centre by 2025 (AMCOW, 2013)
2. Universal access to safe drinking water at home, in schools, health centres and refugee camps (HLP, 2013)
3. Universal access to affordable and safe fresh water (UNGC, 2013)
4. Universal access to safe and sustainable water (UNDG, 2013)
5. Universal access to WASH as a human right (Swiss Paper, 2014)
6. Percentage of population using basic drinking water (UN-Water, 2014a)
7. Percentage of population using a safely managed drinking water service at home (UN-Water, 2014a)

Source: See Appendix 1 to this report

It is critically important to define terms clearly in a way that is universally applicable. These terms include "safe drinking water", and "access". The safety of drinking water can be measured objectively. "Access" is more difficult. Dimensions include timing (is water available 24 hours a day, or on a regular and predictable schedule?), location (does water need to be piped into all homes, or is availability within a certain distance as in the South African case a reasonable definition?), and amount (only a minimum amount needed for drinking, cooking and hygiene, or a sufficient amount for small-scale productive uses as well?). Universal access in public places such as schools and health centres is easily measured. Inclusion of measure such as the Equity Index is also a critical tool to aid in targeting efforts to those most in need. It is recommended that a basic set of universal definitions be prepared, but it will be important to assist countries to adapt them to their own conditions.

4.3.2 *Target 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

The sanitation target generated 21 indicators, though there is some overlap with the indicators proposed for the safe water target (for example, "universal access to WASH"). Again, seven indicators propose universal access to adequate sanitation, while five propose to measure the target

using a percentage increase. The rest propose various other options. Nevertheless, it seems little attention has been paid to the variability of sanitation options across geographical regions. Technical options for sanitation facilities depend on the availability of water, type of settlement and socio-cultural acceptance among other factors[13]. As such, sanitation facilities can either be wet or dry, and therefore located in-house or outside, while waste treatment can be on-site or offsite. The indicators do not encompass this reality. The JMP attempts to address this problem with its "sanitation ladder" concept (WHO and UNICEF 2014). Moreover, terms like 'adequate' and 'equitable', used in the phrasing of the target, add to the viability challenges of the indicators as they cannot be objectively measured. Hygiene seems not to be captured in this list; SDSN (2014) has proposed an indicator on this: "percentage of population with basic hand washing facilities in the home". Finally, as observed above for Target 6.1, no indicators are suggested that break populations down by such categories as gender, age, rural-urban, etc. The Equity Index proposed by Luh, Baum and Bartram (2013) offers one solution to this problem. Box 3.1, above, documents the need to ensure comparisons of achievement of the water and sanitation targets are based on comparable units: household-level or community-level. The discussion under Target 6.1 of the need to define terms clearly applies to sanitation as well.

Proposed Indicators for Target 6.2

1. No open defecation, and all schools and health care facilities providing all users with adequate sanitation and hygiene facilities by 2025 (JMP, 2012)
2. Universal use of household sanitation by 2040, inequality in access to adequate household sanitation is halved by 2030, and the excreta of at least x% of those households with adequate sanitation are safely managed by 2030 (JMP, 2012).
3. Increase of access to water supply and sanitation (Peru, Colombia and UAE, 2012).
4. Universal provision of sanitation facilities and the practice effective hygiene behaviour by 2030, and in schools and health centres by 2025 (AMCOW, 2013)
5. Universal access to WASH (Swiss Paper, 2014)
6. All public places must be served by WASH by 2030 (AMCOW, 2013)
7. Provision of socially, financially and environmentally sustainable WASH and the removal of gender inequality by 2030 (AMCOW, 2013)
8. improvement of sanitation by x% (HLP, 2013)
9. Universal access to water, sanitation and hygiene with a focus on expeditious ending of open defecation and ensuring sustainability of services (Beyong2015, 2013)
10. Use of appropriate technologies (GWP, 2013)
11. Universal access to basic sanitation by 2020 and improved sanitation by 2030 (UNGC, 2013)
12. Universal access to safe and sustainable water, sanitation and hygiene services (UNDG, 2013)
13. Universal access to basic sanitation facilities by 2020 and improved sanitation facilities by 2030 (UNGC, 2013).
14. Percentage of population practicing open defecation(UN-Water, 2014a)
15. Percentage of population using basic sanitation (UN-Water, 2014a)
16. Percentage of population with hand washing facilities at home (UN-Water, 2014a)
17. Percentage of health facilities with basic drinking water, basic sanitation and hygiene (UN-Water, 2014a)
18. Percentage of primary and secondary schools that have basic drinking water, basic sanitation and hygiene. (UN-Water, 2014a)
19. Percentage of population with basic sanitation whose excreta is safely managed(UN-Water, 2014a)
20. Data will be disaggregated by the four population groups urban/rural; rich/poor; slums/formal urban settlements; disadvantaged groups/general population (UN-Water, 2014a)
21. The difference in rate of change for the disadvantaged groups versus the general population (UN-Water, 2014a)

[13] See Akpabio and Takara (2014) on confronting the cultural complexities of promoting WASH in sub-Saharan Africa.

Source: See Appendix 1 to this report

4.3.3 *Target 6.3:* by 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater, and increasing recycling and safe reuse by x% globally

In this target, 13 of the 20 indicators focus on the treatment of wastewater. However, none of these indicators provides any biological or chemical parameters of water quality. The level to which water should be treated is a function of its planned use: water for agriculture does not need to meet the standards of water for drinking. This is one target that could be measured using objective indicators that refer to accepted water quality standards using such parameters as biological oxygen demand, phosphorous content, density and pH. That said, capacity to collect and analyse these data will likely need to be strengthened in many developing countries. The target itself also seems to ignore the financial and technical demands of wastewater treatment as it prescriptively recommends the recycling of wastewater. Treating wastewater to a high standard requires expensive treatment plants that can handle physical (sedimentation, filtration), biological (bio-filtration, anaerobic reactions) and chemical (e.g. chlorination) processes, and most local authorities in developing countries cannot afford them. The indicators for this target must be flexible to accommodate such differences, and indicators must be framed in objective measurable terms.

Proposed Indicators for Target 6.3

1. Reduced health risks from water related diseases (Peru, Colombia and UAE, 2012)
2. Establish policies and institutions for wastewater treatment in x% of African countries by 2030 (AMCOW, 2013)
3. All urban areas with a population of 100 000 or more must adopt appropriate water treatment technology by 2030 (AMCOW, 2013)
4. Treatment of wastewater to a minimum standard before disposal in transboundary water bodies by2030 (AMCOW, 2013)
5. Effective cost recovery in wastewater collection and treatment by 2030 (AMCOW, 2013)
6. Effective wastewater collection, treatment, and management, with parameters for pollution control and water quality (Beyond2015, 2013)
7. Address legal and compliance issues on discharge of untreated wastewater and increase wastewater treatment systems and provide incentives for connection (GWP, 2013)
8. Manage water quality to high standards and control pollution (GWP, 2013)
9. Recycle or treat all municipal and industrial wastewater before discharge (HLP, 2013)
10. Collect used water, manage wastewater pollution and maximize water re-use (Aquafed, 2013)
11. Ensure establishment and full implementation of national water effluent standards (UNGC, 2013)
12. Establish and fully implement national water standards (UNGC, 2013)
13. Collection and treatment of all wastewater before it is returned to nature, and managed under principles of pollution prevention and reuse (UNDG, 2013).
14. Improve global freshwater quality by addressing pollution and wastewater treatment –(Swiss Paper, 2014)
15. Proportion of the population for whom all domestic wastewater is treated to national standards in either collective or individual facilities (UN-Water, 2014a)
16. Proportion of industrial (and point source agricultural) wastewater flows not collected in public systems that is treated to national standards (UN-Water, 2014a)
17. Proportion of the flows of treated municipal wastewater that are directly and safely reused (UN-Water, 2014a)
18. Proportion of the flows discharged by industrial wastewater treatment plants that are safely re-used. (This indicator does not include water directly re-used without leaving the factory) (UN-Water, 2014a)
19. Proportion of receiving water bodies meeting water quality standards (nitrogen & phosphorous as a minimum) (UN-Water, 2014a)

20. Proportion of the population connected to collective sewers or with on-site storage of all domestic wastewaters (UN-Water, 2014a)

Source: See Appendix 1 to this report

4.3.4 *Target 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

The 14 proposed indicators for this target are mainly focused on the efficiency of consumptive water use – agriculture, industry and domestic, though some indicators refer to freshwater storage and the non-consumptive uses of energy production and ecological requirements. While six of the indicators propose some percentage measurement of water use, the rest vaguely recommend the balancing of water supply with demand, which is a target, not an indicator. These proposals do not offer specific measureable indicators; instead they use vague qualitative terms such as 'improve' or 'more efficient'. The viability of these indicators is therefore compromised. WWAP (2014: Volume 2) proposes additional energy-related indicators. The indicators proposed for agricultural water are focused on withdrawals and productivity. These need to be supplemented by indicators that measure changes in *access* to water for agriculture and other productive purposes at household level, as this is a critically important ingredient for reducing rural poverty and increasing food security.

Proposed Indicators for Target 6.4

1. Increased water efficiency (Peru, Colombia and UAE, 2012)
2. Increased storage capacity of water, and efficient use by x% by 2030 (AMCOW, 2013)
3. Freshwater withdrawals brought in line with supply and increase efficiency in water use by x% in agriculture, by y% in industry and z% in urban consumption (HLP, 2013)
4. Fresh water use brought in line with supply (UNGC, 2013).
5. Change in withdrawal-to-availability ratio (change in withdrawals as % of total actual renewable water resources, within sustainable limits) (UN-Water, 2014a)
6. % of basins with an allocation framework (balancing demands for all sectors, including the environment, from groundwater and surface water) (UN-Water, 2014a)
7. Storage capacity per capita/% of available water (UN-Water, 2014a)
8. Change in agricultural GDP per agricultural withdrawals (agricultural water productivity) (UN-Water, 2014a)
9. Change in industrial GDP per industrial withdrawals (industrial water productivity) (UN-Water, 2014a)
10. Change in electricity production per unit of water (energy sector water productivity) (UN-Water, 2014a)
11. Change in withdrawals for domestic use per capita (domestic water supply and use efficiency) (UN-Water, 2014a)
12. Improvement in water use efficiency across all sectors – agriculture water productivity, industrial water efficiency, energy water efficiency, and per capita domestic water withdrawals (UN-Water, 2014b)
13. Water withdrawals are linked with availability, considering the environmental requirements (UN-Water, 2014b)
14. Reduction of number of people living in severely water stressed areas and the improved water availability per capita (UN-Water, 2014b)

Source: See Appendix 1 to this report

Another issue is that few countries have the capacity to collect the data on water use needed in order to measure these indicators (e.g. UN Water 2014; GLAAS 2014; UNU 2015 [forthcoming]). A major capacity strengthening effort including allocation of substantial resources would be required for countries to use these indicators. This statement applies to other targets as well.

4.3.5 *Target 6.5:* by 2030 implement integrated water resources management at all levels, including through transboundary cooperation as appropriate

The nine indicators for measuring IWRM in this target are all general and lack focus. The first four are not really 'indicators' at all; they are possible sub-targets. No specific indicators are prominent as each one addresses different attributes of IWRM. Five indicators propose quantifiable measures, like the percentage of countries implementing IWRM or undertaking user participation, and the number of transboundary basins with basin agreements. Although these indicators are quantifiable, they offer assessment only at the international level and fail to measure progress within countries. The other four indicators do not contain measurable objectives at all. Identifying specific indicators for this target, which can measure both the elements of IWRM (e.g. decentralization of water management and existence of stakeholder participation) and transboundary cooperation are needed.

Proposed Indicators for Target 6.5

1. Balance water use and safeguard the ecosystem while holistically implementing IWRM and mainstreaming climate change (Beyond 2015, 2013)
2. Establish transboundary agreements, build up basin capacity to ensure enforcement of laws, and strengthen transboundary water management through establishing basin organisations (GWP, 2013)
3. Monitor, govern and manage ground and surface water sustainably and in an integrated manner to satisfy human needs while respecting ecosystem requirements (UNDG, 2013).
4. Management of freshwater sources for human needs, culture, gender, economic growth while respecting ecosystem requirements (adopting sustainable, long lasting basin treaties) and resilience to disasters (Swiss Paper, 2014a)
5. Percent of countries implementing IWRM plans (UN-Water, 2014a)
6. Percent of countries with strategic planning and participatory decision-making processes (UN-Water, 2014a)
7. Percent of transboundary basins and aquifers with cooperative management frameworks (UN-Water, 2014a)
8. Percent of countries with national policies supporting integrated disaster risk management (including drought and flood policies), as part of national development plans (UN-Water, 2014a)
9. Proportion of communities which have implemented risk strategies (UN Water, 2014a)
10. Monitoring and evaluation systems that include surveys on governance issues (building on Rio+20 status report) (UN-Water, 2014a)

Source: See Appendix 1 to this report

The list of indicators in the box for Target 6.5 is not exhaustive. For example, in a draft paper, Saruchera and Lautze (2014) developed a long list of 33 possible indicators related to transboundary basin cooperation. They pilot-tested ten of these in southern Africa and found that six are sufficiently meaningful and measurable to monitor the strength of transboundary water cooperation. These are:

1. Existence of international agreements,
2. Reference to transboundary cooperation in national water legislation,
3. Conductance of basin planning,
4. Regular data exchange,
5. Harmonisation of standards and units of measurement, and
6. Financial support for transboundary institutional activities.

These proposed indicators are an improvement, but they do not measure effectiveness and outcomes of transboundary cooperation. Agreements and planning are important, but their implementation is the crux of the matter.

4.3.6 *Target 6.6*: by 2020 protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes

This target focuses on the restoration of ecosystems; therefore the seven proposed indicators are aimed at wetlands and lakes. Only one indicator proposes a quantifiable measure (percentage change in freshwater ecosystem area and condition). The other indicators rely on ambiguous qualitative terms, like 'strengthen', 'develop', and 'improve'. This target can be more objectively measured by indicators that quantify groundwater abstraction, lake water levels and wetland coverage among others. Finally, agro-ecosystems are not recognized at all in this list.

Proposed Indicators for Target 6.6

1. Improve quality of water resources and ecosystems (Peru, Colombia and UAE, 2012)
2. A commitment by all governments and businesses to the sustainable, integrated, and transparent management of water by 2030 (SDSN, 2013)
3. integrated approach to water resources management through enabling environment, strengthening institutional systems and applying management instruments (GWP, 2013)
4. Develop monitoring and reporting systems in WRM progress (GWP, 2013)
5. % change in freshwater ecosystem area and condition (indicator of change in ecosystem extent and health, includes brackish ecosystems) (UN-Water, 2014a)
6. Threatened Species (Red List) Index and Living Planet Index (for relevant flora and fauna) (UN-Water, 2014a)
7. Environmental water stress (based on deviation from natural flow/availability) (UN-Water, 2014a)

Source: See Appendix 1 to this report

UNEP does a great deal of work on ecosystem management and ecosystem services through its Ecosystem Management Programme[14]. This is not reflected well in the indicators proposed for Target 6.6. Freshwater is one of the six highest priority ecosystem services identified by UNEP, though surprisingly UNEP gives lower priority to water purification and wastewater treatment.

4.3.7 Target 6.6a: 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

This target is on international cooperation and capacity building, currently with eight proposed indicators. Three indicators are financial (apparently intended to use financial criteria to measure capacity building, though they seem more focused on measuring financial viability of water infrastructure). Three others are institutional. On the one hand, all the proposed indicators for this target can be objectively measured, though they could still be improved. On the other hand, many of the proposed indicators focus on the performance of local water authorities, not on the level and effectiveness of "international cooperation and capacity building". If this target stands, more work is needed to identify practical and measurable indicators, focusing on outcomes, not only inputs. This

[14] See http://www.unep.org/ecosystemmanagement/ (accessed January 13, 2015).

target could also be subsumed under the broader SDG goal of strengthening global partnerships for sustainable development (Open Working Group Goal 17).

Proposed Indicators for Target 6.6a

1. Percentage of population using water and sanitation service providers registered with a regulatory authority (disaggregate rural and urban) (UN-Water, 2014a)
2. Percentage of population in the poorest quintile whose financial expenditure on water, sanitation and hygiene is below 3% of national poverty line (disaggregate rural and urban) (UN-Water, 2014a)
3. Ratio of annual revenue to annual expenditure on maintenance (including operating expenditures, capital maintenance, debt servicing) (UN-Water, 2014a)
4. Ratio of annual expenditure on maintenance (including operating expenditures, capital maintenance, debt servicing) to annualized value of capital assets (UN-Water, 2014a)
5. Number of countries with regulatory frameworks and enforcement capacity (UN-Water, 2014a)
6. Proportion of responsible water authorities and water operators for which operational performance is measured and reported (UN-Water, 2014a)
7. Number of capacity building networks using multidisciplinary skills of competent members to scale up capacity building and actively support implementation programs. (UN-Water, 2014a)
8. Number of countries with knowledge management systems in place that ensure access to the best of international and local knowledge and measure the effectiveness of capacity building services through locally developed indicators and monitoring systems (UN-Water, 2014a)

Source: See Appendix 1 to this report

4.3.8 Target 6.6b: support and strengthen the participation of local communities for improving water and sanitation management

This target focuses on community participation. Only three indicators have been proposed to date. Of these, only one quantitative indicator can be viably measured while the other two are ambiguous. A more precise measure of participation must be developed for this target, for example existence of mechanisms for participation in every catchment/ community, actual empowered roles of women and youth in decision-making, and flows of benefits broken down by gender, age, etc.

Proposed Indicators for Target 6.6b

1. Institutional strengthening at community level, knowledge management and awareness at all levels and development of skills to implement WASH at household level (GWP, 2013)
2. Cost recovery in water supply and private sector support (GWP, 2013)
3. No. of institutions using relevant education and training materials in local capacity building programs (UN-Water, 2014a)

Source: See Appendix 1 to this report

4.4 The data problem – or "revolution"

4.4.1 Data for monitoring the sustainable development agenda

Indicators are used to measure progress towards a measurable and well-defined goal. They are generally distilled from data collected through a wide variety of methods. Indicators convert raw data into information that can be used for multiple purposes. But the quality of indicators as information is largely a function of the quality, reliability, quantity, comparability, and representativeness of the data used. Without timely high-quality data, it is nearly impossible to produce reliable indicators and therefore it is also impossible to design, monitor, evaluate and adapt policies.

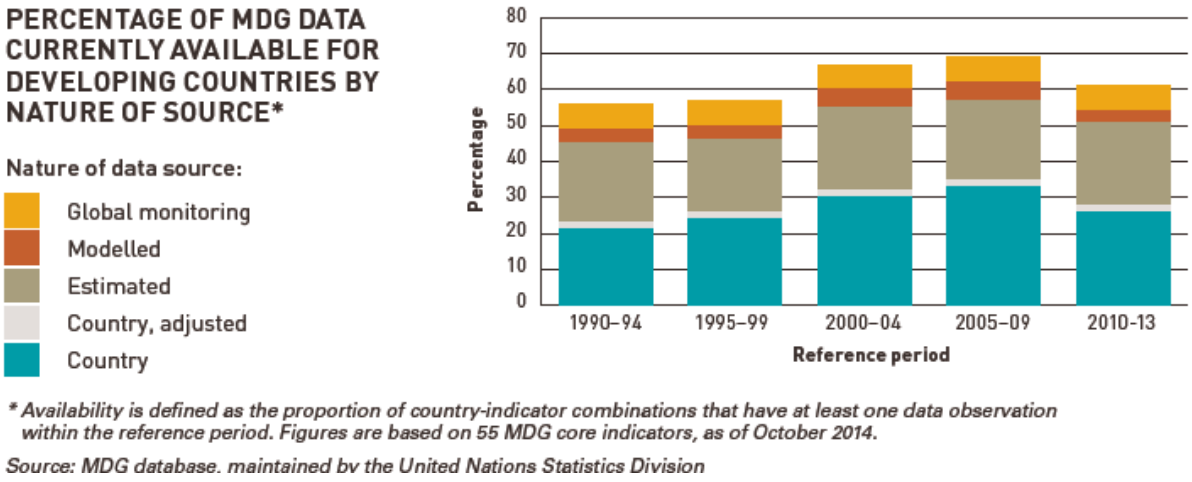
Agenda 21 called on countries to work toward developing coherent and useful indicators of sustainable development, and harmonizing them to enable cross-national comparisons. The Committee on Sustainable Development (CSD) began working on this issue following the 1992 Rio Conference[15]. In 2007, the third and most recent edition of guidelines and methodologies for sustainable development indicators was published by the UN (UN-DESA 2007). There is overlap between the CSD's set of 96 indicators and the 48 indicators for the MDGs. However, the CSD set of indicators is broader than those specifically used for monitoring MDG progress. They were intended as a sample set of possible sustainable development indicators that countries could use if they wished. A core set of 50 indicators (out of a larger set of 96) are used, under 17 themes, of which "freshwater" is one. The proportion of the population using an improved drinking water source, and the proportion using an improved sanitation facility are two of the six poverty indicators. There are three indicators for freshwater. The CSD set of indicators is designed to enable assessment of linkages to other themes, for example use of improved water supply and health. An effort has been made to harmonize the CSD and MDG indicators, as is discussed in detail in the report by UN-DESA (2007). The report argues that its broader set of indicators, derived from Agenda 21, is useful for measuring broad outcomes of the sustainable development agenda, thereby going beyond the MDGs. This set is a useful source of ideas as indicators are developed for the future SDGs.

Without timely high-quality data, it is nearly impossible to produce reliable indicators and therefore it is also impossible to design, monitor, evaluate and adapt policies.

During the MDG implementation period, the availability of reasonably good data has vastly improved, in part because countries and international financing institutions have invested in collecting more data on poverty, nutrition, health, and other socio-economic dimensions, and in part because new sources of data are rapidly emerging. Nevertheless, as the UN Secretary-General's Independent Expert Advisory Group on a Data Revolution for Sustainable Development (IEAG) states, "**too many countries still have poor data, data arrives too late and too many issues are still barely covered by existing data**" (IEAG 2014: 11, bold in original). Figure 4.5 graphically illustrates the problem, for 55 core indicators of the MDGs from 157 countries. Overall, there is improvement but as of 2005-2009, only about 70% of the data needed for effective monitoring was available. In the 2010-2013 period this has declined to about 60% with most of the decline occurring in the data countries collect directly. Buvinic, Furst-Nichols and Koolwal (2014) document the serious gender gaps in available data and propose ways to overcome this gap.

Figure 4. 5 Changes in Availability of MDG Data for Developing Countries by Source

[15] Following the Rio +20 Conference, the CSD was replaced by the High Level Political Forum (HLF) on Sustainable Development. See http://sustainabledevelopment.un.org/globalsdreport, accessed December 15, 2014.



Source: IEAG 2014: 12.

After the MDGs were agreed in 2000, collecting quality data and using these data for key indicators of progress in achieving the MDGs became a high priority, reinforced at the WSSD. Many countries have upgraded their data collection and analysis capacities in recent years (IAEG 2014). Nevertheless, entire ethnic groups and many critical socio-economic issues are either missing or only partially included. Even basic data such as births are not recorded systematically. The poorest people – those that the proposed SDGs plan to target more effectively – remain to a considerable degree invisible in the available data. For example, while nearly all developing countries have national estimates on the number of people with access to safe drinking water, it is often not broken down by districts or sub-districts. Very little data are available on women's work and their roles in households and communities. As noted above in section 3.2.2, the report by the UN Water "Global Analysis and Assessment of sanitation and drinking-water" (GLASS 2014) confirms the large gap between the level of monitoring required and the current state of affairs.

The poorest people – those that the proposed SDGs plan to target more effectively – remain invisible in the available data.

The proposed SDGs are far more ambitious in scope than the MDGs. For example, a lot more data will be needed on environmental issues, such as the multiple dimensions of water pollution. If interventions are going to target the poorest people in order to reduce inequality and achieve basic universal coverage, it will be critical to collect accurate and timely disaggregated data to monitor progress and make needed adjustments. Data needs to be relevant, timely, accurate, accessible, comparable, communicated in user-friendly formats, and produced free of political interference – a tall order for many countries. Data are needed to create an "accountability framework" for the SDGs. Therefore, the IAEG (2014) calls for a "data revolution" – decisive action by the global community to take advantage of new sources of data, collaborate to integrate and share different sources of data, build data collection, management and analysis capacities, and increase investments to make this revolution possible. The IAEG report sets out basic principles and an overall strategy to achieve this.

New technologies are leading to a rapid expansion in the quantity of data being generated. These include using data obtained by remote sensing from satellites, and tapping data generated through the internet and mobile telephone services. Private firms and civil society are producing data in addition to that produced by governments. There is an explosion of data – hence the term "data

revolution"— but these new sources of data must be tapped and integrated with traditional types of data to produce the information needed to monitor progress and lessons learned in implementing the SDGs. Good data is not a luxury, it is essential. Although a recent paper has argued that high costs mean that a data revolution to support the proposed 17 SDGs and 169 targets is not a good investment (Jerven 2014), most observers agree with the IAEG that costs can be minimized and the benefits would far outweigh the costs[16].

4.4.2 Water data for monitoring the sustainable development agenda

Monitoring the performance of the water sector, the state of water resources, quantities of water developed and diverted for various human uses, the efficiency and productivity of water use by agriculture and industry, poor people's access to good quality water for domestic and productive purposes, levels of chemical and other sources of pollution and impacts on ecosystem and human health, quality of water governance – and the trends over time of these and other parameters – is extremely difficult. According to the UN Water Task Force on Indicators, Monitoring and Reporting (UN TF-IMR 2009a), at national level, there is strong evidence that the quality and availability of water data has been deteriorating over the past decade. IWMI (2014) among others supports this observation. Therefore there are no truly reliable updated data on the trends regarding availability of water resources and their broader social and economic trends. There are a number of global water data sets such as AQUASTAT (FAO), JMP (WHO and UNICEF), and GEMS (UNEP),[17] and some regional organizations such as OECD collect and share useful data. The managers of these global data sets make major efforts to work with countries to improve the quality of the data generated at national level and then included in the global data sets – but much remains to be done. UN-TF-IMR (2009: 23ff) analyzes the low quality and unreliability of much of the data used by national agencies (the source of most data) and by global institutions. The UN agencies produce important periodic reports on water, for example the WWDR (2014), GLAAS (2014), and JMP (2014), but these also depend on the same inadequate data base. While there is a need for countries to improve their systems for collecting water data, which will require additional financial and human resources, there are also growing opportunities to tap and use new sources of data (e.g. IWMI 2014).

There is strong evidence that the quality and availability of water data has been deteriorating over the past decade.

The UN TF-IMR has been developing a broad global framework to monitor water using a limited set of key indicators. Its final report offers a "core set of key indicators" derived from a larger possible set (UN TF-IMR 2009a). Applying SMART criteria[18], the indicators were chosen based on their policy relevance, analytical soundness and measurability. Four categories of indicators are used: context,

[16] See recent blog from Lawrence Haddad of IFPRI: http://www.developmenthorizons.com/2014/12/dont-kill-of-data-revolution-before-it.html?utm_source=feedburner&utm_medium=email&utm_campaign=Feed%3A+DevelopmentHorizons+%28Development+Horizons%29, accessed December 12, 2014.

[17] See, respectively, http://www.fao.org/nr/water/aquastat/main/index.stm, http://www.wssinfo.org/, http://www.gemstat.org/, all accessed December 12, 3014.

[18] SMART criteria: S Specific; M Measurable; A Achievable; R Relevant; T Time-bound.

functioning, governance and performance. *Context indicators* relate to the natural context (e.g. rainfall), infrastructure, and human and economic capitals. They serve as benchmarks for comparison. *Functioning indicators* relate to inputs, outputs and outcomes (e.g. water withdrawals). *Governance indicators* refer to institutional performance and reforms. *Performance indicators* relate actual social, economic and environmental performance to objectives, e.g. levels of efficiency or productivity, effectiveness or impact.

The report acknowledges the weaknesses of national and therefore global data sets on which the proposed indicators depend. It includes a table listing all the data needed for calculating its proposed indicators, and its availability and quality. There are huge gaps. Systematic water productivity data and gender-related information are not available. Water quality and wastewater data are available mainly for OECD countries. Global monitoring of groundwater trends is problematic, and information on the status of freshwater systems is patchy (ibid.). The report provides a detailed assessment of the data quality issues affecting global water data sets and describes efforts of various UN agencies to address the problems (UN TF-IMR 2009a: 23ff). An Annex provides details on indicators currently in use (UN TF-IMR 2009b).

The Task Force recommends three working areas to improve the quality and usefulness of water data (UN TF-IMR 2009a: 28ff): 1) at global level, collaboration and coordination for more consistent and complementary data collection is needed; 2) at the operational level, there is a need to harmonize, standardize and improve data collection at the national and global levels; and 3) more training, technical support and financial assistance to countries is needed to enable them to collect and use better data. This third working area is the most critical and is also emphasized by UNU (2015 [forthcoming]) among others. Finally, updating data collection and analysis systems to monitor equality outcomes – in other words, gender, age, income group, ethnic groups, etc.—will be a critical requirement. Currently disaggregated data on gender and other social categories is very weak in many developing countries (e.g. UN Women 2014; Buvinic, Furst-Nichols and Koolwal. 2014).

4.4.3 Water accounting

Simply stated, “water accounting is a procedure for analyzing the uses, depletion, and productivity of water in a water basin context” (Molden 1997). It offers a systematic conceptual framework for better organizing and understanding water stocks and flows, and how they relate to other social and economic factors. Currently, there are two basic approaches to water accounting. One focuses on integrating hydrological processes with land use, managed water flows, and agricultural production and other ecosystem services in a river basin context. This approach was initially developed by IWMI and has recently been expanded by IWMI working with FAO, UNESCO-IHE, and others (IWMI 2014). A second approach to water accounting takes a broader perspective and links water national economic and environmental accounts (UNSD 2012).

The origins of the first approach lay in IWMI’s work to better understand water productivity and the efficiency of water use, especially in agriculture, in the context of river basins (see, e.g. Molden 1997; Molden, ed. 2007; IWMI 2014). IWMI and its partners recently launched an updated water accounting methodology using global public domain datasets — referred to as *Water Accounting Plus* (WA+). Karimi, Bastiaanssen and Molden (2013) provide a detailed discussion of the WA+

framework; more information is available on the website[19]. The main focus is on the impacts of land use and evapotranspiration in landscapes on the water cycle in river basins. It clearly distinguishes water depletion from withdrawals and 'green' from 'blue' water. Its use of public domain satellite-based data (complemented by some proprietary data sets) means it can be used in ungauged basis or in basins with disputed water flows as its data are independent of data produced by political entities. The WA+ framework is presented in an easily understood tool using four 'sheets': a *resource base* sheet, an *evapotranspiration* sheet, a *productivity* sheet, and a *withdrawal* sheet (Karimi, Bastiaanssen and Molden 2013). The website provides several others, for example sheets distinguishing surface and ground water. Impacts of influences like climate change or building infrastructure can be estimated using WA+. It does not replace hydrological models but complements them.

The "*System of Environmental-Economic Accounting for Water*" (SEEA-Water) takes a different but complementary approach. It uses the System of National Accounts, 2008 as its basic framework. This is the standard system used by all countries to compile economic statistics and derive economic indicators such as GDP. SEEA-Water is also an elaboration of the *Handbook of National Accounting: Integrated Environmental and Economic Accounting*, which uses the same national accounts framework to describe the interactions between the economy and the environment, covering a wide spectrum of natural resources and the environment (UNSD 2012). In essence, SEEA-Water is an accounting framework linked to broader frameworks for measuring social and economic progress. It includes a set of standard tables linking water to social and economic indicators, and also provides a set of supplementary tables with further information. Whereas WA+ links water use with land use in river basins, SEEA-Water integrates water, other natural resources, and social and economic indicators. It enables a systematic analysis of the contribution of water to the economy, and of the impact of economic choices on water resources. Policymakers can use it to assess the likely consequences of their decisions for the economy, water, and other natural resources. For example, developing industries needing large quantities of water may affect other sectors in a water-scarce context. While the WA+ framework is specifically designed for river basins, the SEEA-Water framework is best used to analyze alternative decisions at national or other political levels at which economic accounts are maintained. This is because national accounts are at its core. However, the report says it can also be used at the level of river basins but this would require data that are disaggregated to basin level (UNSD 2012). Figures 4.6 and 4.7 graphically illustrate the SEEA-Water framework integrating water and the economy; Figure 4.7 also hints at the complexity and the detailed data requirements.

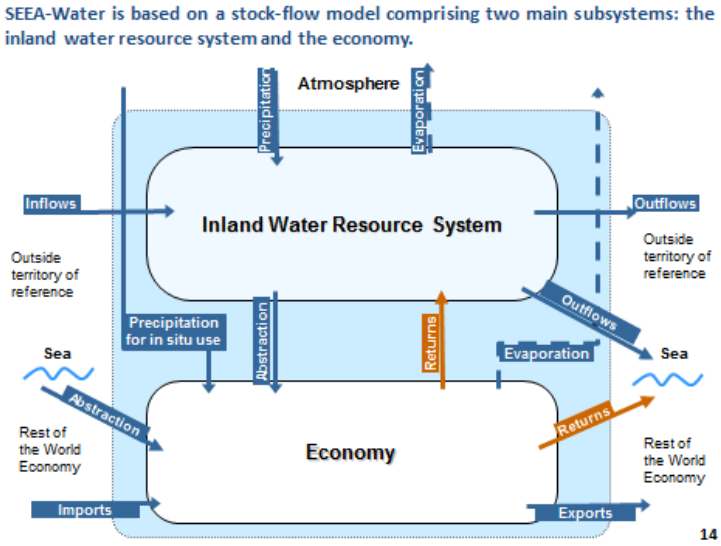
SEEA-Water … enables a systematic analysis of the contribution of water to the economy, and of the impact of economic choices on water resources.

The Achilles Heel of both approaches to water accounting is the weak data base. The SEEA-Water accounting system is especially data-intensive as is clear from Figure 4.6. The issue of the availability and reliability of the data is not addressed in the report. It is likely that reliable national accounts accurately reflecting the value of water and linkages to key economic and social sectors will not be feasible for most developing countries in the short run. The best way forward will be to work on

[19] http://www.wateraccounting.org/, accessed December 12, 2014.

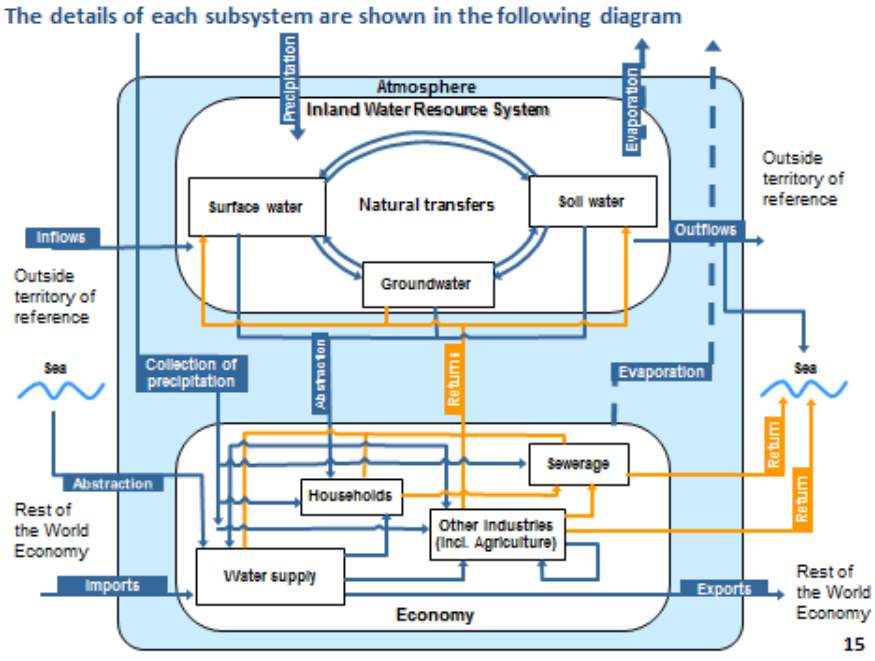
improving national capacities and investments to improve the quality of water and other data, and introduce the SEEA-Water framework incrementally as capacities improve.

Figure 4.6 The SEEA-Water Framework



Source: Workshop for the Implementation of SEEA-Water and International Recommendations for Water Statistics (IRWS), 6-8 June, Pretoria, South Africa.
https://unstats.un.org/unsd/envaccounting/workshops/SA2011/sa2011-2.asp (accessed January 13, 2015).

Figure 4.7 Details of the SEEA-Water Framework



Source: Workshop for the Implementation of SEEA-Water and International Recommendations for Water Statistics (IRWS), 6-8 June, Pretoria, South Africa.
https://unstats.un.org/unsd/envaccounting/workshops/SA2011/sa2011-2.asp (accessed January 13, 2015).

The WA+ framework is most useful for analyzing interactions of water and land use decisions on river basins. The SEEA-Water framework could in the future be most useful for answering broader questions related to alternative sustainable development paths and the most appropriate policy instruments for achieving them. They are not competing water accounting frameworks – they have different purposes. It is likely that for the purposes of monitoring water in the sustainable development agenda, SEEA-Water will be most useful – but it may not be possible to do this accurately for several more years. A final observation is that neither approach to water accounting takes adequate notice of social equity issues such as gender.

4.5 Future areas of work for advancing implementation

During the period immediately preceding the Rio +20 Conference, UN-DESA and UNDP worked with about 70 countries to synthesize the key lessons learned from implementing the MDGs (UN-DESA and UNDP 2012). The resulting synthesis of these national reports identified four key challenges and gaps: 1) *integration* of environmental issues in economic planning, 2) *inclusive* stakeholder process, 3) *coherent* planning and decision-making at and between the national, subnational, and local levels, and 4) *implementation* of commitments. While substantial progress has been made conceptually and institutionally, the overwhelming conclusion was that "today's challenge is chiefly implementation" (ibid.). The synthesis of experiences with water in implementing the MDGs comes to the same conclusion: lack of implementation is a critical issue (UN-DESA 2014a). The broader synthesis of experiences identified five priorities for advancing the future sustainable development agenda. These are:

> *Key priority 1*: Strengthening institutions and governance systems and building capacities for collaboration and coordination;
>
> *Key priority 2*: Unpacking and operationalizing the "green economy";
>
> *Key priority 3*: Reinforcing the connection between the SD agenda and the MDGs.
>
> *Key priority 4*: Meaningfully engaging stakeholders; and
>
> *Key priority 5*: Measuring development progress in a way that looks across the three pillars of sustainable development.

This sub-section first discusses the fifth key priority on measuring progress, and then the first on capacities, with specific reference to the role of water in the sustainable development agenda.

4.5.1 Measuring development progress with reference to water

While presenting the SEEA-Water accounting framework at a workshop, a representative of UN Statistics stated that water information is 'trapped' in a vicious cycle. Because data is insufficient, it has a low value in terms of policy advice, which results in low funding for water information, leading to even poorer data. The capability to establish water's contribution to economic growth is almost non-existent. A disconnect of water agencies from key ministries of finance and development planning hampers progress (UN-DESA 2013). For example, WWAP (2014 volume 1:44) observes that "lack of data puts water resources management at a political disadvantage in terms of priority decision making. While energy may be perceived as 'big business', the central role of water in socioeconomic development remains under-acknowledged". This vicious cycle needs to be

transformed into a virtuous cycle, where water data contribute significantly to policy, leading to a higher priority in terms of funding, which will enable better quality data to be collected. While the UN and other agencies can and must play critical roles, efforts to improve the availability of data must be nationally led and must meet the specific needs of each country while also contributing to the global system. Current global efforts to improve water information systems are driven by a variety of agencies, each with its own mission and priorities. What is needed is an improvement in the collection of basic data that can be the building blocks to serve multiple purposes (WWAP 2012).

"… lack of data puts water resources management at a political disadvantage in terms of priority decision making."

UN-HABITAT, UNEP and WHO (2014), in association with UN Water, have recently launched a new initiative with support from the Swiss Agency for Development and Cooperation. This initiative has three thrusts: 1) harmonization of methodologies for data collection and analysis; 2) establishing an effective post-2015 global monitoring mechanism for establishing baselines and measuring progress; and 3) from 2018 extending analysis to cover inputs and environmental factors (drivers and bottlenecks). This will build on other UN initiatives such as GLAAS, JMP, WWAP, and SEEA-Water. Unfortunately, the available document does not provide much detail. However, the initiative seems to place greatest emphasis on monitoring wastewater, water quality, and water resources management. It is not clear that the initiative pays sufficient attention to social dimensions (e.g. gender equality), productive use of water (e.g. for energy and food), or the multiple roles of water in achieving the full sustainable development agenda.

The WHO/UNICEF Joint Monitoring Program (JMP) for Water Supply and Sanitation has proposed enhanced indicators for both water supply and sanitation that focus on "safe management" of these services (WHO and UNICEF 2014:41ff). The proposed indicators are more sophisticated than those used for the MDGs. The JMP also advocates adding indicators for behaviour change with reference to hand washing and menstrual hygiene. There is no doubt about the importance of these proposals – indicators currently used do not capture the extent of faecal contamination of drinking water for example. Further, the strong emphasis on progressively achieving equality of access to services, requiring a strong focus on extending services to poor communities, also raises the bar in terms of monitoring: currently few governments are able to monitor progress in achieving access by the poorest communities, or by women. The JMP notes that the quality and quantity of data have substantially improved since 2000 and new data sources offer opportunities for the future (WHO and UNICEF 2014). However, the report is silent on exactly *how* developing countries can be assisted to strengthen their capacity to collect and use the data necessary for these indicators.

The World Water Assessment Programme (WWAP) has periodically produced the UN World Water Development Reports (WWDR). These have progressively introduced improved water indicators, focused largely on trends in the quantity, quality and uses of water resources. SEEA-Water has introduced an overlapping but somewhat different set of indicators to integrate water resources as an environmental asset into national economic and social accounts. There are other related global and regional initiatives, summarized by WWAP (2012). It seems timely to become serious about

harmonizing these various laudable initiatives and focus far more attention on assisting countries to improve their capacities to collect reliable, consistent raw data and convert it into useful information. In addition, it is time to develop and implement a unified program to build national capacities to collect and process water data. This should be linked to, but autonomous from broader efforts aimed at strengthening the evidence base for implementation and monitoring of the proposed SDGs. This proposed initiative should include systematically tapping new sources of data and adopting innovations that are more cost effective, for example the use of donor-financed coordinated "waves" of household surveys in developing countries (Demombynes and Sandefur 2014), and supporting peer-to-peer programs in which developing countries with more experience assist other countries to strengthen their capacities.

4.5.2 Capacities for ensure availability and sustainable management of water and sanitation for all

As noted above, while countries have made good progress overall in terms of policy and legal frameworks related to water for sustainable development, actual implementation on the ground falls short of what is needed. While insufficient finance is an important issue, it is clear that the most important reasons for implementation shortcomings have to do with human resources and institutional capacities (though these are to a large degree a function of availability of funds). For example, in the survey of African countries carried out by AMCOW (2012) the constraint mentioned most often by countries was inadequate human capacity (mentioned by more countries than insufficient financial capacity). Strong concern over institutional capacities and the lack of responsive capacity development programs emerged, as did the need for better evidence-based systems for monitoring progress. The UN Secretary-General's Independent Expert Advisory Group on a Data Revolution for Sustainable Development (IEAG 2014) also strongly emphasizes the need to invest in capacity development and technology transfer to make good use of the 'data revolution' for monitoring progress on the proposed SDGs. This is re-emphasized by UNU (2015 [forthcoming]) which noted that capacity is not being developed rapidly enough in the water sector.

There are multiple dimensions of "capacity" which can be organised into three categories:

1. *Governance and institutions*: Institutional frameworks are often too fragmented, with various specialized ministries and departments having narrowly focused mandates and no mechanism for integration. Thus, separate units are often responsible for rural domestic water, urban water supplies, provision of sanitation and water in schools, quality of water to meet minimum health standards, wastewater management, and water for agriculture, to name a few. Government units are often limited by availability of equipment and operating funds, inefficient decision-making procedures ("red tape"), ineffective incentive systems, and inability to recruit and retain the expertise they need. Further, there is often insufficient cooperation among government, private firms, civil society and community organizations. Finally, local communities and organizations are often weak and unrepresentative; and even when they are effective they often have little influence over higher level policies.

2. *Financial resources*: All governments face the challenge of mobilising sufficient financial resources to meet heavy demands. This problem is especially acute for developing countries. While international finance institutions can support capital expenditures, normally governments

are expected to finance their own operations. Most governments therefore find it difficult to offer attractive salaries and provide adequate operational funds.

3. *Human resources*: Even if institutions have the resources to recruit expertise, that expertise is often in short supply. This reflects a combination of insufficient number of potential recruits, insufficient number of national training institutions, training quality issues, and a lack of fit between the demand for expertise and the supply – in other words giving the right training to people to meet demand.

In the national preparations for Rio +20, the biggest constraint emphasized by many developing countries was the limited capacity in data and statistics, including the capacity to develop and use indicators for monitoring the contribution of water to economic development, ecosystem services, and social wellbeing. Unless capacity is strengthened, "we end up with goals, targets and indicators that countries will not be able to monitor" (UN-DESA 2013:3). Adopting complex systems of water accounting such as SEEA-Water is especially challenging for most developing countries: a major effort will be required to strengthen capacities. The participants in an international workshop on strengthening capacity for water resources management (UN-DESA 2013:3) identified two priorities: 1) repositioning water in the larger sustainable development agenda, and 2) data collection and statistics to support decision-making. Regarding repositioning water, the participants suggested that common terms such as "water for food" and "water for nature" could be replaced by placing water within a development framework, emphasizing its values in terms of contributions to human wellbeing, and social, economic and political benefits and values. In other words, "'Mainstreaming' of water into national planning processes is vital" (UN-DESA 2013:19). This repositioning would lead to recognizing capacity needs that would have to be addressed.

In the national preparations for Rio +20, the biggest constraint emphasized by many developing countries was the limited capacity in data and statistics, including the capacity to develop and use indicators for monitoring the contribution of water to economic development, ecosystem services, and social wellbeing.

Practical steps to enhance capacity to establish and use integrated monitoring systems such as SEEA-Water could be as follows: Begin with what exists and build on it. A first step could be institutional mapping to better understand the potential on engagement between water and other key sectors. This could be followed by developing cooperative agreements to galvanize commitments, followed by an evaluation of available data and identification of ways to source data that are not currently available.

4.6 Conclusions

Section 4 has reviewed and dissected the proposed Goal 6 for water and its associated targets, some of the indicators that have been proposed for each target, and the data issue. Without reliable, timely and comparable data, the usefulness of the proposed indicators will be limited. The Section has reviewed the merits of two approaches to water accounting – i.e. integrating water data into conceptual frameworks that enhance their usefulness. With regard to the proposed indicators, there remain many challenges in terms of their definition and harmonizing local needs and the demand for global indicators. A major gap is that to date there are no proposed targets or indicators related to

access to water for productive purposes. Indeed, “promote sustainable agriculture” is tacked onto proposed SDG 2, “end hunger, achieve food security and improved nutrition ….” This seems inadequate given the critical role water plays in agriculture, and the importance of improving agricultural productivity to reduce poverty. Section 5 discusses this further. Two areas needing further work are discussed: the need to strengthen the database by both integrating parallel initiatives into a coherent approach and tapping new sources of data; and the need to invest in strengthening both institutional capacities and human resources for data collection and analysis, development and use of indicators, as well as for implementation. A stronger capacity for monitoring and evaluation should include not just measuring progress in quantitative terms, but learning lessons and using them for adaptive management.

A large number of indicators has been proposed for each of the Goal 6 targets. Many institutions are involved in promoting particular formulations. It is now important to focus on identifying a smaller set of indicators that are robust, measurable, and universal. Countries will wish to use additional indicators that are appropriate in their particular contexts.

5. Water and Other Proposed SDGs

It is now important to focus on identifying a smaller set of indicators that are robust, measurable, and universal. Countries will wish to use additional indicators that are appropriate in their particular contexts.

As discussed in Section 4, there has been considerable debate on how to frame the role of water in the sustainable development agenda. UNU and UNOSD (2013) distinguished three broad roles: water as a sector, as an enabler, and as a supporter of development and economic growth. UN Water (2014) strongly advocated for a dedicated water and sanitation goal and the Open Working Group (2014) has accepted this recommendation. It has proposed 17 Goals of which one, Goal 6, is a specific “Water Goal” with eight proposed targets. This has been discussed in detail above in Section 4. Section 5 discusses the potential roles of water in achieving the other proposed Goals and Targets, i.e. water as an enabler or supporter. In addition to Goal 6, four other proposed SDGs include targets that mention water specifically. These are discussed in sub-section 5.1. Sub-section 5.2 discusses the crucial roles that water may play in achieving several of the other targets, while 5.3 discusses synergies and gaps.

5.1 Proposed SDGs with targets specifically mentioning water

Table 5.1 lists the four proposed SDGs that specifically mention ‘water’ in one or more of their proposed targets. Only six targets specifically mention ‘water’. Two of the targets for Goal 3, ensuring healthy lives, mention reducing water-borne diseases and water-borne pollution. Goal 11 on cities and human settlements includes a target to reduce water-related disasters (but none mention the critical need for safe water and sanitation services). Goal 12 on ensuring sustainable consumption and production systems includes a target to reduce chemical pollution of water. This is very similar to Target 3.9, to reduce deaths and illnesses from pollution. Goal 15 on protecting ecosystems includes two targets related to conservation of freshwater ecosystems. All of the targets that specifically mention water are oriented toward environmental protection or conservation. This is a worthy objective, but it fails to capture the other possible benefits to which water contributes,

for example its critical importance for economic growth and food security. The next sub-section addresses this issue. Figure 5.1 graphically illustrates the linkages of water to other Goals that specifically mention water in their targets.

Table 5.1 Proposed SDGs with Specific Water-related Targets[20]

Goal 3. Ensure healthy lives and promote well-being for all at all ages
3.3 by 2030 end the epidemics of AIDS, tuberculosis, malaria, and neglected tropical diseases and combat hepatitis, *water-borne diseases*, and other communicable diseases 3.9 by 2030 substantially reduce the number of deaths and illnesses from hazardous chemicals and air, *water*, and soil pollution and contamination
Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable
11.5 by 2030 significantly reduce the number of deaths and the number of affected people and decrease by y% the economic losses relative to GDP caused by disasters, *including water-related disasters,* with the focus on protecting the poor and people in vulnerable situations
Goal 12. Ensure sustainable consumption and production patterns
12.4 by 2020 achieve environmentally sound management of chemicals and all wastes throughout their life cycle in accordance with agreed international frameworks and significantly reduce their release to air, *water* and soil to minimize their adverse impacts on human health and the environment
Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss
15.1 by 2020 ensure conservation, restoration and sustainable use of terrestrial and inland *freshwater ecosystems* and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements 15.8 by 2020 introduce measures to prevent the introduction and significantly reduce the impact of invasive alien species on land and *water ecosystems*, and control or eradicate the priority species

Source: Open Working Group 2014. Italics added.

Figure 5.1 Direct Links of Water to Other Proposed SDGs Whose Targets Specifically Mention Water

[20] These

ıt.

Source: Based on Table 5.1.

5.2 The relevance of water to other proposed SDGs

Water is an enabler, indeed a requirement, for achieving all the core SDGs. Development of water resources and making water available is a key ingredient for agricultural and broader economic growth. It will not be possible to end poverty (Goal 1) or achieve most of the other SDGs without significant investments in water. Table 5.2 presents examples of the contributions of water to each of the proposed 17 SDGs. The examples are not comprehensive but illustrative of the critical importance of water for achieving the individual SDGs. Although often invisible or taken for granted, water enables or supports nearly all human activities. Taken together, the examples listed in Table 5.2 therefore constitute an argument for enhancing the recognition of the critical role of water in the sustainable development agenda and therefore for adjusting the targets to ensure this materializes. An examination of the multiple roles that water plays for achieving the sustainable development agenda, as presented in Table 5.2, clearly suggests that water is under-represented in the current formulation of the SDGs and targets.

Table 5.2 Roles of Water in Achieving the Proposed SDGs

Proposed Goal	Examples of Roles of Water in Achieving the Goal and Implications
Goal 1. End poverty in all its forms everywhere	• Target 1.4 advocates equal access to economic resources including ownership of assets such as land, natural resources – which includes water • Target 1.5 on building the resilience of the poor is achievable only under conditions of water security at national and household levels • Achieving Goal 6 on water and sanitation is a necessity for reducing poverty • Ending poverty is possible only with substantial equitable and sustainable economic growth, which is not possible without reliable and adequate supplies of water
Goal 2. End hunger, achieve food security and improved nutrition, and promote sustainable agriculture	• Achieving Target 2.3, doubling agricultural productivity and the incomes of smallholders will be possible only if farmers have access to a secure supply of water among other factors, and are able to use the water productively. This applies to rainfed as well as irrigated agriculture. Annual freshwater withdrawals for agriculture including irrigation and water productivity have direct relevance to both sustainable water management and sustainable agriculture • Achieving Target 2.4 on sustainable, resilient and productive agro-ecosystems is achievable only with a reliable and secure water supply; a major impact of climate change is likely to be a decrease in water security, especially in the areas where the poorest people reside • Ending malnutrition in all its forms (Target 2.2) is achievable only if people have access to safe water and adequate sanitation (Goal 6) • The major threat to food security, especially of smallholders and rural people generally, is drought. Reliable and secure access to water is a necessary condition for achieving food security
Goal 3. Ensure healthy lives and promote well-being for all at all ages	• Targets 3.3 and 3.9 specifically mention reducing water-borne diseases and reducing diseases and deaths from water pollution • Achieving Goal 6 on WASH is a necessary condition for achieving Goal 3, promoting healthy lives and well-being of all people
Goal 4. Ensure inclusive and equitable quality education and promote life-long learning opportunities for all	• Provision of proper WASH facilities in all schools will lead to significant increases in the number of students, especially girls, who complete their education • Access to good water and sanitation combined with good nutrition enhances the performance of children in school and increases life-time labour productivity • In most of developing countries, access to water supply at reasonable distance reduces burden on girls house hold work load and leaving time for education
Goal 5. Achieve gender equality and empower all women and girls	• Goal 5.a, to "undertake reforms to give women equal rights to economic resources, as well as access to … ownership and control over land and other forms of property, … and natural resources …" should specify water as a critical natural resource over which women should have equal rights
Goal 6. Ensure availability and sustainable management of water and sanitation for all	Needs no further discussion here

Proposed Goal	Examples of Roles of Water in Achieving the Goal and Implications
Goal 7. Ensure access to affordable, reliable, sustainable, and modern energy for all	• Water supplies are critically important for energy generation; renewable energy, thermal and thermos nuclear plants are dependent on water; and significant amounts of energy are used in pumping and purifying water • Growing and processing bio-fuels requires significant amounts of water—expansion of bio-fuels accounts for most of the recent growth in the amount of water used in agriculture • The water-energy nexus is further discussed below in Section 6
Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all	• Target 8.4, "improve progressively through 2030 global resource efficiency in consumption and production, and endeavour to decouple economic growth from environmental degradation" by implication includes water use efficiency • Water security is a necessary condition for sustained economic growth. Water is a major driver for growth, and increasingly recognized by private firms as a major risk factor • Development, production and wide-spread use of innovative water technologies will create decent employment opportunities • Promoting sustainable tourism (Target 8.9) requires development and conservation of water resources
Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation	• Developing "quality, sustainable reliable and resilient infrastructure" (Target 9.1) will include significant investments in water infrastructure • Target 9.4 on upgrading infrastructure for sustainability and resource use efficiency necessarily includes water infrastructure (e.g. dams, irrigation schemes, water supply systems) (see also 9.a on African infrastructure)
Goal 10. Reduce inequality within and among countries	• Investment to improve access to and productive use of water for agriculture, energy, industry and other sectors is an important strategy to improve the growth rates of the poorest 40% of the population
Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable	• Ensuring access to safe, reliable and affordable water and sanitation services is a necessary condition to achieve the cities and human settlements goal • Target 11.5 on reducing the number of deaths and economic losses from natural disasters specifically mentions water-related disasters
Goal 12. Ensure sustainable consumption and production patterns	• Target 12.2, "by 2030 achieve sustainable management and efficient use of natural resources", clearly includes water • Reducing global food wastes (Target 12.3) will significantly reduce water losses • Target 12.4 on reducing release of harmful chemicals and wastes to minimize their impacts on people specifically mentions water • Target 12.5 implicitly includes water ("by 2030, substantially reduce waste generation through prevention, reduction, recycling, and reuse")
Goal 13. Take urgent action to combat climate change and its impacts	• A major impact of climate change is on the hydrological cycle and therefore on the availability of water • A major adaptation strategy to improve resilience to the impacts of climate change, for example on agriculture, is through enhancing water security • Low carbon renewable energy such as wind and solar technologies will reduce demand for water and contribute to ameliorating climate change

Proposed Goal	Examples of Roles of Water in Achieving the Goal and Implications
Goal 14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development	• The targets for reducing marine pollution and protection of marine and coastal ecosystems largely require interventions that improve the quality of freshwater flows
Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss	• Target 15.1, "by 2020 ensure conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services" specifically mentions fresh water • A major cause of land degradation is poor water management; therefore improving water management a necessary condition for reversing land degradation and for reversing desertification • Target 15.8 on invasive alien species specifically mentions water ecosystems
Goal 16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels	• Scarcity of and competition for water, especially transboundary water resources and between upstream and downstream communities, are potential source of conflicts between nations and communities within a nation. Therefore, promoting institutional frameworks for benefit sharing of shared rivers, lakes and aquifers is a strategy to promote peaceful societies • Indicators are needed for institutional effectiveness, including justice, equity, voice and access
Goal 17. Strengthen the means of implementation and revitalize the global partnership for sustainable development	• This Goal and its targets are aimed at enhancing global cooperation and partnerships to achieve the sustainable development agenda. Water is clearly part of that agenda. • Since 40% of the world's population live in transboundary river or lake basins[21], international cooperation to promote development and shared management of water resources for equitable benefits should be an important target

This raises an important question: why is there such a large apparent disconnect between what water development professionals have advocated vis-à-vis the sustainable development agenda, and what has been included in the agenda as proposed by the Open Working Group? As discussed above, at the WCCD in 2002 drinking water and sanitation and management of water resources, previously nearly invisible, received greater recognition as part of the MDGs. Since that time, multiple international studies led by various international organizations, including but not only UN agencies, have carried out detailed highly credible studies highlighting both the risks posed by water scarcity, water pollution, and water-related natural disasters, and the opportunities for achieving sustainable agricultural production and sustainable, productive management of ecosystems through wise water development and effective management. Major conferences that include high-level policy makers along with water professionals, civil society representatives and others regularly highlight these challenges and opportunities[22].

[21] See: http://www.unwater.org/topics/transboundary-waters/en/, accessed December 10, 2014.
[22] These include the annual World Water Week in Stockholm and the World Water Forum held every four years.

There are several possible reasons for this apparent neglect. One is that water is really not that important, and does not need so much attention. This position does not seem tenable. Another possible reason is that despite all their efforts, water professionals have simply failed to communicate their message effectively. This is possible, indeed plausible, though difficult for water professionals to admit. A third possible reason is that unlike the energy sector for example, the water sector has no powerful global special interests, with the exception perhaps of firms specializing in dam construction. Water is not commoditized in the way that energy is. A fourth possibility is that 'water' is seen as one of many special interests competing for attention and inclusion in the sustainable development agenda. In this perspective, inclusion of water is at the expense of some other sector, such as nutrition or energy. If this is the case, it is based on a profound misunderstanding: as should be clear from this paper, "water" is not a competing sector but is fundamental to achieving the worthy objectives of nearly all the items in the sustainable development agenda. Section 6, below develops this argument further in the context of the discussion of "nexus".

It is surprising that water does not have a more prominent place in the proposed SDGs and targets.

5.3 Water and the SDGs: Synergies and gaps

In sub-section 3.4, six lessons emerging from a review of MDG experiences regarding water are identified. This sub-section uses these lessons to examine the question as to whether the proposed water-dependent goals and targets recognize water adequately. If not, what are the gaps if any, and what are possible synergies? The six lessons are listed in Table 5.3 along with observations on whether they have been internalized in the proposed SDGs.

Table 5.3 shows that while there is substantial progress in drawing lessons from the MDG experience to develop the future sustainable development agenda, more needs to be done. This Section concludes by highlight two very critical gaps in the currently proposed SDGs. One is that there is no goal or target dedicated to improving access to water for agricultural and other productive purposes. This is surprising given the strong evidence that enhancing poor households' access to water for productive purposes contributes significantly to reducing poverty, improving food security and health, and rural economic growth. The second critical gap is highlighted in Table 5.3: reforming and strengthening institutions and policies. The sustainable development agenda is being defined in terms that require major changes in the behaviour of all humans: using resources more productively, reducing resource degradation, reducing impacts on global planetary systems, empowering poor people and progressive achieving greater equality, and moving toward a "Green Economy". These goals cannot be achieved under the current set of institutions.

There is no goal or target dedicated to improving access to water for agricultural and other productive purposes.

Table 5.3 Incorporation of Selected MDG Lessons into the Proposed SDGs

Lesson	Observations
1. Need for a conceptual framework linking water clearly to the sustainable development agenda	There is progress—a number of conceptual frameworks have been proposed

2. Strong focus on equality and human rights: A 'human development' agenda	Good progress—but need more useful indicators to track the rate of change and convergence
3. Stronger emphasis on SDGs as drivers of economic growth	This is Goal 8 but it is not well-integrated with other Goals and Targets, including water and sanitation

The essence of a nexus approach is to reduce trade-offs and enhance the efficiency of the entire system rather than increasing the productivity of specific sectors, often at the expense of other sectors.

4. Based firmly on sustainability in the context of global challenges	This is recognized but remains a weak point-need clearer links to planetary and social boundaries and clarity on the "Green Economy"
5. Prioritize policy and institutional reform and capacity strengthening at multiple levels	Policy and institutional reform receive too little serious attention; more attention is needed to capacity strengthening especially at national levels
6. Effective monitoring systems linked to adaptive management	There is progress, but most indicators are designed to measure achievements, not rates of change and lessons learned from implementation processes. This limits their usefulness in adaptive management

Source: Lessons from sub-section 3.4, above. Observations are those of the authors.

6. Cross-sectoral Integration and Nexus: Water Management as a Unifying Factor[23]

The analysis in Section 5 demonstrates the interdependence of water and other goal areas and sectors, and the intrinsic nature of the role of water in achieving the SDGs. The water nexus concept helps to understand water as a unifying parameter. Allouche et al. (2014) state that the nexus idea had its origins at the 2008 World Economic Forum and gained relevance since then at a variety of international conferences and through several important papers. The Stockholm Environment Institute (SEI) produced an important paper explaining the multiple interactions that constitute the water-food security-energy nexus (Hoff 2011). Reversing current trends of resource degradation while meeting the needs of those who currently do not have access to adequate water, food and energy will require a transformation of the global system towards a "Green Economy" (see Box 6.1). The essence of a nexus approach is to reduce trade-offs and enhance the efficiency of the entire system rather than increasing the productivity of specific sectors, often at the expense of other sectors. This can be achieved through such measures as treating natural capital as an asset to be preserved and enhanced, not exploited, recycling and reusing waste, improved management of ecosystems to enhance and sustain their multiple services, and integrating poverty reduction and "green growth" (ibid.). Figure 6.1 is a schematic illustration of the water-food-energy nexus.

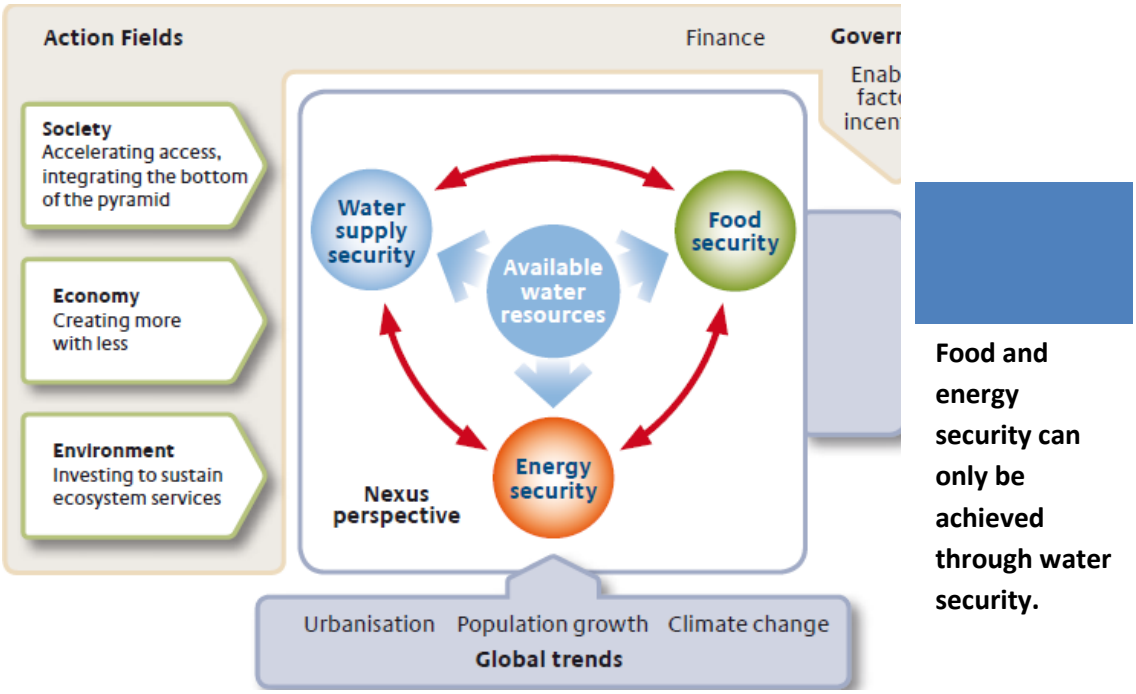
Box 6.1 What is a "Green Economy"?

There is no universally accepted definition of a "Green Economy". However, UNEP considers a Green Economy to be one that achieves improved human well-being and social equity and reduces environmental risks. Its carbon output and pollution levels are low and its resource use efficiency is high. Natural capital is valued as a critical economic asset and as a provider of benefits for the poor. A Green Economy is the nexus approach par excellence. A Green Economy will therefore actively address the water, energy and food security nexus, in-line with human rights-based approaches.

Sources: Hoff (2011); Allouche et al. 2014.

[23] The jou… …peared too late t… (accessed…

Figure 6.1 The Water-Food-Energy Nexus



Source: Hoff 2011:66, Figure 2.

The German government sponsored a Conference in 2011 on the theme of "The Water, Energy and Food Security Nexus – Solutions for a Green Economy" (BMU and BMZ 2012). The focus was the interdependencies among water, energy, food security, and the underlying natural resources - water, soil and land and related ecosystems. The Bonn2011 Conference was based on the conviction that "universal access to minimum standards of water, energy and food can be achieved and sustained within planetary boundaries provided there is political commitment and an appropriate enabling environment"(BMU and BMZ 2012:2). However, achieving these goals requires abandoning conventional planning and decision-making and recognizing the critical inter-dependencies among these and other sectors. The Conference document (ibid.) expresses optimism that a "nexus-aware" approach can be achieved within existing institutional structures – a view that needs to be revisited as existing institutional structures may be part of the problem, not necessarily the solution. The Conference identified six "Nexus Opportunity Areas": increase policy coherence; accelerate access; create more with less; end waste and minimize losses; value natural infrastructure; and mobilize consumer influence.

Since 2011, other conferences have followed up on the nexus theme and additional research has been done to clarify the implications of a nexus approach. The water-food-energy nexus was also

discussed at the Rio+20 Conference. It is driven by a fundamental concern that water scarcity is at the core of a host of challenges facing agriculture, energy, urban growth, trade, finance, national security and the lives of all, rich and poor. Food and energy security can only be achieved through water security. Climate change is a driver that amplifies these systemic interactions. As noted above, a nexus approach is linked closely to the concept of the Green Economy, as was clear at the Bonn2011 and Rio +20 Conferences. Some developing countries are already developing strategies to achieve a Green Economy, though it was also clear at the Rio +20 Conference that there is still considerable confusion and uncertainty as to its meaning (UN-DESA and UNDP 2012).

6.1 Defining the domain: The multiple linkages of water and other critical domains

6.1.1 Concepts

A nexus approach is in essence an approach based on a systems perspective. Traditionally, separate policies, institutional arrangements and investments are decided and implemented within sector-based silos. Thus, energy policy is usually made with little consideration for its implications for water or for agriculture; water policies do not consider linkages to energy, or other sectors. Agricultural expansion policies do not consider the consequences for water resources, such as groundwater. Adopting a nexus or systems perspective draws attention to the multiple linkages among nearly all sectors as well as at multiple scales. There are potentials for conflicts, synergies, trade-offs and resource use efficiencies. This perspective also draws attention to the need to adopt an integrated landscape or socio-ecological perspective, and take account of climate change and other planetary systems trends. It also draws attention to the need for a broad conceptual framework linking water to the larger sustainable development agenda, as advocated above in sub-section 3.4.

A nexus approach needs to include careful consideration of balancing the use of natural resources within a larger global planetary systems perspective, briefly discussed above in sub-section 1.3. Rockström et al. (2009) identify nine inter-linked planetary systems that are part of the larger earth system. These include, among others, climate change, changes in land use, and global freshwater use. They argue that largely because of human-induced drivers, these global systems are either in danger of or already being transformed in ways that are not predictable but likely to pose serious threats to humanity. They attempt to define a "safe operating space" for all of the nine systems and find the boundaries have been exceeded in three of them to date (climate change, biodiversity, nitrogen cycle). In a later article, the threat posed by growing scarcity of water is discussed, as summarized above in sub-section 1.3. (Rockström et al. 2014). Rockström and Karlberg (2010) argue for a "triply green revolution" that doubles food production in many of the poorest parts of the world in a way that is environmentally sustainable based on investments in green water for rainfed agriculture at a landscape scale.

A nexus approach is in essence an approach based on a systems perspective.

Raworth (2012) combines this concept of safe operating space within planetary boundaries with the concept of "social boundaries" as a way of creating a safe and just place for humanity to thrive, with an emphasis on achieving greater equity within and between countries and more efficient use of natural resources to meet human needs. She combines the nine dimensions of the environmental

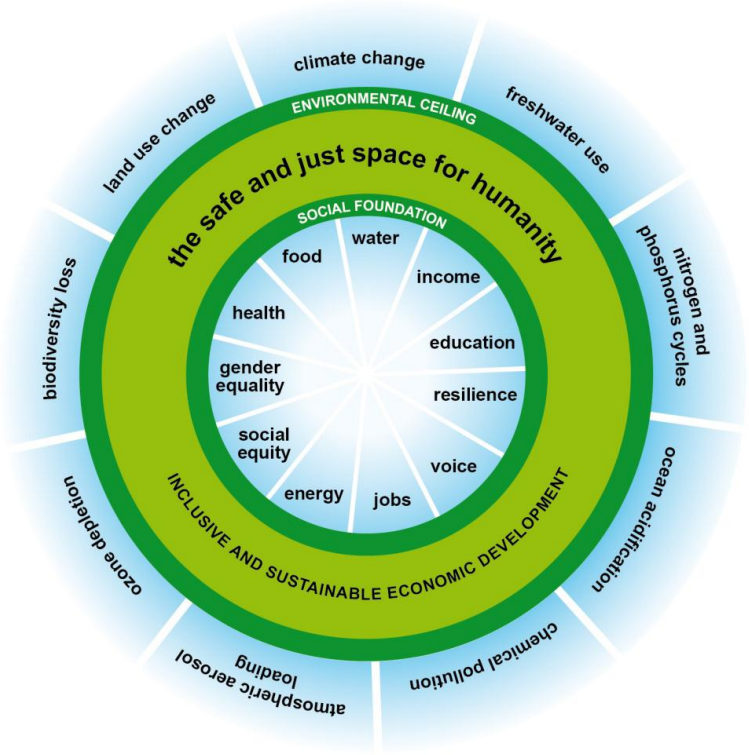
planetary boundaries proposed by Rockström et al. (2009) with 11 social dimensions based on priorities identified at Rio +20. Between the two boundaries – planetary environmental and social – lies a "safe and just" space for humanity, as illustrated in Figure 6.2. Nexus thinking is contextualized by understanding the interdependencies of humanity and the earth's systems.

6.1.2 The water-energy-food-climate change nexus

The nexus area that has received the most attention is water-energy-food-climate change (or sometimes only water and energy). This relates directly to the proposed SDGs on achieving food security and promoting sustainable agriculture (Goal 2), ensuring the availability and sustainable management of water and sanitation for all (Goal 6), and ensuring access to affordable, reliable energy for all (Goal 7). However, the water-food-energy nexus also impinges on all of the other proposed SDGs, in some cases quite directly, in other less directly. Climate change introduces uncertainties and increases the tensions among sectors. For example, conventional energy and food production emit greenhouse gases; but some measures intended to reduce emissions such as subsidized biofuel production can withdraw water from growing food as well as lead to higher food prices (IWMI 2014: Chapter 2). The worst negative impacts of climate change occur through the medium of water as drought, flood, sea level rise, and extreme weather (rainfall) events such as hurricanes and typhoons.

The UN World Water Assessment Programme (WWAP) has recently published a World Water Development Report (WWDR) with a thematic focus on water and energy (WWAP 2014). This is a detailed and authoritative analysis of the water-energy nexus. Both energy and water are crucial to human wellbeing and therefore to achieving the sustainable development agenda. By 2035, global energy demand is projected to grow by more than a third, and demand for electricity by 70%. Over half of this growth will be in India and China. Energy can be produced in a variety

Figure 6.2 A Safe and Just Space for Humanity



Source: Raworth 2012: 4, Figure 1.

of ways, but about 90% of the energy currently produced is water-intensive. Thermal energy production requires large volumes of water for cooling, much of it evaporated (consumed); biofuels consume water for its growth and processing; production of gas and oil uses large amounts of water; and hydroelectric power uses large amounts of water though most of it is not consumed and can be used again. On the other hand, not only is agriculture the largest user of water globally, the food production and supply chain account for about a third of the total global energy consumption. Biofuel production is currently the largest source of new demand for water for agricultural production (ibid.). Water and energy demand and prices are distorted by political decisions and subsidies. As discussed in sub-section 2.1, global scenario modelling suggests there are potentially critical trade-offs between achieving a low-carbon energy future and achieving a water-smart future: a low-carbon future places greater pressure on water resources (see Table 2.1, above; Ringler et al. 2014). On the other hand, the International Renewable Energy Agency (IRENA) has recently published a report that argues strongly that a transition to renewable energy sources such as solar and wind technologies are less water-intensive and therefore will lead to substantial reductions in water use (IRENA 2015). The report offers considerable case study evidence and also describes analytical tools that can be used to assess the potential water-energy-food trade-offs and synergies.

Energy can be produced in a variety of ways, but about 90% of the energy produced is water-intensive.

It is clear that the challenges of reversing the current unsustainable trends related to water, energy and food security and achieving the potential synergies which would result in sustainable development are immense. However, with all the complexities and interdependencies, taking a

pragmatic approach is critical and offers a way forward, as argued by IWMI (2014: chapter 2) for example. There are clear inter-dependencies among the proposed SDGs, but there are also practical opportunities to address many of these effectively. For example, expanding irrigation increases land productivity, food production and poverty reduction, but pumping water increases energy demand compared to rainfed agriculture. Over-pumping of aquifers can result from the expansion of pumping, especially in the context of subsidized electricity as in some Indian states. Reforming electricity policies in Gujarat, India, led to higher agricultural production while enabling the recovery of groundwater levels. A different energy reform in water-abundant West Bengal state in India improved farmers' access to groundwater (summarized in IWMI 2014: chapter 2). The advent of lower-cost solar pumps is about to lead to further potential for groundwater irrigation – though this may reduce the capacity of policy makers to influence groundwater pumping through energy policies.

Nexus thinking applies to the trade-offs and potential synergies and benefit sharing on transboundary river basins and aquifers. This is another area requiring a broad integrated systems approach. Innovative solutions are needed to optimize water use for energy production versus food production and other uses in the context of climate change uncertainties and growing demands requires innovative solutions. Hydroelectric power may reduce greenhouse gases if it replaces coal-fired plants, but may also place greater pressure on food systems dependent on irrigation unless it is carefully designed as multipurpose development. This also draws attention to the linkages of cooperating in water management with peace and security. Global priorities may not reflect local concerns, and the assumption that a systems-based modeling approach which narrows choices down to a single "optimal" solution is insufficient as a basis for decision-making. (see Allouche 2014).

If the strong emphasis on rights, equality and justice that now permeates the proposed SDGs is going to be meaningful, the nexus must be inclusive and grounded in local realities and human needs.

6.2 The proposed SDGs: Do they address the critical nexus issues?

The proposed targets and suggested indicators for Goal 6 on water and sanitation have been discussed in sub-section 4.4, above. Reviewing those proposed targets and indicators through a nexus lens suggests that the nexus issues discussed in this Section have not been addressed or even considered. Indeed, the proposed targets for the other 16 proposed SDGs also fail to take a nexus perspective, i.e. recognizing there are inherent trade-offs but also potential synergies among the proposed SDGs and their targets. Achieving both water and energy security without compromising the natural resource base and the planetary systems on which life depends will be a daunting challenge. Put differently, there are inherent tensions between the water and sanitation Goal (6) and the energy Goal (7). In addition, as discussed above in Sections 1.3 and 2, achieving the proposed SDG on combatting climate change while also achieving water and sanitation, energy, and food security (Goal 2) will be very difficult. Major transformations in consumption and production patterns (Goal 12) will be required. Addressing all of these challenges

The proposed Goals and Targets … fail to take a nexus perspective.

simultaneously is probably not possible without drastic changes in human behaviour, supported by radical reforms in policies and institutions from the global to the national and local levels.

The proposed Goal 16 is to "Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels". A dozen targets are proposed (Open Working Group 2014: 18-19). All the proposed targets are worthy and important. However, developing useful and measurable indicators for many of them will be a difficult task: quantitative indicators for such "soft" targets usually do not capture the effectiveness or actual levels of inclusiveness and empowerment. Further, as currently framed, none of the proposed targets for SDG 16 focuses on transformation of policies and institutions. More work is needed in this area.

This discussion also reinforces the critical importance of framing a broad but easily communicated conceptual framework for the sustainable development agenda. Several have been discussed in previous sections of this paper. Some have emphasized the interactions of the human development agenda and planetary systems (e.g. Figure 6.2). Others have a more narrow focus, such as the UN Water proposal focused on water, the water-energy-food nexus (Figures 1.1 and 6.1), the water-food and nutrition linkages (Figure 4.3) and the UNCTAD proposal linking economic and social development (Figure 3.2). The Secretary General's proposal with its six basic "essential elements" (Figure 4.1) emphasizes some of the key points discussed here: integration, people-focused while linking the sustainable development agenda to the larger planetary and ecosystem challenges, and transformative. However, water is invisible. The framework proposed by UNU and UNOSD (2013) with water as an enabler, and therefore an entry point, is therefore attractive, as it includes the water-energy-food nexus, links water to other proposed SDGs, and links these with poverty-reducing economic growth (Figure 3.1). Its drawback is that it does not link the specific proposed SDGs (as is also the case with the Secretary General's proposal); and does not clearly link to planetary systems or highlight the need for institutional transformation. Further work is needed on this topic.

Selecting or developing appropriate indicators to measure nexus-friendly targets for the energy, agriculture and industry sectors will be critical. Some indicators linking water and energy have been proposed, but these do not include food security and other linkages (WWAP 2014: Volume 2, Pp. 193ff). A great deal more work is needed to identify measurable useful indicators that can be used to monitor systemic rather than only sectoral progress.

7. Recommendations: Fully Integrating Water into the Sustainable Development Agenda

This paper has reviewed experiences and lessons learned from implementing the MDGs, promoting water management for development, and the proposals for the future sustainable development agenda. The review was done within the context of emerging evidence regarding threats to the critical planetary systems on which humans depend and the recent strong emphasis on achieving social equality and human rights. This final Section offers the most important recommendations emerging from the study. The recommendations are under four headings: 1) the proposed Goal 6 (ensuring availability and sustainable management of water and sanitation for all); 2) the linkages of water and other SDGs; 3) water and nexus issues; and 4) capacity strengthening.

7.1 Recommendations on ensuring availability and sustainable management of water and sanitation for all

The MDGs as originally formulated did not prioritize water. They were retrofitted in part after the Earth Summit in 2002 to give water more emphasis. In formulating the future sustainable development agenda, the critical importance of water and sanitation is receiving more attention. Nevertheless, given the fundamental roles that water plays in all aspects of life, the large number of people who do not have access to an adequate water supply for domestic and productive uses, and the growing threat to water global water systems, the currently proposed SDGs and associated targets need further work to strengthen recognition and attention to water.

- R*ecommendation number one* is to confirm the specific water goal as expressed by the Open Working Group, "ensure availability and sustainable management of water and sanitation for all". The independent goal on water and its six target areas with two means of implementation-related targets represent significant progress compared to the MDGs. However, the proposed targets and indicators need to be further refined, clear definition of terms agreed, and consideration needs to be given to highlighting the critical roles of water for achieving a number of other SDGs, as recommended below.

- *Recommendation number two* is therefore that water professionals develop a clear consensus on how to give higher priority to investments in water (as well as sanitation) in ways that strongly support the most fundamental Goal, to "end poverty in all its forms everywhere", make strong efforts to integrate water interventions into the sustainable development agenda, and support the member states through the articulation of interventions.

The Open Working Group has proposed eight targets for Goal 6 on ensuring availability and sustainable management of water and sanitation for all; UN Water had proposed five targets, each with several "elements" and multiple targets. While further improvements are needed, the way in which UN Water has framed the elements and indicators takes into account many of the broader sustainable development issues. They also include some important dimensions: they are people-centric and focused on water as a human right; they pay specific attention to progressively achieving equality; they emphasize achieving both environmental sustainability and financial and institutional sustainability of water and sanitation infrastructure and services; they emphasize improving knowledge and capacities; and they address nexus issues, for example water for energy. There is also a conceptual framework linking water to the sustainable development agenda.

- *Recommendation number three* is that the UN system, particularly UN-Water and its task teams, in consultation with member state partners, should use the available background documents as the basis for finalizing the dedicated water goal and targets, and improving the specificity and measurability of indicators. This should include a stronger emphasis on the links between the proposed Goal 6 and economic growth, especially *access* to water for agriculture and nutrition; a firmer grounding in the planetary challenges context (e.g. climate change, water security); and more attention to a monitoring system that would learn lessons to inform adaptive management processes. Further, while the indicators understandably emphasize progress toward achieving targets, they do not measure the *rate* of progress toward achieving universality – a fundamental characteristic of the sustainable development

agenda. As discussed above, many terms need to be defined in precise and measurable ways, and those proposed indicators that are not measurable should be dropped to avoid compromising their viability.

New water services and sanitation services must be operated, maintained, and periodically either replaced or upgraded. Lack of finance for scheme operation and maintenance has been a huge challenge and this will continue. The objective should be achieving *sustainable* water services and sanitation services.

- *Recommendation number four* is, therefore, that an important gap in the indicators for the Open Working Group Targets 6.1 (water services) and 6.2 (sanitation services) be addressed: ensuring the long-term sustainability and continuous improvement of measures to achieve universal and equal access to water, sanitation and hygiene. Specific water and sanitation services sustainability indicators need to be adopted.

In addition, the currently proposed indicators for the water and sanitation targets are focused on the level of achievement but are less useful in measuring the progressive realization of the human right to water and sanitation.

- *Recommendation number five* is to consider making use of an Equity Index that is designed to measure the rate of convergence toward equality, thus addressing an issue – progressive realization – that is fundamental to human rights. A similar Equity Index can be developed for other SDG Targets.

The Open Working Group's Target 6.4 seeks to substantially increase water use efficiency. The indicators proposed for agricultural water are focused on withdrawals and productivity. These are important but by themselves inadequate, as millions of small farmers, especially in the poorest regions of southern Asia and sub-Saharan Africa, lack access to a reliable water supply. Investments to improve access to irrigation, including pump-based irrigation, have been shown to be very effective in improving food security, reducing poverty, and promoting rural economic development.

- *Recommendation number six* is therefore that indicators that measure changes in *access* to water for agriculture and other productive purposes in rural and peri-urban areas at household level be adopted. This recommendation is discussed further below.

Although some proposed indicators for Target 6.5 (IWRM including at transboundary level) are quantifiable, they offer assessments only at the international level and fail to measure progress within countries. Other proposed indicators do not contain measurable objectives at all.

- *Recommendation number seven* is to identify specific indicators for this target that can measure both the elements of IWRM (e.g. decentralization of water management and existence of stakeholder participation) and the *effectiveness* of transboundary cooperation.

Agreements and planning are important, but their implementation is the crux of the matter. Indicators should measure the effectiveness and outcomes of transboundary cooperation in terms of such parameters as equitable access to water for domestic and productive uses, and investments in water development that lead to broad benefit sharing among and within countries. IWRM should also be applied at lower spatial scales of watersheds and sub-basin levels. Successful sustainable

river basin management could be achieved when supported by Integrated Watershed Management (IWSM). Concepts such as Payment for Environmental Services (PES) and Payment for Water Services (PWS) could also evolve as useful indicators

Target 6.6 relates to protection of water-related ecosystems. However, it does not mention agro-ecosystems, which are crucial to human wellbeing.

- *Recommendation number eight* is that agro-ecosystems be included in the list of water-related ecosystems and appropriate indicators be developed.

Regarding Target 6.6a (international cooperation and capacity building), many of the proposed indicators focus on the performance of local water authorities (itself very important), not on the level and effectiveness of "international cooperation and capacity building".

- *Recommendation number nine* is to do more work to identify practical and measurable indicators, focusing on *outcomes*, not only inputs. On the other hand, this target could be subsumed under the broader SDG goal (17) of strengthening global partnerships for sustainable development.

Target 6.6b aims to "support and strengthen the participation of local communities for improving water and sanitation management".

- *Recommendation number ten* is to develop a precise measure of the effectiveness of participation, for example, the existence of mechanisms for participation in every catchment/ community, actual empowered roles of women and youth in decision-making, and flows of benefits broken down by gender and age.

The lack of reliable and credible data on water management has put water resources management at a serious political disadvantage. This is reflected in the relative invisibility of water linkages in the other proposed SDGs, and in formulations such as the framework proposed by the Secretary General. This leads to a vicious cycle: water is not given high priority, therefore collecting and using water data is low priority, leading to further deterioration of the quality and credibility of water data.

- *Recommendation number eleven* is that water professionals make a concerted effort to reverse this vicious cycle and convert it to a virtuous cycle where water data contribute significantly to policy, leading to a higher priority in terms of funding, which will enable better quality data to be collected. Use of recent technologies such as remote sensing, radar shuttle and isotop technologies could help transforming water data in developing countries if the data of these technologies could be accessible. Efforts to improve the availability of data must be nationally led and must meet the specific needs of each country while also contributing to the global system. However, the UN and other agencies can and must play critical roles. A strong effort must be initiated to harmonize various water data initiatives and focus on assisting countries to improve their capacities to collect reliable, consistent raw data and convert it into useful information. Development and implementation of a unified program to build national capacities to collect and process water data is recommended, linked to broader efforts aimed at strengthening the evidence base for implementation and

monitoring of the proposed SDGs. An example is support for peer-to-peer programs in which developing countries with more experience assist other countries to strengthen their capacities.

Current global efforts to improve water information systems are driven by a variety of agencies, each with its own mission and priorities. Improvement in the collection of basic data that can be the building blocks to serve multiple purposes is needed.

7.2 Recommendations on water and other SDGs

Water is a potentially effective and certainly critical entry point to achieve the future sustainable development agenda. In formulating this agenda, the global community can draw on important lessons learned from implementing the MDGs. These include: a need for a conceptual framework linking water clearly to the sustainable development agenda; a strong focus on equality and human rights — what has been called a "human development" agenda; a stronger emphasis on economic growth and synergies between economic growth and social development; a firm basis in sustainability in the context of global challenges such as climate change; effective monitoring systems linked to adaptive management; and a very high priority on policy and institutional reform and capacity strengthening at all levels

Water is a potentially effective and certainly critical entry point to achieve the future sustainable development agenda.

Stressing the linkages of economic and human development is relevant for specifying the potential roles of water in achieving the SDGs. First, access to quality domestic water and sanitation is a way of improving health and therefore productivity of labour. Second, enhancing access to and the productive use of water in agriculture will increase the possibility of reducing malnutrition and hunger. Third, better management of water resources including recycling wastewater will contribute to the provision of quality water for domestic and productive uses. But these are all opportunities for promoting economic development and job creation as well. A major benefit of irrigation is indeed enhancing the productivity of and demand for labour. Expansion of private pump irrigation contributes to the diversification of rural economies through manufacturing, servicing, spare parts, etc. There are growing opportunities to turn urban waste management into profitable businesses. Fourth, integrated management of water can help achieve equitable use of water and enhance transboundary cooperation, regional integration, economic growth, and better ecological functions.

- *Recommendation number twelve* is that in the process of finalizing the targets and indicators for the other SDGs, investments in water as an enabler and entry point for equitable and sustainable socio-economic development be explicitly included along with measurable indicators. **Enhancing access to water for productive use should be strongly emphasized in addition to access for domestic use and ensuring ecological sustainability**.

A major gap is that there are no proposed targets or indicators related to access to water for productive purposes including smallholder agriculture. Recommendations six and thirteen, above, specifically address this issue, which goes beyond agriculture. "Promote sustainable agriculture" is tacked onto proposed SDG 2, "end hunger, achieve food security and improved nutrition …." This is

inadequate given the critical role water plays in agriculture, and the importance of improving agricultural productivity to reduce poverty. SDSN (2014) had recommended a specific goal on agriculture: "Improve agricultural systems and raise rural prosperity". However, by itself 'sustainable agriculture' is not enough; food insecurity is only partly a result of production shortfalls. In essence it is a result of a food system in which a large percentage of what is produced is wasted, and of an economic system that condemns people with very low incomes to hunger.

- *Recommendation number thirteen* has two parts. *First*, change "sustainable agriculture" to "sustainable agriculture and food systems". Goal 2 would then read "end hunger, achieve food security and good nutrition, and promote sustainable agriculture and food systems". *Second*, refine the eight proposed targets for Goal 2 to explicitly recognize the critical roles of water, and to include specific measurable indicators of the role of water.[24]

Finally, this report has emphasized the many ways in which water plays a critical role in achieving nearly all of the proposed SDGs. For example, good water, sanitation and hygiene facilities in schools (Goal 4) and other public places encourage more use – and higher rates of girls' education. Making cities and human settlements safe, resilient and sustainable (Goal 11) is possible only with adequate water and sanitation (including wastewater removal and recycling) services. Water infrastructure is surely a major component of the infrastructure proposed in Goal 9.

- *Recommendation number fourteen* is therefore that the water professional community work with other colleagues to ensure that water is explicitly included where appropriate in the final SDG targets, and that appropriate indicators be included for these targets.

7.3 Recommendations on water and nexus issues

A nexus perspective draws attention to the multiple interdependencies among water, energy, food security, and the underlying natural resources – water, soil and land and related ecosystems. There are potentials for conflicts, synergies, trade-offs and resource use efficiencies. This perspective also draws attention to the need to adopt an integrated landscape or socio-ecological perspective, and the need for a broad conceptual framework linking water to the larger sustainable development agenda. The "Green Economy" has been proposed to provide broad guidance for addressing critical long term threats to humanity and the planetary systems on which humanity depends for survival.

Reviewing the proposed SDG targets and indicators through a nexus lens suggests that a nexus perspective has not been adopted in their framing. The proposed SDG targets fail to take a nexus perspective, i.e. they fail to recognize there are inherent trade-offs but also potential synergies among the proposed SDGs and their targets. For example, achieving both water and energy security without compromising the natural resource base and the planetary systems on which life depends will be a daunting challenge. Put differently, there are inherent tensions between the water and sanitation Goal (6) and the energy Goal (7). In addition, achieving the proposed Goal 13 on combatting climate change while also achieving the SDGs for water and sanitation, energy, and food security will be challenging. Major transformations in consumption and production patterns (Goal

[24] Another possibility is to add a sixth target to the UN Water proposals, "improving the use of water throughout the food system". Otherwise, it could be made a fourth "element" under the proposed Target B, "improve by (x%) the sustainable use and development of water resources in all countries". However, revising SDG 2 seems to be a more logical option.

12) will be required. Addressing all of these challenges simultaneously is probably not possible without drastic changes in human behaviour, supported by radical reforms in policies and institutions from the global to the national and local levels (see below).

- *Recommendation number fifteen* is in two parts. *First*, frame a broad but easily communicated conceptual integrative framework for the sustainable development agenda that draws attention to critical nexus issues. This should include specific linkages to planetary and social boundaries by combining the "safe operating space within planetary boundaries" concept with the concept of "social boundaries" as a way of creating a safe and just place for humanity to thrive. *Second*, use this conceptual nexus framework to critically analyse all of the proposed SDGs and targets in order to identify both those areas with serious trade-offs, and those areas where there are potential synergies. A pragmatic approach is critical and possible. There are clear tensions among some of the proposed SDGs, but there are also practical opportunities to address many of them effectively.

Finally, selecting or developing appropriate indicators to measure nexus-friendly targets, especially for water energy, agriculture and industry will be critical. WWAP (2014) makes a start for the water-energy nexus.

- *Recommendation number sixteen* is to identify measurable useful indicators that can be used to monitor systemic rather than only sectoral progress.

7.4 Capacity strengthening recommendations

There is a strong consensus that that while overall capacities have been strengthened in developing countries over the past decade, there remains a substantial gap between current capacities and the requirements for achieving the SDGs. This observation applies to all levels and sectors – not only governments but civil society as well. This report emphasizes two aspects: institutional and human resources (see Box 7.1). Institutional capacity refers to the organizational structure, rules and procedures, financial resources, authority and political legitimacy, and incentives needed to enable the people in the organization to accomplish the tasks as hand. It clearly also includes the human resource component as well – having the necessary number and types of skills needed. Human resources can be strengthened relatively easily through training and education. Strengthening institutions is a more difficult and time-consuming task. These observations apply to the planning and implementing of SDG programs as well as to monitoring and evaluation. There are other dimensions of capacity as well, especially financial capacity[25].

A review of MDG experiences shows that implementation capacities of most developing nations are limited, including integration, inclusiveness and cohesion. Capacities to integrate the three dimensions of sustainable development into the national development policies, plans, strategies and programmes are important. Therefore, *Recommendation number seventeen* is to encourage governments, their financial partners, and the private sector to ramp up investments in strengthening capacities, especially in the early stages, even if this requires transferring resources

Box 7.1 Capacity Development

"Capacity development must be nested within, and form a pillar of, institutional reform at all scales within a country, with an emphasis on transferable skills that can be used for sustainable development across all areas and goals."

Source: UNU 2015 [forthcoming]: 48. Bold in original.

from implementation. An up-front investment in capacity strengthening will pay rich dividends in the long run. To obtain the full benefit, these investments must be in both institutions and human resources, and should include attention to the requirements for long-term sustainability.

While the world community has made important progress in reducing poverty and hunger during the past few decades, we have also seriously damaged the planetary systems, natural resources such as water, and the ecosystems on which life depends. In addition, human societies are characterized by very high and growing levels of socio-economic inequity, among and within countries. The sustainable development agenda is being defined in terms that require major changes in the behaviour of all humans: using resources more productively, reducing resource degradation, reducing impacts on global planetary systems, empowering poor people and progressively achieving greater equality, moving toward a "Green Economy", and achieving more sustainable production-consumption patterns. These goals cannot be achieved under the current set of institutions. Achieving them will require major transformations in governance, policies, values and behaviour. Institutions establish the incentives and rules that guide behaviour but they are not immutable.

Achieving the Sustainable Development Goals will require major transformations in governance, policies, values and behaviour.

Many professionals are optimistic that technological innovations by themselves will contribute substantially to achieving a better future. There is no denying the critical importance of technological innovations. However, it is also important to underscore that institutional innovation is equally and perhaps more important than technological innovation. Indeed, there are potential synergies: more equitable and just institutions could enhance the uptake and impacts of new technologies, while new technologies offer opportunities to promote institutional change.

- *Recommendation number eighteen* is that the design and implementation of the sustainable development agenda be explicitly based on reforming, transforming and strengthening governance structures, institutional arrangements, and policies.

Achieving a higher degree of equality in access to basic services and in opportunities for improved wellbeing will require empowerment of those currently having little power, and a higher degree of accountability. One way forward is to reframe the proposed Goal 16 on peaceful and inclusive societies and accountable institutions to focus on achieving these transformations. Implementing this recommendation will be extremely challenging, as there are strong vested interests and considerable inertia in the current institutional systems at global, national, and local levels. However, implementing the ambitious sustainable development agenda through the current institutional frameworks will severely limit the outcomes and only postpone reforms that are necessary conditions for success. *Institutional transformation is a necessary condition for ending poverty and hunger, ensuring healthy lives and wellbeing, and achieving equality.*

References

2030 Water Resources Group. 2009**.** *Charting our Water Future: Economic Frameworks to Inform Decision Making*.

Albuquerque, Catarina de, with Virginia Roaf. 2012. *On the right track: Good practices in realising the rights to water and sanitation*. UN Special Rapporteur on Human Rights to Water and Sanitation.

Akpabio, Emmanuel M. and Kaoru Takara. 2014. Understanding and confronting cultural complexities characterizing water, sanitation and hygiene in Sub-Saharan Africa. *Water International*. 39 (7): 921-932.

Alexandratos, N. and J. Bruinsma. 2012. *World agriculture towards 2030/2050: the 2012 revision.* ESA Working paper No. 12-03. Rome, FAO.

Allouche, Jeremy. Food, energy and water: the politics of the nexus. http://www.theguardian.com/science/political-science/2014/jun/24/food-energy-water-politics-nexus. Accessed 10/30/2014.

Allouche, Jeremy, Carl Middleton and Dipak Gyawali 2014. *Nexus Nirvana or Nexus Nullity? A dynamic approach to security and sustainability in the water-energy-food nexus*. STEPS Centre.

Amarasinghe, U. A.; Smakhtin, V. 2014. *Global water demand projections: past, present and future*. Colombo, Sri Lanka: International Water Management Institute (IWMI). 32p. (IWMI Research Report 156).

AMCOW (African Ministerial Council on Water). 2012. *Status report on the application of integrated approaches to water resources in Africa.*

Beddington, John. No date. *Food, Energy, Water and the Climate: A perfect storm of global events?*

BMU (German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety) and BMZ (German Federal Ministry for Economic Cooperation and Development). 2012. Bonn2011: *The Water, Energy and Food Security Nexus – Solutions for a Green Economy*. http://www.water-energy-food.org/en/conference.html.

Boelee, E. ed. 2013. *Managing Water and Agroecosystems for Food Security.* Comprehensive Assessment of Water Management in Agriculture Series. CAB International, Wallingford, UK.

Burney, Jennifer A. and Rosamond L. Naylor. 2012. Smallholder irrigation as a poverty alleviation tool in Sub-Saharan Africa. *World Development* 40 (1): 110–123.

Buvinic, Mayra, Rebecca Furst-Nichols, and Gayatri Koolwal. 2014. *Mapping Gender Data Gaps*. http://data2x.org/

Castillo, Gina E. and Regassa E. Namara. 2007. Reversing the flow: agricultural water management pathways for poverty reduction. In: Molden, D., ed. 2007. *Water for Food, Water for Life: The Comprehensive Assessment of Water Management in Agriculture*. Earthscan, UK. http://www.iwmi.cgiar.org/Publications/Books/index.aspx

Chiramba, Thomas, Elizabeth Khaka, Eric Hoa, Maite Aldaya, Djaheezah Subratty, Ryuichi Fukuhara (UNEP); Maija Berthule, Gareth James Lloyd (UNEP DHI); Rebecca Welling (IUCN); and Eline Boelee (Water Health) chap 9 "Ecosystems" of WWDR 2014, PP 77-83.

Cumming O, Elliott M, Overbo A, Bartram J (2014) Does Global Progress on Sanitation Really Lag behind Water? An Analysis of Global Progress on Community- and Household-Level Access to Safe Water and Sanitation. *PLoS ONE* 9(12): e114699. doi:10.1371/journal.pone. 0114699

Demombynes, Gabriel, and Justin Sandefur. 2014. Costing a Data Revolution. CGD Working Paper 383. Washington, DC: Center for Global Development. http://www.cgdev.org/publication/costing-data-revolution-working-paper-383

de Fraiture, Charlotte, and Meredith Giordano. 2014. Small private irrigation: A thriving but overlooked sector. *Agricultural Water Management* 131: 167-174.

Dorosh, Paul A. and John W. Mellor. 2013. Why agriculture remains a viable means of poverty reduction in Sub-Saharan Africa: The case of Ethiopia. *Development Policy Review* 31 (4): 419-441.

Faurès, J.M. and Santini, G., eds. 2008. *Water and the rural poor: Interventions for improving livelihoods in sub-Saharan Africa*. Rome: FAO and IFAD. www.fao.org/nr/water/docs/FAO_IFAD_rural-poor.pdf.

Galopin, Gilberto C. 2012**.** *Five Stylized Scenarios*. United Nations World Water Assessment Program. Paris: UNESCO.

Giordano, M., and de Fraiture, C. 2014. Small private irrigation: Enhancing benefits and managing trade-offs. *Agricultural Water Management* 31: 175-182. http://dx.doi.org/10.1016/j.agwat.2013.07.003.

Giordano, M., C. de Fraiture, E. Weight, and J. van der Bliek., eds. 2012. *Water for Wealth and Food Security: Supporting Farmer-Driven Investments in Agricultural Water Management*. Synthesis Report of the AgWater Solutions Project. Colombo, Sri Lanka: International Water Management Institute (IWMI). http://awm-solutions.iwmi.org/publications-2.aspx.

Giordano, Mark, and Tushaar Shah. 2014. From IWRM back to integrated water resources management. *International Journal of Water Resources Development*, 30:3, 364-376, DOI: 10.1080/07900627.2013.851521

GLAAS (UN-water global analysis and assessment of sanitation and drinking-water). 2014**.** *Investing in water and sanitation: Increasing access, reducing inequalities.* Geneva: World Health Organization. http://www.who.int/water_sanitation_health/publications/glaas_report_2014/en/

Grey D., and Sadoff, C. 2007. Sink or Swim? Water Security for Growth and Development. *Water Policy* 9:545-571.

GWP (Global Water Partnership). No date. *Investing in infrastructure: The value of an IWRM approach*. Policy Brief 7.

Hagos, Fitsum, Gayathri Jayasinghe, Seleshi Bekele Awulachew, Mekonnen Loulseged and Aster Denekew Yilma. 2012. Agricultural water management and poverty in Ethiopia. *Agricultural Economics* 43 (Supplement s1): 99-111.

HLPE (Committee on World Food Security, High Level Panel of Experts on Food Security and Nutrition). 2015 [forthcoming]. *Water for food security*. V1 peer review draft. 14 January 2015. Cited with permission.

Hoff, H. (2011). *Understanding the Nexus*. Background Paper for the Bonn2011 Conference: The Water, Energy and Food Security Nexus. Stockholm Environment Institute, Stockholm.

IEAG (UN Secretary-General's Independent Expert Advisory Group on a Data Revolution for Sustainable Development. 2014. *A World that Counts: Mobilizing the Data Revolution for Sustainable Development*. A report prepared at the request of the United Nations Secretary-General.

IFAD. 2010. *Rural Poverty Report 2011: New Realities, New Challenges: New Opportunities for Tomorrow's Generation*. Rome: IFAD. http://www.ifad.org/rpr2011/index.htm.

IPCC. 2014. *Climate Change 2014 Synthesis Report: Approved Summary for Policy Makers*. IPCC Fifth Assessment Synthesis Report. 1 November 2014. http://www.ipcc.ch/.

IRENA (International Renewable Energy Agency). 2015. *Renewable Energy in the Water, Energy and Food Nexus*. http://www.irena.org/menu/index.aspx?mnu=Subcat&PriMenuID=36&CatID=141&SubcatID=496.

IRF (Independent Research Forum). 2013. *Towards a Transformative Post-2015 Development Agenda*: Summary of a retreat, Glen Cove,NY

IWMI (International Water Management Institute). 2014. *On target for people and planet: Setting and Achieving Water–related Sustainable Development Goals.* Edited by: Julie van der Bliek, Peter McCornick, James Clarke.

Jerven, Morten. 2014. Benefits and Costs of the Data for Development Targets for the Post-2015 Development Agenda: Post-2015 Consensus. Copenhagen Consensus Center Working Paper. http://www.copenhagenconsensus.com//publication/post-2015-consensus-data-development-assessment-jerven.

Karimi, P., W. G. M. Bastiaanssen, and D. Molden. 2013. Water Accounting Plus (WA+) – a water accounting procedure for complex river basins based on satellite measurements. *Hydrol. Earth Syst. Sci*., 17, 2459–2472, 2013.

Katz, David. 2011. Hydro-Political Hyperbole: Examining Incentives for Overemphasizing the Risks of Water Wars. *Global Environmental Politics* Volume 11, Number 1, February 2011 pp. 12-35.

Khanal, Puspa Raj, Guido Santini, Douglas J. Merrey. 2014. *Water and the rural poor: Interventions for improving livelihoods in Asia*. FAO.

KPMG International. 2014. *Future State 2030: The global megatrends shaping governments*. Switzerland: KPMG. [Mowat Centre at the School of Public Policy and Governance, University of Toronto did the research.]

Lautze, Jonathan, and Herath Manthrithilake. 2014. Water Security. Chapter 2 in: Jonathan Lautze, ed. *Key concepts in water resource management: A review and critical examination*. London and New York: Earthscan from Routledge.

Loevinsohn, Michael, Lyla Mehta, Katie Cuming, Alan Nicol, Oliver Cumming and Jeroen H. J. Ensink. 2014. The cost of a knowledge silo: a systematic re-review of water, sanitation and hygiene interventions. *Health Policy and Planning* 2014: 1–15. doi:10.1093/heapol/czu039.

Luh, Jeanne, Rachel Baum, Jamie Bartram. 2013. Equity in water and sanitation: Developing an index to measure progressive realization of the human right. *International Journal of Hygiene and Environmental Health* 216: 662– 671.

McNamara, Robert S. 1973. *Address to the Board of Governors*, World Bank Group. Nairobi, Kenya, September 24, 1973.

Mehta, Lyla. 2014. Water and human Development. *World Development* 59: 59-69.

Merrey, D.J., Drechsel, P., Penning de Vries, P., Sally, H., 2005. Integrating 'Livelihoods' into Integrated Water Resources Management: Taking the Integration Paradigm to its Logical Next Step for Developing Countries. *Regional and Environmental Change* 5, 197–204.

Merrey, D.J. 2008. Is normative integrated water resources management implementable? Charting a practical course with lessons from Southern Africa. *Physics and Chemistry of the Earth* 33:899-905.

Millennium Ecosystem Assessment. 2005. Ecosystems and human wellbeing: A synthesis. Washington, D.C.: Island Press. http://www.unep.org/maweb/en/Reports.aspx.

Molden, D. 1997. *Accounting for water use and productivity.* SWIM Paper 1. Colombo, Sri Lanka: International Irrigation Management Institute.

Molden, D., ed. 2007. *Water for Food, Water for Life: The Comprehensive Assessment of Water Management in Agriculture*. Earthscan, UK. Pp 315-382. http://www.iwmi.cgiar.org/Publications/Books/index.aspx.

Molle, F. 2008. Nirvana concepts, narratives and policy models: Insights from the water sector. *Water Alternatives* 1(1): 131-156. www.water-alternatives.org.

Molle, F.; Berkoff, J. 2006. *Cities versus agriculture: Revisiting intersectoral water transfers, potential gains and conflicts.* Comprehensive Assessment Research Report 10. Colombo, Sri Lanka: Comprehensive Assessment Secretariat (IWMI).

Motesharrei, Safa, Jorge Rivas b, Eugenia Kalnay. 2014. Human and nature dynamics (HANDY): Modeling inequality and use of resources in the collapse or sustainability of societies. (Methodological and Ideological Options). *Ecological Economics* 101 (2014) 90–102.

Mwanza, Dennis D. 2005. Water for Sustainable Development in Africa. Chapter 4 in: Luc Hens and Bhaskar Nath, *The World Summit on Sustainable Development: The Johannesburg Conference*. Springer, Netherlands. Pp. 91-112.

Namara, R.E., A. Munir, M.A. Hanjra, G.E. Castillo, H.M. Ravnborg, L. Smith, & B. van Koppen. 2010. Agricultural Water Management and Poverty Linkages. *Agricultural Water Management* 97: 520-527.

Onda, Kyle, Joe LoBuglio and Jamie Bartram. 2012. Global Access to Safe Water: Accounting for Water Quality and the Resulting Impact on MDG Progress. *Int. J. Environ. Res. Public Health* 2012, *9*, 880-894; doi:10.3390/ijerph9030880.

Open Working Group. 2014. *Proposal of the Open Working Group for Sustainable Development Goals*. 19 July 2014.

Raworth, K. 2012. *A Safe and Just Space for Humanity: Can We Live Within the Doughnut*? Oxfam Discussion Paper. Oxfam, Oxford, UK.

Ringler, Claudia, Tingju Zhu, Sebastian Gruber, Ronan Treguer, Auguste Laurent, Lee Addams, Nicola Cenacchi and Tim Sulser. 2014. *Sustaining growth via water productivity: Outlook to 2030/2050.* [forthcoming as IFPRI report-shared by Claudia]

Ringler, C., Zhu, T., Gruber, S., Treguer, R., Laurent, A., Addams, L, Cenacchi, N. and Sulser, T. 2015. Role of water security for economic development – concepts and global scenarios. *In* Pahl-Wostl, C., Gupta, J. and A. 31 Bhaduri, A. (eds.) *Handbook of Water Security*. Aldershot, UK: Edward Elgar. [forthcoming, I have draft chapter from Claudia]

Rockström, J., Steffen, W., Noone, K., Persson, A˚., Chapin III, F.S., Lambin, E., Lenton, T.M., Scheffer, M., Folke, C., Schellnhuber, H., Nykvist, B., De Wit, C.A., Hughes, T., van der Leeuw, S., Rodhe, H., So¨ rlin, S., Snyder, P.K., Costanza, R., Svedin, U., Falkenmark, M., Karlberg, L., Corell, R.W., Fabry, V.J., Hansen, J., Walker, B., Liverman, D., Richardson, K., Crutzen, P., Foley, J., 2009. A safe operating space for humanity. *Nature* 46: 472–475.

Rockström, J., Karlberg, L., 2010. The quadruple squeeze: defining the safe operating space for freshwater use to achieve a triply green revolution in the Anthropocene. *Ambio* 39: 257–265.

Rockström, J., Karlberg, L., Wani, S.P., Barron, J., Hatibu, N., Oweis, T., Bruggeman, A., Farahani H. and Qiang. 2010. Managing water in rainfed agriculture—The need for a paradigm shift, *Agricultural Water* 44 *Management*. 79(4): 543-550.

Rockström, J., M. Falkenmark,1 T. Allan,2 C. Folke,1 L. Gordon,1 A. Jägerskog,3 M. Kummu,4 M. Lannerstad,5 M. Meybeck,6 D. Molden,7 S. Postel,8 H.H.G. Savenije,9 U. Svedin,1 A. Turton. 2014. The unfolding water drama in the Anthropocene: towards a resilience-based perspective on water for global sustainability. Ecohydrology Bearings — Invited Commentary. *Ecohydrology* 7, 1249–1261 (2014).

Saruchera, Davison, and Jonathan Lautze. 2014. *Measuring Transboundary Water Cooperation: Learning from the Past to inform the SDGs*. Unpublished manuscript.

Sayer, J., T. Sunderland, J. Ghazoul, J.-L. Pfund, D. Sheilb, E. Meijaard, M. Venter, A. K. Boedhihartono, M. Day, C. Garcia, C. van Oosten, and L.E. Buck. 2013. Ten principles for a landscape approach to reconciling agriculture, conservation, and other competing land uses. *PNAS* 110(21): 8349–8356.

Schoeman, Jess, Catherine Allan & C. Max Finlayson (2014) A new paradigm for water? A comparative review of integrated, adaptive and ecosystem-based water management in the Anthropocene. *International Journal of Water Resources Development*, 30:3, 377-390, DOI: 10.1080/07900627.2014.907087.

Schewea, Jacob, Jens Heinkea,b, Dieter Gertena, Ingjerd Haddelandc, Nigel W. Arnelld, Douglas B. Clarke, Rutger Dankersf, Stephanie Eisnerg, Balázs M. Feketeh, Felipe J. Colón-Gonzálezi, Simon N. Goslingj, Hyungjun Kimk, Xingcai Liul, Yoshimitsu Masakim, Felix T. Portmannn,o, Yusuke Satohp, Tobias Stackeq, Qiuhong Tangl, Yoshihide Wadar, Dominik Wissers, Torsten Albrechta, Katja Frielera, Franziska Pionteka, Lila Warszawskia, and Pavel Kabatt. 2014. Multimodel assessment of water scarcity under climate change. *PNAS* 111 (9): 3245-3250.

SDSN (Sustainable Development Solutions Network). 2014. *Indicators for Sustainable Development Goals*. Working Draft, 22 May 2014. Unpublished report.

Shah, T., Burke, J. and Villholth, K. 2007. Groundwater: A global assessment of scale and significance. Chapter 10 In D. Molden, ed. Water for food, water for life: a comprehensive assessment of water management in agriculture, pp. 395-424. London/Colombo: Earthscan/IWMI.

South African Human Rights Commission. 2014. *Report on the Right to Access Sufficient Water and Decent Sanitation in South Africa: 2014*. Braamfontein, South Africa. Available: http://www.sahrc.org.za/home/21/files/FINAL%204th%20Proof%204%20March%20-%20Water%20%20Sanitation%20low%20res%20(2).pdf

Stakeholder Forum 2014. Tests of Success for the SDGs: *A Tool for Designing and Assessing Sustainable Development Goals and Targets*.

Steffen, W., Richardson, K., Rockström, J., Cornell, S.E., Fetzer, I., Bennett, E.M., Biggs, R., Carpenter, S.R., de Vries, W., de Wit, C.A., Folke, C., Gerten, D., Heinke, J., Mace, G.M., Persson, L.M., Ramanathan, V., Reyers, B., and Sörlin, S. 2015. Planetary boundaries: Guiding human development on a changing planet. Published online 15 January 2015 / Page 1 / 10.1126/science.1259855. http://www.sciencemag.org/content/early/recent.

Tortajada, Cecilia. 2014. IWRM revisited: from concept to implementation, *International Journal of Water Resources Development*, 30:3, 361-363, DOI: 10.1080/07900627.2014.937085

UN (United Nations). 2014a. *The Millennium Development Goals Report, 2014*.

UN. 2014b. *Millennium Development Goal 8. The State of the Global Partnership for Development*. MDG Gap Task Force Report 2014.

UNCED (UN Conference on Environment and Development). 1992. *Agenda 21*. Rio de Janeiro, Brazil, 3-14 June 1992.

UNCTAD (UN Conference on Sustainable Development). 2014. *The Least Developed Countries Report 2014. Growth with Structural Transformation: A Post-2015 Development Agenda*. Geneva: UNCTAD Secretariat.

UN-DESA (United Nations Division for Sustainable Development, Department of Economic and Social Affairs). 2007. *Indicators of Sustainable Development: Guidelines and Methodologies*.

UN-DESA. 2013. *Beyond the WASH Agenda: Strengthening Capacity for Water Resources Management in the post-2015 Development Framework*. 25th - 27th November 2013.

UN-DESA 2014a. *Synthesis of Water-Related Issues Highlighted in National Reports for Rio+20.* Draft, March http://sustainabledevelopment.un.org/rio20nationalreports.html.

UN-DESA 2014b. *Synthesis of Energy-Related Issues Highlighted in National Reports of Rio+20*. Final draft, March.

UN-DESA and UNDP. 2012. *Synthesis of national reports for Rio +20*.

UN-HABITAT, UNEP and WHO. 2014. *Expanded Water Monitoring: A global framework for monitoring progress on wastewater, water quality and water resources management*.

UN Office of the Commissioner of Human Rights, UN-HABITAT, WHO. No date a. *The right to water*. Fact sheet 35. http://www.ohchr.org/EN/PUBLICATIONSRESOURCES/ Pages/FactSheets.aspx.

UN Office of the Commissioner of Human Rights, UN-HABITAT, WHO. No date b. *The Right to Adequate Food*. Fact Sheet No. 34.

UN Secretary General. 2014. The Road to Dignity by 2030: Ending Poverty, Transforming All Lives and Protecting the Planet: *Synthesis Report of the Secretary-General On the Post-2015 Agenda*. Unedited advance copy, 4 December 2014. New York.

UN TF-IMR (UN Water Task Force on Indicators, Monitoring and Reporting). 2009a*. Final Report: Monitoring progress in the water sector: A selected set of indicators.* http://www.unwater.org/activities/task-forces/indicators/pt/

UN TF-IMR 2009b. *Final Report: Monitoring progress in the water sector: A selected set of indicators*. *Annexes: Indicators in Use*.

UN Water 2013. *Water Security and the Global Water Agenda: A UN-Water Analytical Brief*. Ontario, Canada: United Nations University Institute for Water, Environment & Health (UNU-INWEH) with UN ESCAP.

UN Water. 2014. *A Post-2015 Global Goal for Water: Synthesis of key findings and recommendations from UN-Water*.

UN Women. 2014. *Gender Equality and Sustainable Development: World Survey on the Role of Women in Development 2014*. First issued by the United Nations in 2014 as a report of the Secretary-General (A/69/156).

UNEP 2012. *The UN-Water Status Report on the Application of Integrated Approaches to Water Resources Management.*

UNSD (UN Department of Economic and Social Affairs, Statistics Division). 2012. *System of Environmental-Economic Accounting for Water (SEEA-Water).* ST/ESA/STAT/SER.F/100.

UNTT (UN System Task Team). 2012. *Realizing the Future We Want for All, Report to the Secretary General*. UN System Task Team on the Post-2015 UN Development Agenda.

UNU. 2015 [forthcoming]. *Water in the World We Want: Catalyzing National Water-related Sustainable Development* (Working Title). Draft manuscript. Cited with permission.

UNU and UNOSD. 2013. *Water for Sustainability: Framing Water within the Post-2015 Development Agenda*. United Nations University Institute for Water, Environment and Health, UN Office of Sustainable Development and Stockholm Environment Institute.

van Koppen, Barbara and Barbara Schreiner. 2014. Moving beyond integrated water resource management: developmental water management in South Africa, *International Journal of Water Resources Development*, 30:3, 543-558, DOI: 10.1080/07900627.2014.912111

Veolia Water. No date [2011?]. *Finding the Blue Path for a Sustainable Economy*. A white paper by Veolia Water. http://growingblue.com/water-in-2050/.

WCED (World Commission on Environment and Development). 1987. *Report of the World Commission on Environment and Development: Our Common Future* (Brundtland Report). http://www.un-documents.net/our-common-future.pdf

Webb, P. 2013. *Impact Pathways from Agricultural Research to Improved Nutrition and Health: Literature Analysis and Research Priorities*. Rome: FAO and WHO. http://www.fao.org/fileadmin/user_upload/agn/pdf/Webb_FAO_paper__Webb_June_26_2013_.pdf.

WEF (World Economic Forum). 2014. *Global Risks 2014. Ninth Edition.*

WEF. 2015. *Global Risks 2015. Tenth Edition. http://reports.weforum.org/global-risks-2015/.*

WHO and UNICEF. 2014. *Progress on sanitation and drinking-water - 2014 update*.

WLE (CGIAR Research Program on Water, Land and Ecosystems). 2014. *Ecosystem services and resilience framework*. Colombo, Sri Lanka: International Water Management Institute (IWMI). CGIAR Research Program on Water, Land and Ecosystems (WLE). 46p. doi: 10.5337/2014.229.

Working Group UNICEF-WHO Joint Monitoring Programme. No date. *Eliminating Inequalities: Towards a Post-2015 Development Agenda Proposal of Equality and Non-Discrimination*. Poster.

WSSD (World Summit on Sustainable Development). 2002a. Declaration on Sustainable Development.

WSSD. 2002b. *Plan of Implementation of the World Summit on Sustainable Development*.

WWAP (United Nations World Water Assessment Programme). 2012. *Green Accounting and Data Improvement for Water Resources*. Working Paper prepared for the session 'Green Accounting and Data Improvement: Critical Tools for Informed Decision Making and Sustainable Growth' at World Water Forum 6, Marseille, 13 March 2012. Colombella, Perugia, Italy: UNESCO.

WWAP. 2014. *The United Nations World Water Development Report 2014: Water and Energy*. Two volumes. Paris, UNESCO.

Appendix 1 Targets and Indicators for Open Working Group Proposed Goal 6: "Ensure availability and sustainable management of water and sanitation for all"

Water related SDG target	Proposed Indicators
By 2030 achieve universal and equitable access to safe and affordable drinking water for all	- Increased access to water supply (Peru, Colombia and UAE, 2012) - Safe drinking water in every household by 2030, and in every school and health center by 2025 (AMCOW, 2013) - Cost recovery in water supply and private sector support (GWP, 2013) - Universal access to safe drinking water at home, in schools, health centers and refugee camps (HLP, 2013) - Universal access to affordable and safe fresh water (UNGC, 2013) - Universal access to safe and sustainable water (UNDG, 2013) - Universal access to WASH as a human right (Swiss Paper, 2014) - Percentage of population using basic drinking water (UN-Water, 2014a) - Percentage of population using a safely managed drinking water service at home (UN-Water, 2014a)
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	- No open defecation, and all schools and health care facilities providing all users with adequate sanitation and hygiene facilities by 2025 (JMP, 2012) - Universal use of household sanitation by 2040, inequality in access to adequate household sanitation is halved by 2030, and the excreta of at least x% of those households with adequate sanitation are safely managed by 2030 (JMP, 2012). - Increase of access to water supply and sanitation (Peru, Colombia and UAE, 2012). - Universal provision of sanitation facilities and the practice effective hygiene behavior by 2030, and in schools and health centers by 2025 (AMCOW, 2013) - Universal access to WASH (Swiss Paper, 2014) -all public places must be served by WASH by 2030 (AMCOW, 2013) - Provision of socially, financially and environmentally sustainable WASH and the removal of gender inequality by 2030 (AMCOW, 2013) - improvement of sanitation by x% (HLP, 2013) - Universal access to water, sanitation and hygiene with a focus on expeditious ending of open defecation and ensuring sustainability of services (Beyong2015, 2013) - Use of appropriate technologies (GWP, 2013) - Universal access to basic sanitation by 2020 and improved sanitation by 2030 (UNGC, 2013) - Universal access to safe and sustainable water, sanitation and hygiene services (UNDG, 2013) - Universal access to basic sanitation facilities by 2020 and improved sanitation facilities by 2030 (UNGC, 2013). - Percentage of population practicing open defecation(UN-Water, 2014a) - Percentage of population using basic sanitation (UN-Water, 2014a) - Percentage of population with hand washing facilities at home (UN-Water, 2014a) - Percentage of health facilities with basic drinking water, basic sanitation and hygiene (UN-Water, 2014a) - Percentage of primary and secondary schools that have basic drinking water, basic sanitation and hygiene. (UN-Water, 2014a) - Percentage of population with basic sanitation whose excreta is safely managed(UN-Water, 2014a) - Data will be disaggregated by the four population groups urban/rural; rich/poor; slums/formal urban settlements; disadvantaged groups/general population (UN-Water, 2014a) - The difference in rate of change for the disadvantaged groups versus the general population (UN-Water, 2014a)

Water related SDG target	Proposed Indicators
By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater, and increasing recycling and safe reuse by x% globally	- Reduced health risks from water related diseases (Peru, Colombia and UAE, 2012) - Establish policies and institutions for wastewater treatment in x% of African countries by 2030 (AMCOW, 2013) - All urban areas with a population of 100 000 or more must adopt appropriate water treatment technology by 2030 (AMCOW, 2013) - treatment of wastewater to a minimum standard before disposal in transboundary water bodies by2030 (AMCOW, 2013) - Effective cost recovery in wastewater collection and treatment by 2030 (AMCOW, 2013) -Effective wastewater collection, treatment, and management, with parameters for pollution control and water quality (Beyond2015, 2013) - Address legal and compliance issues on discharge of untreated wastewater and increase wastewater treatment systems and provide incentives for connection (GWP, 2013) - Manage water quality to high standards and control pollution (GWP, 2013) -Recycle or treat all municipal and industrial wastewater before discharge (HLP, 2013) -Collect used water, manage wastewater pollution and maximize water re-use (Aquafed, 2013) - Ensure establishment and full implementation of national water effluent standards (UNGC, 2013) - Establish and fully implement national water standards (UNGC, 2013) - Collection and treatment of all wastewater before it is returned to nature, and managed under principles of pollution prevention and reuse (UNDG, 2013). - Improve global freshwater quality by addressing pollution and wastewater treatment –(Swiss Paper, 2014) - Proportion of the population for whom all domestic wastewater is treated to national standards in either collective or individual facilities (UN-Water, 2014a) - Proportion of industrial (and point source agricultural) wastewater flows not collected in public systems that is treated to national standards (UN-Water, 2014a) - Proportion of the flows of treated municipal wastewater that are directly and safely reused (UN-Water, 2014a) - Proportion of the flows discharged by industrial wastewater treatment plants that are safely re-used. (This indicator does not include water directly re-used without leaving the factory) (UN-Water, 2014a) - Proportion of receiving water bodies meeting water quality standards (nitrogen & phosphorous as a minimum) (UN-Water, 2014a) - Proportion of the population connected to collective sewers or with on-site storage of all domestic wastewaters (UN-Water, 2014a)
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	- Increased water efficiency (Peru, Colombia and UAE, 2012) - Increased storage capacity of water, and efficient use by x% by 2030 (AMCOW, 2013) - Freshwater withdrawals brought in line with supply and increase efficiency in water use by x% in agriculture, by y% in industry and z% in urban consumption (HLP, 2013) - Fresh water use brought in line with supply (UNGC, 2013). - Change in withdrawal-to-availability ratio (change in withdrawals as % of total actual renewable water resources, within sustainable limits) (UN-Water, 2014a) - % of basins with an allocation framework (balancing demands for all sectors, including the environment, from groundwater and surface water) (UN-Water, 2014a) - Storage capacity per capita/% of available water (UN-Water, 2014a) - Change in agricultural GDP per agricultural withdrawals (agricultural water productivity) (UN-Water, 2014a) - Change in industrial GDP per industrial withdrawals (industrial water productivity) (UN-Water, 2014a) - Change in electricity production per unit of water (energy sector water productivity)

Water related SDG target	Proposed Indicators
	(UN-Water, 2014a) - Change in withdrawals for domestic use per capita (domestic water supply and use efficiency) (UN-Water, 2014a) - Improvement in water use efficiency across all sectors – agriculture water productivity, industrial water efficiency, energy water efficiency, and per capita domestic water withdrawals (UN-Water, 2014b) - Water withdrawals are linked with availability, considering the environmental requirements (UN-Water, 2014b) - Reduction of number of people living in severely water stressed areas and the improved water availability per capita (UN-Water, 2014b)
By 2030 implement integrated water resources management at all levels, including through transboundary cooperation as appropriate	-Balance water use and safeguard the ecosystem while holistically implementing IWRM and mainstreaming climate change (Beyond 2015, 2013) - Establish transboundary agreements, build up basin capacity to ensure enforcement of laws, and strengthen transboundary water management through establishing basin organisations (GWP, 2013) - Monitor, govern and manage ground and surface water sustainably and in an integrated manner to satisfy human needs while respecting ecosystem requirements (UNDG, 2013). - Management of freshwater sources for human needs, culture, gender, economic growth while respecting ecosystem requirements (adopting sustainable, long lasting basin treaties) and resilience to disasters (Swiss Paper, 2014a) - Percent of countries implementing IWRM plans (UN-Water, 2014a) - Percent of countries with strategic planning and participatory decision-making processes (UN-Water, 2014a) - Percent of transboundary basins and aquifers with cooperative management frameworks (UN-Water, 2014a) - Percent of countries with national policies supporting integrated disaster risk management (including drought and flood policies), as part of national development plans (UN-Water, 2014a) - Proportion of communities which have implemented risk strategies 6. Monitoring and evaluation systems that include surveys on governance issues (building on Rio+20 status report) (UN-Water, 2014a)
By 2020 protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes	- Improve quality of water resources and ecosystems (Peru, Colombia and UAE, 2012) - A commitment by all governments and businesses to the sustainable, integrated, and transparent management of water by 2030 (SDSN, 2013) -integrated approach to water resources management through enabling environment, strengthening institutional systems and applying management instruments (GWP, 2013) -develop monitoring and reporting systems in WRM progress (GWP, 2013) - % change in freshwater ecosystem area and condition (indicator of change in ecosystem extent and health, includes brackish ecosystems) (UN-Water, 2014a) - Threatened Species (Red List) Index and Living Planet Index (for relevant flora and fauna) (UN-Water, 2014a) - Environmental water stress (based on deviation from natural flow/availability) (UN-Water, 2014a)
By 2030, expand international cooperation and capacity-building support to developing countries in water and sanitation related activities and programmes,	- Percentage of population using water and sanitation service providers registered with a regulatory authority (disaggregate rural and urban) (UN-Water, 2014a) - Percentage of population in the poorest quintile whose financial expenditure on water, sanitation and hygiene is below 3% of national poverty line (disaggregate rural and urban) (UN-Water, 2014a) - Ratio of annual revenue to annual expenditure on maintenance (including operating expenditures, capital maintenance, debt servicing) (UN-Water, 2014a) - Ratio of annual expenditure on maintenance (including operating expenditures, capital maintenance, debt servicing) to annualized value of capital assets. (UN-Water,

Water related SDG target	Proposed Indicators
including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies	2014a) - Number of countries with regulatory frameworks and enforcement capacity 2. Proportion of responsible water authorities and water operators for which operational performance is measured and reported (UN-Water, 2014a)
Support and strengthen the participation of local communities for improving water and sanitation management	-Institutional strengthening at community level, knowledge management and awareness at all levels and development of skills to implement WASH at household level (GWP, 2013) - No. of institutions using relevant education and training materials in local capacity building programs. (UN-Water, 2014a) - No. of capacity building networks using multidisciplinary skills of competent members to scale up capacity building and actively support implementation programs. (UN-Water, 2014a) - No. of countries with knowledge management systems in place that ensure access to the best of international and local knowledge and measure the effectiveness of capacity building services through locally developed indicators and monitoring systems. (UN-Water, 2014a)

References for Appendix 1

AMCOW (2013) "Tunis Outcome Document for the Water Sector post-2015 Thematic Consultations, 1 March 2013" http://www.amcow-online.org/images/docs/outcomes_of_the_tunis_post_2015_water_consultations.pdf

Aquafed (2013) "Post-2015 Global Goals – Towards a wastewater sub-goal of the goal on water" http://www.worldwewant2015.org/node/306022

Beyong2015. Global Thematic Consultation on Water and the Post-2015 Development Framework - Water In The Post-2015 March 2013. Development Agenda. http://www.beyond2015.org/sites/default/files/Position%20paper%20Water.pdf

Government of Colombia, Peru, United Arab Emirates (2012) "Concept Note on Sustainable Development" http://www.minambiente.gov.co/documentos/DocumentosInstitucional/rio_20/150512_proposal_colombia_emirates.pdf

GWP 2013. Global Water Partnership National Stakeholder Consultations on Water: Supporting the 2015 Development Agenda. www.gwp.org

HLP (2013) "A New Global Partnership: Eradicate Poverty and Transform Economies through Sustainable Development - The Report of the High-Level Panel of Eminent Persons on the Post-2015 Development Agenda" http://www.un.org/sg/management/pdf/HLP_P2015_Report.pdf

JMP Working Groups (2012) "Proposal for consolidated drinking water, sanitation and hygiene targets, indicators and definitions" http://www.wssinfo.org/fileadmin/user_upload/resources/A-proposal-for-consolidated-WASH-goal-targets-definitionsandindicators_version7_Nov22_final.pdf

SC, 2014. Swiss Position Paper on post 2015 Water Goal. The Switzerland Confederation. http://www.swisswaterpartnership.ch/wp-content/uploads/2014/07/2013.12.20_Swiss_Position_on_Water_in_Post2015_Agenda.pdf

SDSN, 2013. Report prepared by the Leadership Council of the Sustainable Development Solutions Network And Action Agenda for Sustainable Development REPORT FOR THE UN SECRETARY-GENERAL 6 June 2013

UN Global Compact (2013) "Corporate Sustainability and the United Nations Post-2015 Development Agenda" http://www.unglobalcompact.org/docs/news_events/9.1_news_archives/2013_06_18/UNGC_Post2015_Report.pdf

UN. 2014. United Nations. Outcome Document - Open Working Group on Sustainable Development Goals. Sustainable Development Knowledge Platform. http://sustainabledevelopment.un.org/focussdgs.html

UN-Water, 2014a. UN Water. A Post-2015 Global Goal for Water: Synthesis of key findings and recommendations from UN-Water

UN-Water, 2014b. Water Efficiency Working Group. Post-2015 Global Monitoring Mechanism Development: Water Withdrawals and Productivity. Water Withdrawals and Productivity Task Team Report on Open Working Group proposed SDG target 6.4. Version 0.5. 18 September 2014.

UNDG (United Nations Development Group).2013. *A Million Voices: The World We Want. A Sustainable Future with Dignity for All*. http://www.undg.org/content/achieving_the_mdgs/post-2015_development_agenda/undg_post-2015_report.

WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation. http://www.wssinfo.org/fileadmin/user_upload/resources/summary-of-sanitation-goals-targets-indicators-and-definitions-Oct-25th.pdf