

REPORT

CATALYZING WATER FOR SUSTAINABLE DEVELOPMENT AND GROWTH

FRAMING WATER WITHIN THE POST 2015 DEVELOPMENT AGENDA: OPTIONS AND CONSIDERATIONS



UNITED NATIONS
UNIVERSITY

UNU-INWEH

Institute for Water,
Environment and Health



United Nations Office for
Sustainable Development
Incheon - ROK



SEI STOCKHOLM
ENVIRONMENT
INSTITUTE



CATALYZING WATER FOR SUSTAINABLE DEVELOPMENT AND GROWTH

**Framing Water within the Post 2015 Development Agenda:
Options and Considerations**

PREPARED BY



United Nations Office for Sustainable Development
Incheon, Republic of Korea



**UNITED NATIONS
UNIVERSITY**

UNU-INWEH

Institute for Water,
Environment and Health

**United Nations University —
Institute for Water, Environment and Health**
Hamilton, Canada

IN COLLABORATION WITH



Stockholm Environment Institute
Stockholm, Sweden





Citation: 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

Writing Team: Adeel Z., Bullock A., Chaudry M.A., Kuylenstierna J., Qadir M., Schuster-Wallace C.J. and Weitz N.

Acknowledgements: This report would not have been possible without the support of the following: Bill Cosgrove, Bert Diphoorn, Engin Koncagul, Joakim Harlin and Olcay Unver (pre-consultation); Mari Ahmed, Eul-Saeng Cho, Keneti Faulalo, Francois Fortier, Johan Gely, Hyeongsik Kang, Sang-In Kang, Ahmed Abu Moussa, Maimuna Nalubega, Nina Odenwaelder (observer), Kilaparti Ramakrishna, Ni Ni Thein, Henry Tachie-Menson, Olcay Unver, Frederick van Zyl and Kereeta Whyte (Incheon consultation); Tom Gill (editing); Keneti Faulalo, Johan Gely, Jakob Granit, Joakim Harlin, Chris Metcalfe, Ahmed Abu Moussa, Nina Odenwaelder, Emma Quillerou and Richard Thomas (final comments); Carly Popenko (graphic design); and, Government of Korea and UNU-INWEH (financial support)

©United Nations University, 2013

Available from:

United Nations University
Institute for Water, Environment and Health (UNU-INWEH)
175 Longwood Road South, Suite 204
Hamilton, ON L8P 0A1 CANADA

Telephone: +1-905-667-5511

Fax: +1-905-667-5510

E-mail: contact.inweh@unu.edu

Web: inweh.unu.edu

Facebook: facebook.com/UNUINWEH

Twitter: twitter.com/UNUINWEH

Available for download at: <http://inweh.unu.edu/reports>

ISBN: 978-92-808-6040-5

The United Nations University – Institute for Water, Environment and Health is a member of the United Nations University family of organizations. It is the UN Think Tank on Water created by the UNU Governing Council in 1996. The mission of the institute is to contribute to efforts to resolve pressing regional and global water challenges that are of concern to the United Nations, its Member States, and their people, through targeted research, capacity development, knowledge enhancement and transfer, and public outreach. It is hosted by the Government of Canada and McMaster University.

The United Nations Office for Sustainable Development was established in 2011 to support governments in implementing international agreements on sustainable development. The Office is managed by the Division for Sustainable Development (DSD) of the United Nations Department of Economic and Social Affairs (UNDESA), and supported by the Republic of Korea Ministry of Environment, Yonsei University and the City of Incheon.

The Stockholm Environment Institute is an independent international research institute established in 1989 by the Swedish Government. Its goal is to bring about change for sustainable development by bridging science and policy. The institute has been engaged in environment and development issues at local, national, regional and global policy levels for more than 20 years and has established a reputation for rigorous and objective scientific analysis in the field of environment and development.



UNITED NATIONS
UNIVERSITY

UNU-INWEH

Institute for Water,
Environment and Health



United Nations Office for
Sustainable Development
Incheon - H2K





PREFACE

The international community has invested considerably in discussing and defining the global development agenda after 2015, when the Millennium Development Goals (MDGs) will reach their maturity date. The underlying debate was kicked off in earnest at Rio, where the world leaders gathered in June 2012 to *inter alia* discuss the outlines and framework of that development agenda. The outcome of the dialogue at Rio, encapsulated in the document “The Future We Want,” included elements of social development, environmental integrity and economic growth. Water, as both a resource and a human right, figured centrally in this document.

As the dialogue and efforts further intensified since the Rio Summit to converge on the global framework for a post-2015 development agenda, it also became apparent that the evidence base for comparatively assessing various development scenarios was largely absent. This indeed was the case for the discussion around issues related to drinking water, sanitation, water resources management and water quality. It is apparent that some ambiguity exists around whether water should be identified as a stand-alone issue area, or considering its significance in various sectors and fields of development, should appear in all of them in an integrated manner. In recent years, there has been considerable debate in the international community about understanding the nexus between water, energy and food security; while some interesting approaches have emerged from that discussion, implementation of this concept through sector-focused government agencies and various stakeholders remains a challenge.

This report is an independent evidence-based analysis of how water can be addressed in a developing agenda beyond 2015. Its formulation, and the underlying study, was undertaken by UNOSD, UNU-INWEH and SEI as a way of addressing the information gaps and providing background information that

can be used by the UN member states and other stakeholders in negotiations. The overall goal of this report is to draw attention to the complexities of water as a resource and a human right, and the challenges associated in implementing the various formulations of Sustainable Development Goals related to water.

The report takes stock of how water figured in the MDGs and the key lessons we can learn about how to improve the response of the international community to the global water challenges. It uses this analysis to offer a forward-looking assessment of the various models of incorporating water in the post-2015 development agenda. It is obvious that significant investments are needed to meet the water-related challenges; the report gives the first ballpark-estimates of these investments. It also highlights the fact that these investments are not just needed by developing countries but, in fact, by all countries. Developed countries will need to provide significant new investments in near future to replace aging infrastructure and support urban sprawl. Emerging studies point to the consideration that decentralization, social media, and novel ways to raise capital should be used to empower local populations to create their own solutions.

This report has made us realize that more concerted efforts at all levels are required to create the enabling environment necessary to implement solutions and that such efforts will have to be broader than just dealing directly with water issues. Transparent and accountable governance will have to support all aspects of a sustainable planet. As we approach some planetary tipping points, and resulting irreversible changes, innovative perspectives and paradigm shifts are necessary. This report is meant to enable that process. We look forward to engaging with the UN member states and other stakeholders in order to discuss its findings and address emerging issues through future studies.

Director, DSD
UN DESA

Director, UNU-INWEH
UN University



SUMMARY FOR DECISION MAKERS

Water should not be treated as a “sector” alone, but as a cross-linked issue given its crosscutting nature and essential roles in social and economic development and environmental integrity.

Water is both a resource and a sector; a key to social development, environmental integrity and economic growth. As a sector, water requires infrastructure development and operational funds, while as a resource it cuts across sectors and requires integrated approaches to management and a recognized value in economic terms. Water is extremely sensitive to external drivers, such as increased consumption or mismanagement through increased food demand and changing diets, increased demand for and access to energy, climate change impacts and new geopolitical dynamics. A growing, increasingly prosperous and rapidly urbanizing global population will demand more and different food, more energy and more water resources to meet its needs. These demands from industrial development and rapid population growth must be viewed as incentives for mobilizing new investments in water and increasing efficiency.



Photo credit: Nina Weitz, SEI

Any proposed SDGs should follow eight fundamental principles based on desired outcomes and pragmatic attributes.

Our analysis of the identified strengths and weaknesses of the MDGs helped us identify these principles that should feed into the transition from MDGs to post-2015/SDGs. Four outcome-based principles reflect aspirations and ambitions, which should ensure: poverty eradication, equity, sustainability, and economic growth. Four attribute-based principles focus on practical dimensions essential to the success of SDGs; these include: universality, measurability and time-boundedness, sensitivity to external drivers and grounded in good governance.

All SDGs should include dimensions of economic growth, social development and environmental management.

Dedicated goals must establish and maintain links to targets and indicators in other related goals. This will facilitate, for example, “nexus thinking”, recognizing and internalizing the inter-relationships between themes. It further provides a mechanism for monitoring integrated progress.

A wide range of proposals exist for how water may be incorporated in the formulation of Sustainable Development Goals.

Fourteen water-based proposals, from as many stakeholder groups, had emerged by mid-2013. These proposals fall into three broad groupings, or clusters: Water as a Sector (with a dedicated goal), Water as an Enabler (with distributed targets) and Water as a Supporter (to development and economic growth). Further examination of these clusters indicates that they more or less lie along a continuum. At the one end, proposals emphasize a continuation and expansion of the water sector focus of existing MDGs with an extended timeline, continuing through to proposals in which water is seen as an enabler and tied to key processes of national development and growth plans, ending with proposals in which water supports a comprehensive high-level development agenda. Cluster characteristics and conceptualization vary considerably, but there are distinct points of convergence between the three clusters.



Each cluster for implementing SDGs would require enabling environments, institutions and policies, and human and technological capacity. It is simply not possible for one cluster alone to capture all dimensions of water that are relevant for development. Taken all together, however, the clusters can be seen to comprise the water agenda that is needed to support and fully backstop goals related to water in the post-2015 agenda. This cross-cluster framework can begin to be articulated into a dedicated water goal, while establishing and maintaining its links to targets and indicators in other related goals.

We estimate that between 1.8 and 2.5% of the annual global GDP is needed for implementation of water-related SDGs, which would generate a minimum \$3,108 billion in additional benefits; a net benefit of \$734 billion. The implementation of water-related SDGs come with a price tag as well as revenue and savings opportunities. Conservative estimates of global investments in a post-2015 water for sustainable development and growth agenda range between approximately US\$1.25 and 2.25 trillion dollars per year over a 20-year investment period. These estimates are based on available data and account for benefits from cost savings, such as efficiencies in systems, but not benefits provided, for example through time, health savings and ecosystem services. At 1.8–2.5% of global GDP (2011), this is up to triple the current median annual WaSH expenditure of about of 0.73% global GDP.

Implementation of water-related SDGs must be built upon comprehensive national water assessments and linked to national development strategies. Despite their universality, SDGs should take into account national realities, capacities and levels of development as well as respecting national policies and priorities. Several conditions are required for implementation, including but not limited to: promoting stakeholder engagement through non-traditional mechanisms, building vertical and horizontal linkages, feasibility assessment and prioritization, the need for bottom-up, participatory processes, global mechanisms, as well

as high-level political commitment and ownership. Practical support required includes policy-focused implementation guidelines, national monitoring and reporting structures, scaling of innovative financing mechanisms and capacity development strategies

National monitoring systems, linked to global harmonization and assessment, will be central to ensuring implementation of SDGs and instigating possible course correction. Many of the existing national and global monitoring systems would need to be retooled to additionally monitor potential financial flows in the water domain, allowing for evidence-based economic analyses. Significant capacity development would be required to put such monitoring and assessment systems in place and to ensure that information generation is harmonized, while implementation is being undertaken in parallel. We anticipate that this will be linked to formulation of a strong governance structure based in transparency, cooperation and integration.



Photo credit: Richard Thomas, UNU-INWEH



PREAMBLE

As the timeframe of the Millennium Development Goals (MDGs) draws to a close in 2015, the global community is taking stock of ways to chart pathways towards a sustainable future. Post-2015 processes are responding to a mandate from the 2010 UN General Assembly to set out the development agenda that will succeed the MDGs. To this end, member states at the 2012 United Nations Conference on Sustainable Development (Rio+20) agreed to launch a process to develop a set of Sustainable Development Goals (SDGs). While the MDGs focused primarily on developing economies, SDGs aim to develop a broader sustainability framework with a global outlook, and will focus on thematic areas that are a priority for sustainable development. These thematic areas will be subject to

further negotiation under an inter-governmental working group, and could potentially include energy, food security, water and sanitation, health, poverty alleviation, gender equality, climate change, green economy and biodiversity protection.¹ The SDG process aims to develop global goals to be agreed by the General Assembly in the second half of 2014.

Currently, a number of processes are running in parallel, and may yet converge into one common framework for development. While there is still strong emphasis on attaining the MDGs by 2015, the post-2015 processes are striving to incorporate reviews of the MDGs, including their strengths and weaknesses, in order that principles and lessons learned can be brought to bear upon the future, broader, development framework. Within this context, several proposals on water goals, targets and indicators emerged in the first half of 2013 (see section 2.1).

“**R**ather than catalysing action, the importance of water, and sanitation, to human health, livelihoods, ecosystems and economic productivity means that while everyone has an interest in water issues, these interests are often at odds or fragmented.”

Doczi J., Dorr T., Mason N. and Scott A (2013) “The post-2015 delivery of universal and sustainable access to infrastructure services” ODI Working Paper



Purpose and aims of this report

This report has been jointly prepared by the United Nations Office for Sustainable Development (UNOSD)/United Nations Department of Economic and Social Affairs (UN DESA) and the United Nations University (UNU), in collaboration with the Stockholm Environment Institute (SEI). It is written for representatives of UN Member States, UN Water, the UN Task Team and the Open Working Group of UNGA, as well as others involved in the post-2015/SDG processes.

The report is not formally mandated; rather it is an independent evidence-based analysis of how water can be addressed in a development agenda beyond 2015. The purpose is fourfold: i) to help inform global goals that are being established for beyond 2015, and to support informed decision-making by governments; ii) to demonstrate points of convergence and divergence between different water perspectives beyond 2015; iii) to provide an overarching framework that can be used to understand water goals and targets, and be equally applicable to understand other goals and targets, and needs for environmental integrity, human development and economic growth beyond 2015; and iv) to understand the type of water investments required after 2015. It forecasts what might be needed in terms of financial investment, governance and capacity, and examines what these needs imply for implementation. We anticipate that this analysis will be useful for addressing water in a new development agenda as well as providing a methodology that can be applied to other proposals not analysed here, including proposals within other thematic areas.

In June 2013 in Incheon, South Korea, a meeting of experts and member-state representatives reviewed a draft of this report in order to validate the methods applied, identify and respond to potential gaps in the study, validate the emerging findings and recommendations, and to discuss their implications. This report reflects the suggestions and recommendations made by the stakeholders at the meeting.

Structure of this report

In Chapter 1, we describe the context of water; its flows within the environment, society and economy. This is accomplished by taking stock of linkages between water and development, experiences with the MDGs and expectations of the SDGs. Based on this stock-taking, a number of principles are established which SDG proposals can be assessed against, whether water-focused or otherwise. In Chapter 2 we do exactly that; existing proposals are described, grouped into three clusters, and assessed against the principles that we established. Acknowledging similarities and differences between the different clusters both in terms of how they meet the principles and the extent to which they address different elements of water issues, Chapter 2 culminates in a cross-cluster framework for water post-2015. In order to align with the principles established in Chapter 1 we unite elements of the different clusters into a comprehensive framework. In Chapter 3 we assess what is needed to realize this framework, both in terms of the types of enabling environments, institutional capacity and policies and human capacity, and in terms of estimating what investment might be needed. In Chapter 4 we suggest implementation pathways and innovations for moving forward.

REFERENCES

1. See Rio+20, The Future We Want: <http://sustainabledevelopment.un.org/futurewewant.html>



PREFACE	III
SUMMARY FOR DECISION MAKERS	IV
PREAMBLE	VI
Purpose and aims of this report.....	VII
Structure of this report.....	VII
1. TAKING STOCK OF LINKS BETWEEN WATER AND DEVELOPMENT, EXPERIENCES WITH THE MDGS AND EXPECTATIONS OF THE SDGS	2
1.1 Linkages Between Water and Development	3
1.1.1 Drivers of demand.....	5
1.2 Water and the Millennium Development Goals	7
1.2.1 Drinking water, sanitation, hygiene and the MDGs.....	7
1.2.2 Water resources management and the MDGs.....	8
1.2.3 Target 7c as a link between MDGs.....	9
1.2.4 Strengths and weakness of the MDGs.....	11
1.3 From Millennium Development Goals to Sustainable Development Goals	15
1.3.1 Overview of post-2015 and SDG processes.....	15
1.3.2 Lessons learned from the Millennium Development Goals.....	17
1.4 Principles for a post-2015 agenda	19
2. WATER WITHIN THE SDGS AND POST-2015 FRAMEWORK: AN ASSESSMENT OF PROPOSALS	22
2.1 Recent Proposals on Goals, Targets and Indicators for Water	23
Water as a Sector.....	23
Water as an Enabler.....	23



TABLE OF CONTENTS

Water as a Supporter.....	26
2.2 A Continuum of Clusters.....	28
2.3 Assessment of Clusters against key principles.....	30
2.4 A Cross-cluster Framework: “Catalyzing Water for Sustainable Development and Growth”.....	32
3. PRELIMINARY NEEDS ASSESSMENT.....	34
3.1. Needs Assessment: Catalyzing Water for Sustainable Development and Growth.....	35
3.2. Estimated Cost of Investment.....	48
3.2.1 The Bottom Line.....	53
4. IMPLEMENTATION CHALLENGES FOR A CATALYZING WATER FOR SUSTAINABLE DEVELOPMENT AND GROWTH FRAMEWORK.....	56
4.1 Implementation scenarios.....	57
4.2 The challenges of implementation.....	59
Monitoring and report of targets.....	59
Stakeholder engagement.....	59
Securing ownership of decisions – engaging UN member states and organizations.....	59
Mobilizing financial resources.....	59
4.3 Moving forward on Implementation.....	61
Non-traditional engagement mechanisms.....	61
Global mechanisms.....	61
Innovative Financing.....	62
Monitoring and Reporting.....	62
Representing Integration.....	65
Externalities.....	65
Policy implications.....	65

TAKING STOCK OF LINKS BETWEEN WATER AND DEVELOPMENT, EXPERIENCES WITH THE MDGS AND EXPECTATIONS OF THE SDGS

1.1 Linkages Between Water and Development

1.2 Water and the Millennium Development Goals

1.3 From Millennium Development Goals to Sustainable Development Goals

1.4 Principles for a Post-2015 Agenda

SUMMARY:

This chapter reviews the role of water in development, the status and trends of water-related targets under the MDGs and the linkages of water to other sectors and themes. It further reviews the strengths and weaknesses of the MDGs and the framing of water within them, alongside the expectations on the SDGs that have been established to date. Acknowledging the lessons learned from the MDGs and what is expected of the SDGs, eight principles are derived that a water-related SDG, or indeed any SDG, should address.

1.1 LINKAGES BETWEEN WATER AND DEVELOPMENT

Water is both a resource and a sector; a key to social development, environmental integrity and economic growth. As a sector, water requires infrastructure development and operational funds, while as a resource it cuts across sectors and requires integrated approaches to management. Financing, monitoring and infrastructure have all been identified as high priority management issues facing current governments.¹ Water development is fundamental to economic and social development, and those developments in turn increase the use of water and have environmental consequences. The Bonn 2011 Nexus Conference² has opened up a global debate on inter-linkages of natural resource pressures in water, energy and food, and advanced efforts to move beyond conventional sector thinking.

Mobilising water is critical within the post-2015 agenda in order to realise economic and social potential. It is critical for agriculture, ecosystem services and energy, but water and the services it provides are threatened by climate change, population growth, degrading water quality and extreme hydrological events (floods and droughts). Climate change is altering temperature and therefore precipitation patterns around the world, with drier regions tending to become even drier. Many researchers have made the connection between hydrologic extremes and economic losses.³ Despite this, countries in most regions of the world are only beginning to implement programmes to address water-related disasters; the same is true for water-related climate change impacts.⁴


A strong link has been demonstrated between water resources development and economic development. Water is interlinked in different ways in countries depending upon their economic development. Water is therefore both the subject of change when various users decide how to allocate and consume it, as well as being an enabler of such change. The stage and nature

of a country's development defines its relationship to water resources. This was highlighted, for example, in the Presidency Paper to the European Commission, *The Role of Water in EU Development Policy*.⁵

All industrialized countries have made early and large investments in water-related infrastructure, for example in reservoirs or hydropower, and water treatment, and in the human capacity required to operate and maintain these investments. Such investments have reduced the risk of water-related disasters and resulting damage, increased the reliability of water services for production, and minimized negative impacts on human lives, such as the spread of disease. Mature institutions and hydraulic infrastructure that have harnessed hydrology have clearly been a pre-condition for the broad-based development and growth achieved in the developed world. In some cases, actions may restore environmental assets that were lost during periods of rapid industrialization, while 'green economy' interventions seek to mitigate environmental damage at the same time as generating further economic and social opportunity.

“Water has always played a key role in economic development, and economic development has always been accompanied by water development.”

World Water Assessment Program (2009) “Water in a Changing World” 3rd World Water Development Report



The water landscape is changing, as is the global context within which water is demanded, allocated and used.

Even though economies in transition have already made major investments in water infrastructure, there is considerable scope for investment to realize further socio-economic benefits. This fits the generally accepted pattern that in the process of development countries initially place a premium on physical capital investments, while human capacity and institutions can take much longer to build and adapt. China and India, for example, have made substantial water-related investments to promote growth, for example in hydropower and irrigation infrastructure, but they still remain vulnerable to catastrophic impacts caused by extreme events, such as floods and droughts. In other economies in transition (e.g. in Eastern Europe and Central Asia), financing has been available to build infrastructure, but institutional and human capacity has not adapted to the extent needed to effectively manage water resources and new infrastructure. Getting the balance right between institutional capacity and infrastructure is crucial, and is especially relevant for economies in transition.

In developing countries institutional capacity is often lacking to manage water sustainably and make the needed investments. In these countries, the impacts of climate seasonality and variability, as well as rainfall extremes, are also often most striking. Catastrophic hydrological events such as droughts and floods can have dramatic social and economic impacts and cause substantial loss of human life.⁶ Such events also lead to sharp declines in annual GDP – often exceeding 10% – largely because water shortages translate to energy and food shortages. Globally, simultaneous droughts in the main grain producing areas coupled with biofuel demand have driven up prices for urban citizens in developing countries that have become dependent on buying and importing food rather than producing it. While

hydro-electricity is a key source of energy for the 26 sub-Saharan countries, only 7% of the hydropower potential is exploited in Africa, compared to 75% in Europe. Biofuels and bioenergy is on the rise and offer potential to improved energy security, but also implies additional pressures on water resources. Fuel crops are water intense, and if produced in developing countries where water resources are scarce, they may directly compete with food crops and water for other uses.

In many of the world's poorest countries high climate variability and limited water-related investment lead to a strong correlation between rainfall variability and GDP performance. In those areas where economic performance is closely linked to rainfall and water resources, growth has been described as being 'hostage to hydrology'.⁷ It is often in those same countries that economic performance is low, and where neither governments nor households can afford to invest in basic services because of competing development demands. Safe drinking water, sanitation and hygiene have direct impacts on health and productivity. While access to water enables job creation and opportunity for people to earn a living, the water-related investments that can improve human well-being and support economic growth are not prioritized. It has been estimated that the African continent as a whole loses about 5% of its GDP to poor coverage of water and sanitation, 2% to power outages, and affected countries between 5–25% of GDP to droughts and floods. Africa is also predicted to lose a further 5% to climate change impacts. Many countries in Asia are now serviced by advanced water and sanitation infrastructure, but in some regions a critical lack of access to basic services remains, especially in South and Southeast Asia. In this region, water-related disasters are estimated to cause an estimated 2–20% loss in life and property,

and 12–66% revenue loss, and also risk setting back development efforts that have been made to date.⁸ The Economic and Social Survey of Asia and the Pacific has identified that countries in these regions now face up to a 50% reduction in available water for development purposes relative to 1980 benchmark levels.⁹ It is ironic that the need to deal with the impacts of a lack of basic services actually increases expenditure in other sectors and categories; for example it usually costs more to get water from informal private providers, and health costs increase because waterborne disease is more prevalent, and the potential for human productivity is compromised. In many South and Southeast Asian countries conservation and restoration of land-water interfaces are key to increasing water productivity as improvements in irrigation systems offer potential to free up water resources.¹⁰ In Sub-Saharan Africa it is instead the

under-utilized agricultural and hydropower potentials that are key to unlocking future economic and social development. This emphasizes water's multiple linkages to development and thus the importance of moving beyond sector thinking in order to handle trade-offs and strengthening synergies for development.

1.1.1 Drivers of demand

A growing, increasingly prosperous and rapidly urbanizing global population will demand more food, more energy and more water resources to meet its needs. These demands from industrial development and rapid population growth encourage investments in water and sanitation infrastructure. Expected trends include:

- **Increased water consumption.** In the absence of any change in consumption patterns, by 2030 the shortfall between demand for, and supply of, water is projected to be 40%.¹¹ This is in part due to growing populations; according to the most recent World Population Prospects, there will be an additional 3.7 billion people on the planet by 2100.¹² Much of this growth will be in least developed and developing countries,¹³ while urban growth will also increase, to 60% of world population by 2030.¹⁴
- **Increased food demand and changing diets.** Projections show that providing food supplies for a world population of 9.1 billion people in 2050 would require an overall increase in provision of “on-the-plate” food by some 70% by 2050.¹⁵ Some of this demand can be met by reducing food (and water) wastage. Without reduced wastage, food production in developing countries would need to almost double, with significant increases in the production of several key commodities (notably cereals and meat). Higher yields and increased cropping intensity are expected to provide 90% of the growth in crop production globally (80% in developing countries), with land expansion providing the remainder.¹⁶



Photo credit: Olivia Grey Pritchard, UN Photo



- **Increased demand for and access to energy.** Almost all of the increase in energy demand will come from non-OECD countries as greater numbers of people gain access to electricity. Indeed forecasts suggest that world energy consumption will grow by approximately 50% between 2010 and 2040.¹⁷ A shifting in energy sources may also add pressure on water. For example, increasing demand for biofuels implies increased consumptive use of water to grow fuel crops, as compared to water use in hydropower, which can be used again downstream.
- **Climate change impacts.** Climate change will compound pressure on resources, as will policies to adapt to and mitigate.¹⁸ Furthermore, these pressures will be unevenly distributed around the world with the greatest impacts occurring in populations and locations characterized by low resilience.
- **New geopolitical dynamics.** The World Economic Forum has suggested that new dynamics could be triggered by a scramble for resources,¹⁹ potentially coalescing around national interests and alliances, thus causing a retreat from multilateral globalization that would risk throwing international organizations into question, and leave global companies to face a baffling political landscape.



Photo credit: Andrew Dansie, UNU-INWEH

REFERENCES

1. UN-Water (2012) “Status Report on the Application of Integrated Approaches to Water Resources Management” http://www.un.org/waterforlifedecade/pdf/un_water_status_report_2012.pdf
2. Bonn 2011 Conference: The Water, Energy and Food Security Nexus – Solutions for a Green Economy
3. For example, D. Grey and Sadoff, C.W. (2006) “Water for Growth and Development” in Thematic Documents of the IV World Water Forum, 2006
4. UN-Water (2012) “Status Report on the Application of Integrated Approaches to Water Resources Management” http://www.un.org/waterforlifedecade/pdf/un_water_status_report_2012.pdf
5. See e.g. D.Grey and Sadoff C.W. (2007) “Sink or Swim? Water security for growth and development” Water Policy vol. 9, pp. 545–571
6. IFRC (2012) World Disasters Report, Africa Regional Position Paper, 5th World Water Forum, Istanbul
7. D.Grey and Sadoff, C.W. (2006) “Water for Growth and Development” in Thematic Documents of the IV World Water Forum, 2006
8. APWF (2009) “Regional Document Asia-Pacific, 5th World Water Forum” http://www.apwf.org/archive/documents/ap_regional_document_final.pdf
9. APWF (2009) “Regional Document Asia-Pacific, 5th World Water Forum” http://www.apwf.org/archive/documents/ap_regional_document_final.pdf
10. APWF (2009) “Regional Document Asia-Pacific, 5th World Water Forum” http://www.apwf.org/archive/documents/ap_regional_document_final.pdf
11. 2030 Water Resources Group (2009) “Charting our Water Future. Economic frameworks to inform decision-making”
12. United Nations, Department of Economic and Social Affairs, Population Division, (2013) “World Population Prospects: The 2012 Revision, Key Findings and Advance Tables” Working Paper No. ESA/P/WP.227
13. United Nations, Department of Economic and Social Affairs, Population Division, (2013) “World Population Prospects: The 2012 Revision, Key Findings and Advance Tables” Working Paper No. ESA/P/WP.227
14. UN-Water (2012) “Status Report on the Application of Integrated Approaches to Water Resources Management” http://www.un.org/waterforlifedecade/pdf/un_water_status_report_2012.pdf
15. FAO (2009) “How to Feed the World in 2050” http://www.fao.org/fileadmin/templates/wsfs/docs/expert_paper/How_to_Feed_the_World_in_2050.pdf
16. FAO (2009) “Global agriculture towards 2050” www.fao.org/docrep/016/ap106e/ap106e.pdf
17. US Energy Information Administration (2013) “International Energy Outlook 2013” <http://www.eia.gov/ieo/>
18. World Economic Forum (2011) “Water Security – the Water, Food, Energy, Climate Nexus” http://www3.weforum.org/docs/WEF_WI_WaterSecurity_WaterFoodEnergyClimateNexus_2011.pdf
19. World Economic Forum (2011) “Water Security – the Water, Food, Energy, Climate Nexus.” http://www3.weforum.org/docs/WEF_WI_WaterSecurity_WaterFoodEnergyClimateNexus_2011.pdf

1.2 WATER AND THE MILLENNIUM DEVELOPMENT GOALS

The MDGs partially address water under MDG 7 (environmental sustainability), which includes target 7a that aims to “integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources” in part through the proportion of water resources used, and, target 7c that aims to “[half], by 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation”. A monitoring mechanism was never established for 7a, but indicators against which 7c is measured are; i) the proportion of population using an improved drinking-water source; and ii) the proportion of population using an improved sanitation facility.



Photo Credit: Ian Steele, UN Photo

1.2.1 Drinking water, sanitation, hygiene and the MDGs

In 2010, 89% of the world’s population used improved drinking water sources. This represented an increase of 13% (or approximately 2 billion people) over 1990 access levels, which meant that the proportion of the population without sustainable access to an improved drinking water source had been halved. Almost half of the increase was achieved in China and India, and 11% of the world population – currently 783 million people – still lack access. While significant gains have been made across Africa, current progress is too slow to meet the target for the continent of 78% access by 2015. On the basis of current trends it has been estimated that by 2015, 8% of the world’s people (605 million) will still lack access to an improved source of drinking water.¹ Inequality remains deep, and in terms of access to drinking water there are still significant divides between rural and urban populations, the wealthy and poor, and between genders.

The sanitation target is significantly off track, and is unlikely to

be met, even at the global level, while approximately 50 countries are individually off track.² Despite slight progress, almost half of the population in developing regions – around 2.5 billion people – lack access to improved sanitation facilities and 1.1 billion people (15% of the global population) practice open defecation. Greatest progress has been made in Eastern and Southern Asia, while Oceania, Western Asia and sub-Saharan Africa made the least progress. While 75% coverage is required to achieve the MDG target on sanitation, projections based on current trends estimate that by 2015 only 67% coverage will be achieved. There is also a strong divide between urban and rural populations in terms of sanitation access: global coverage is approximately 80% in urban areas but only 50% in rural areas.

Despite strong evidence that hygiene is at least as important as water and sanitation for combating waterborne and other infectious diseases, hygiene was never explicitly identified in the MDG framework. Water, Sanitation and Hygiene (WaSH) interventions have been described as “critical determinants of health”³ that prevent faecal-oral transmission of pathogens, and hygiene promotion has been identified as having one of the greatest cost-benefit ratios of disease control interventions.⁴ The fact that the MDG framework has neglected hygiene has meant



Photo Credit: Eskinder Debebe, UN Photo

that there has been very little monitoring of hygiene uptake globally, with only 26% of countries having national targets for hygiene promotion programmes.⁵ Despite this, 90% of national health strategies do refer to hygiene.⁶

1.2.2 Water resources management and the MDGs

A range of efforts were made to connect integrated water management to the full set of MDGs,⁷ demonstrating the belief that water issues underpin development aims in one way or another. Strong connections were never developed between water development and management and reducing hunger and household poverty, thus this area became the “poor cousin” to drinking water and sanitation in the MDG context. One key reason for this may be that after the 1992 Earth Summit there was

a fairly quick transition away from Integrated Water Resources Management and Development to Integrated Water Resources Management (IWRM). Thus the co-emphasis on development was lost, and managing sector trade-offs and environmental protection was perhaps over-emphasised ahead of resource development for people-centred outcomes.

By 2008 (three years after the target date of 2005 under the Johannesburg Plan of Implementation), 6 of 27 developed countries had fully implemented IWRM plans, and another 10 had plans in place but only partially implemented.⁸ Of 53 developing countries, nearly 40% had plans completed or being implemented by the same date. According to a 2012 survey of 133 countries, 50% of respondents had made “significant progress” towards developing and implementing IWRM plans, and 45% of high-income countries (Western European and others) had fully implemented national IWRM plans. Other regions were not as advanced, with 15% of respondents in Asia Pacific, 8%

in Africa, 5% in Eastern European States and no respondents in Latin America and the Caribbean having fully implemented national IWRM plans.⁹ At the 4th African Water Week, AMCOW declared its intention to make “Water for Growth” its priority in the next decade, with efforts to raise outcomes on the ground to the same level as has been achieved for drinking water and sanitation.

A UN-Water survey in 2012 on the status of integrated approaches to water resources management reported that 82% of countries are implementing changes to their water laws and proposing integrated approaches for the development, management, and use of water resources. This has been a far-reaching outcome of Agenda 21. The survey specifically found that:

- 79% of countries report changes in their water policy (however, translating policy and legal changes into implementation is a slow process).
- 65% of countries have developed IWRM plans, as called for in the JPOI, and 34% report an advanced stage of implementation (however, progress appears to have slowed or even regressed in low and medium HDI countries since 2008).
- 67% of countries reported the inclusion of water in national/federal development planning documents.
- Approximately 25% of countries reported that they had experienced constraints and obstacles relating to legal frameworks and strategic planning.

1.2.3 Target 7c as a link between MDGs

As already summarized in section 1.1, water is interlinked with all aspects of social and economic development – through energy, food production, health, industry and the environment.¹⁰ These links have not always been fully acknowledged by the prevailing goals framework. One example is the debate on human needs

for water (not only in terms of WaSH, but also in terms of other basic needs, which can range from 20 litres per person to 100 litres per person each day) and the needs of the environment, which results in an overly simplistic separation of development versus environment. Current trends show that the system as a whole is out of balance, increasing both uncertainty and risk.¹¹

It has been argued that target 7c is directly or indirectly relevant to achieving all other MDGs (Figure 1.1).¹² Indeed, soon after the MDGs were formulated, significant efforts were made to stress the links between MDG7 and other MDGs.¹³ However, in the absence of any formal targets for achieving multiple MDGs in the original Millennium Declaration, as well as the lack of any cross-linked monitoring mechanisms, actions that cut across multiple MDGs have been largely absent, and there has been little effort to track water issues in other goals than MDG7.



Photo Credit: Corinne Schuster-Wallace, UNU-INWEH

Figure 1.1. A description of how water supply and sanitation can link and contribute to the MDGs



Source: Modified from Mehta, M and Knapp, A. (2004)¹⁴

1.2.4 Strengths and weakness of the MDGs

It is important to identify the strengths and weaknesses of the MDGs in order to inform decisions on a final post-2015 development agenda. Perhaps not surprisingly, there is already general agreement on several of these strengths and weaknesses (Table 1.1).¹⁵ This section focuses on three scales, namely the MDGs as a whole, MDG7 on Environmental Sustainability, and MDG Target 7c on halving, by 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation.

The MDGs

Looking broadly at the MDGs, it is clear that they ambitiously set out to tackle the challenges that face the world's poorest, while at the same time being framed in a simple way that is easy to communicate. As a result, the MDGs are easy to advocate for, and it has been straightforward to mobilize public and political support for development. The UNTT concludes that global targets have been successful when they have been clear, inspiring, few in number and ambitious, yet feasible and measurable. As was the case when the MDGs were agreed upon at the Millennium Summit, agreement is easier to achieve when negotiations build on previously politically agreed targets. The SDGs, to a large extent, will be subject to new political negotiations and the negotiations and outcomes of the Rio+20 Summit gave early indications that negotiations will be challenging, showing both success as well as limitations of the SDG process. Arguably, achieving consensus demonstrates the limitations of compromise that many see as a dilution of desperately needed leadership and action.

While most of the MDGs will not be achieved by 2015, they have nevertheless been successful as a development instrument that has mobilized political commitment at the highest levels. The MDGs increased aid pledges and aid commitments, and heightened both international attention to poverty as well as the priority that developing countries themselves give to

poverty. The MDGs have helped to advance policy debates and to coordinate and implement international development initiatives. Moreover, by strengthening the focus on the social dimensions of development, they have led to a shift in the type of aid delivered. However, a multi-dimensional approach never evolved out of the MDGs; rather, the shift was from one narrow focus to another. Some have found fault with the MDG framework for neglecting critical issues such as climate change, the quality of education, human rights, economic growth, infrastructure, good governance and security, and for not including some critical aspects of development, such as access to basic energy services. Furthermore, they do not capture the overarching goal of sustainability, and neglected to take account of how growth can contribute to development outcomes. In terms of process, some claim that the MDGs lacked accountability, in that there is no specific responsibility for goal achievement. In addition, the donor-led formulation process allowed little attention to local context, and the focus on results management has been a source of criticism. Although the quantitative and deadline driven nature of the goals and targets made them tractable and provided a clear mechanism for assessment, the focus on measurable global progress meant that the MDGs failed to address inherent inequalities and therefore neglected the poorest and most vulnerable for whom progress was most difficult to achieve. The overall goal structure has also been criticised for being messy, and the lack of data at national levels an obstacle to measuring progress.

MDG 7

With respect to MDG7 on environmental sustainability, within which the drinking water and sanitation targets were framed, the 'World We Want' has identified a series of shortfalls, namely:¹⁶

- Challenges with monitoring at the country-level, including unreliable and inaccessible data, a lack of statistical capacities, as well as difficulties related to lack of public awareness, legislative and regulatory frameworks, inadequate human resource capacity and the need for more partnerships.¹⁷

Table 1.1. Summary of strengths and weaknesses of the MDGs

STRENGTHS	WEAKNESSES
<p>Attributes:</p> <ul style="list-style-type: none"> • Ambitious but realistic • Simple • Long-term (beyond electoral cycles) • Integrated • Partnership focused • Quantified and deadline driven 	<p>Attributes:</p> <ul style="list-style-type: none"> • 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
<p>Outcomes:</p> <ul style="list-style-type: none"> • 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) 	<p>Outcomes:</p> <ul style="list-style-type: none"> • 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

- Weak links between MDG7 and other MDGs, poorly articulated causal links between poverty and the environment, and weak development of responses.
- Fragmented by diverse targets and no integration of the different components means that while elements contribute to environmental sustainability, a full picture is missing.
- Lack of commitment to the national investments required for success.
- Lack of coordination among national institutions and authorities, stemming from an unclear definition of roles and responsibilities and differences in priorities of countries and donor communities.
- However, the inclusion of an environmental goal at best recognises that without environmental integrity and ecosystem services, poverty eradication and social development are difficult to achieve.

MDG target 7c

Regarding MDG targets on drinking water and sanitation specifically, the following shortfalls are identified:

- It has become increasingly clear over the course of the MDG period that, while at the global level the target for drinking water has been achieved, the picture within individual countries is often very different. The target was global, and achieving it within all countries would have exceeded the established target. On the other hand, labelling sub-Saharan Africa as “off-track” against an MDG that was global in its ambition risks labelling solid progress on drinking water as failure, while pointing to the inequity inherent in achieving the global MDG target. Arguably, the setting of a target to attain coverage for half of the population inevitably meant that the easiest would be reached first. Consequently, inequality has proven to be a genuine challenge.¹⁸ Moreover, during the MDG period the UN General Assembly declared water and sanitation to be a human right. This underlines the need for a different pathway toward goal achievement; that is, rather than addressing the easiest-to-reach half of those without access, the focus should shift to universal coverage.
- A recent analysis indicates that water and sanitation are statistically significant in all but one (school enrolment) of the other MDG indicators.¹⁹ Given that water and sanitation are critical to human health, this positioning of the targets for water and sanitation under MDG7 arguably meant that cross-sectoral links were not fully acknowledged.
- In absolute terms, because of population growth (and increasing urbanization), the number of people without an improved source in urban areas has actually increased from the 1990 baseline, a trend that the assessment of goal achievement does not take into account.²⁰
- Improved drinking water coverage can be seen as an indicator of economic and social progress (a cart) or as a driver of development (a horse) with social and economic rates of return. This calls into question where the entry point should be and continues to draw attention to the fact that economic growth was not factored into the MDG process.
- The decision to refer to “improved” water sources rather than “safe” water sources under MDG Target 7c was made because it makes progress easier to measure. The expediency around data handling had profound impacts on measurement and reporting around MDG 7c. Thus, even though the MDG target for drinking water has ostensibly been met, criticisms include the lack of consideration of quality of water as well as 24/7 access. Notwithstanding this, the Joint Monitoring Programme (JMP) has invested significant effort to establish a monitoring framework for the water and sanitation targets. More generally, even in countries with established networks, budget cuts and a lack of standardisation across jurisdictions threaten to undermine monitoring efforts.²¹



- Since it is not yet possible to measure water quality globally, dimensions of safety, reliability and sustainability are not reflected in the proxy indicator used to track progress towards the MDG target. As a result, it is likely that the number of people counted as using “improved” water sources is more than the number of people using “safe” water supplies. However, JMP’s “sanitation and drinking water ladders” have provided some clarity on definitions by setting up standardized thresholds, although the ladders have received similar criticism regarding the lack of consideration to quality and access as mentioned in the previous bullet.
- To ensure that evidence-based policies are developed for environmental sustainability, human wellbeing and economic growth, it is important to strengthen the science-policy interface. There is both a need to collect more data and for it to be effectively analysed and used for informed decision-making. In support of this, the Sanitation and Water for All partnership has taken up the call for standardisation of national monitoring indicators within the WaSH sector, and more recently, Bill Gates has advocated for improved data collection and monitoring for evaluation, saying “we need better measurement tools to determine which approaches work and which do not”.²²

REFERENCES

1. UN (2012) “Millennium Development Goals Report 2012” <http://www.un.org/millenniumgoals/pdf/MDG%20Report%202012.pdf>
2. JMP (2012) “Progress on Drinking Water and Sanitation: 2012 Update” <http://www.unicef.org/media/files/JMPreport2012.pdf>
3. Cairncross S. et al. (2010) “Hygiene, sanitation, and water: What needs to be done?” *PLoS Med* 7:e365
4. Laxminarayan, R. et al. (2006) “Intervention Cost-Effectiveness: Overview of Main Messages” In Jamison DT, Breman JG, Measham AR. et al. (2006) “Disease Control Priorities in Developing Countries. 2nd edition” Washington DC: The World Bank. pp 35–86.
5. WHO/UN-Water (2012) “GLAAS 2012 Report UN-Water Assessment of Sanitation and Drinking Water” http://www.un.org/waterforlifedecade/pdf/glaas_report_2012_eng.pdf
6. Based on survey respondents to the WHO/UN-Water (2012) “GLAAS 2012 Report UN-Water Assessment of Sanitation and Drinking Water” http://www.un.org/waterforlifedecade/pdf/glaas_report_2012_eng.pdf
7. See e.g., GWP (2006) “Policy Brief - How IWRM will contribute to the MDGs”
8. UN-Water (2008) “Status Report on Integrated Water Resources Management and Water Efficiency Plans” Prepared for the 16th Session of CSD16 http://www.unwater.org/downloads/UNW_Status_Report_IWRM.pdf
9. UN Water (2012) “Status Report on the Application of Integrated Approaches to Water Resources Management”
10. WWDR4 (2012) “Managing Water under Uncertainty and Risk” <http://www.unesco.org/new/en/natural-sciences/environment/water/wwap/wwdr/wwdr4-2012/>
11. WWDR4 (2012) “Managing Water under Uncertainty and Risk” <http://www.unesco.org/new/en/natural-sciences/environment/water/wwap/wwdr/wwdr4-2012/>
12. Cheng *et al.*, (2012) “Summary analysis: Quantifying Water Supply, Sanitation and the MDGs” www.inweh.unu.edu/Health/documents/SummaryAnalysis_QuantifyingWaterSupplySanitationandMDGs.pdf; Cheng *et al.* (2012) *Environmental Health* vol 11 issue 4 <http://www.ehjournal.net/content/11/1/4>
13. WWDR4 (2012) “Managing Water under Uncertainty and Risk” <http://www.unesco.org/new/en/natural-sciences/environment/water/wwap/wwdr/wwdr4-2012/>
14. Mehta, M and Knapp, A. (2004) “The Challenge of financing sanitation for meeting the Millennium Development Goals, paper Commissioned by the Norwegian Ministry of the Environment for the 12th session of the CSD-12”
15. See e.g. ODI Background Note (2011) “After 2015: progress and challenges for development”; Bond (2012) “Sustainable Development Goals: Building the Foundations for an Inclusive Process”; World Economic Forum “Global Outlook 2013”
16. The World We Want: E-Discussion Framing Paper: Environmental Sustainability for the World We Want: Moving from the MDGs to Post-2015. 29th January, 2013
17. Many countries are only recently getting up to speed on monitoring efforts on environmental targets, with additional indicators having been added in 2008.
18. JMP (2012) “Progress on Drinking Water and Sanitation: 2012 Update” <http://www.unicef.org/media/files/JMPreport2012.pdf>
19. Cheng *et al.* (2012) “Summary analysis: Quantifying Water Supply, Sanitation and the MDGs” www.inweh.unu.edu/Health/documents/SummaryAnalysis_QuantifyingWaterSupplySanitationandMDGs.pdf; Cheng *et al.* (2012) “An ecological quantification of the relationships between water, sanitation and infant, child, and maternal mortality” *Environmental Health* vol 11 issue 4 <http://www.ehjournal.net/content/11/1/4>
20. JMP (2012) “Progress on Drinking Water and Sanitation: 2012 Update” <http://www.unicef.org/media/files/JMPreport2012.pdf>
21. Confalonieri, U and Schuster-Wallace C.J. (2011) “Data integration at the water-health nexus” *Current Opinion in Environmental Sustainability* Vol. 3 Issue 6
22. 2013 Annual Letter from Bill Gates <http://annualletter.gatesfoundation.org/>.

1.3 FROM MILLENNIUM DEVELOPMENT GOALS TO SUSTAINABLE DEVELOPMENT GOALS

The political and economic landscape has changed since the MDGs were formulated. While the values and principles of the Millennium Declaration are probably just as relevant now as in the past, post-2015 discussions and papers judge it as an out-dated basis for a new development agenda.¹ This means that in the SDG process there is no single agreed text to guide the development agenda.² The shape of the new landscape has been sketched out in several reports, including the outcome of the Busan High Level Forum on Aid Effectiveness, which acknowledged that growth in emerging economies has become the key driver of global growth, that inequalities have increased within and between developing countries, and that the development architecture is becoming more complex than donor-recipient relations.³ For example, many emerging economies are no longer eligible for official development assistance (ODA) and have become aid donors themselves, and developed countries have become increasingly dependent on capital from developing countries.⁴ Changes in the climate, population dynamics and power balances are also altering the political and economic landscape.

1.3.1 Overview of post-2015 and SDG processes

This report has been prepared at a stage of introspection, dialogue and proposition, as uncertainty remains over how the post-2015 and SDG frameworks can converge, and the process for achieving convergence. The key post-2015 and SDG processes that are taking place in the UN system are described below – both those that are specific to water and those that are broader in scope. Other relevant consultative processes are summarized in Box 1.

High-Level Panel of Eminent Persons (HLP) on the Post-2015 Development Agenda. The UN-Secretary General appointed

the HLP in July, 2012. It was composed of 26 members, was co-chaired by Indonesia, Liberia and the United Kingdom, and included representatives of national and local government, civil society, the private sector and academia, as well as a Special Advisor on Post-2015 Development Planning. The Panel helped to build political consensus on the vision for a post-2015 UN development agenda and promote the engagement of all stakeholders in the post-2015 deliberations. The Panel submitted a report to the Secretary General on 30 May, 2013, emphasizing the role of water in social and economic development while including a specific goal on universal access to water and sanitation and targets relating to universal access to safe drinking water and sanitation, ending open defecation, water-efficiency and wastewater.

Open Working Group (OWG) of the General Assembly on Sustainable Development Goals. The OWG was established on 22 January, 2013, by decision 67/555 of the General Assembly and is co-chaired by Hungary and Kenya. The Member States have decided to use an innovative, constituency-based system of representation that is new to limited membership bodies of the General Assembly, which means that most of the seats in the OWG are shared by several countries. The OWG is mandated to



Photo Credit: John Isaac, UN Photo

BOX 1. OTHER RELEVANT CONSULTATIVE PROCESSES

- Sustainable Development Solutions Network (SDSN), see: <http://unsdsn.org>
- IRF2015 (the Independent Research Forum on a Post-2015 Development Agenda), see: www.irf2015.org
- Friends of Water, see: http://www.un.org/waterforlifedecade/friends_of_water.shtml
- European Commission process, see: ec.europa.eu/europeaid/how/public-consultations/documents/1206_consultation_post-2015_development_en.pdf
- Global Water Partnership (GWP), see: www.gwp.org/
- Post-2015 forum, see: www.post2015.org
- Beyond 2015 forum, see: www.beyond2015.org
- UK International Development Committee, see: www.parliament.uk/business/committees/committees-a-z/commons-select/international-development-committee/news/mdg---substantive-press-notice/
- Post-MDGs informal Contact Group.⁵
- AMCOW (African Ministers' Council on Water), see: www.amcow-online.org/index.php?option=com_content&view=article&id=292&Itemid=160&lang=en
- UN Global Compact, see: www.unglobalcompact.org

propose SDGs to the UN General Assembly at its 68th Session (2013–2014). Technical support to the OWG is provided by an inter-agency technical support team under the aegis of the UN System Task Team on the Post-2015 UN Development Agenda (UNTT).

UN System Task Team on the Post-2015 UN Development Agenda. The UNTT was established by the UN Secretary-General in January 2012, and is co-chaired by the United Nations Development Programme (UNDP) and the United Nations Department of Economic and Social Affairs (UNDESA). The UNTT convenes more than 60 UN agencies and international organizations to support both the HLP and the OWG. In 2012

the UNTT published its first report, *Realising the Future We Want for All*, which sets out a vision for the UN system post-2015. The UNTT is comprised of three sub-groups; Global Partnerships; Data and Monitoring; and, Technical Support Team on SDGs.

UN Development Group (UNDG). The UNDG will potentially put in place up to 100 national dialogues in association with civil society organisations and other international organizations. National dialogues are currently set up in 88 countries, principally targeting low-income countries under a process informed by a guidance note and led by UN resident coordinators and UN country teams, partly funded by UNDG. The Group



Photo Credit: Dave Devlaeminck, UNU-INWEH

has also launched 11 thematic consultations, including water and sanitation, each with co-leaders, contributors, a host, and social media outreach. The water theme is led by UN-Water which has been tasked to propose a water-dedicated sustainable development goal. Contributions to the theme are made through a task force led by UNDESA, the United Nations Children's Fund (UNICEF) and the UN-Water Management Team, each of which are likely to take a lead on one of the three potential areas of focus for the water theme. These are: i) access to safe drinking water, sustainable sanitation and hygiene (UNICEF), ii) wastewater and water quality (UN-Habitat), and iii) water resources management (United Nations Economic Commission for Europe – UNECE). The Netherlands and Switzerland will support the water theme by acting as host governments.

The WHO/UNICEF Joint Monitoring Programme (JMP) for Water Supply and Sanitation. The JMP was originally tasked to monitor progress related to MDG target 7c and is now serving as a platform to develop proposals for post-2015 goals, targets and indicators. Since January 2012, four working groups have been operating under the JMP, namely on water, sanitation, hygiene, and equity/non-discrimination. This process has rolled into the UNDG thematic consultation on water.

1.3.2 Lessons learned from the Millennium Development Goals

The identified strengths and weaknesses of the MDGs offer a number of lessons that should feed into the transition from MDGs to post-2015/SDGs. There are lessons that regard water specifically, but for the post-2015 agenda to succeed, all partners and stakeholders will first need to look at the broader picture before 'selling' their particular issue. If not, there is a risk that the final agenda will be unfocused and unfit for purpose. The success of the process will depend on how clear, concise, and measurable the new agenda is. Global targets should serve the agenda, not define it, and its design should be balanced, creative, inclusive and disciplined.⁶

There is general agreement that the targets/indicators must be SMART (specific, measurable, achievable, realistic and time-bound). Moreover, Member States under the UN Economic and Social Council (ECOSOC) have agreed that future goals shall be action-oriented, concise, easy to communicate, limited in number and aspirational. Further it has been agreed that they should be global in nature, and universally applicable while taking into account national realities, capacities and levels of development as well as respecting national policies and priorities. While building on the MDG framework, it is further widely acknowledged that the post-2015 agenda must reflect the changes in the economic and political landscape. ECOSOC emphasizes stronger focus on democratic rights, a supportive international environment and stronger global governance as important factors to support new goals, and, in order to cover dimensions missed by the MDGs, it has emphasized the need for the SDGs to address sustainable development, inclusive growth, inequalities, demographic dynamics, governance, conflict, and food security and nutrition. Furthermore, ECOSOC has stressed that several of the MDGs were too narrow; thus a broader focus and greater emphasis on sustainability should help the SDGs to be more multi-dimensional in scope. There is also emphasis on making new goals more contextual, and the ECOSOC suggests the inclusion of national goals that are, determined nationally, in line with universal global goals. This should avoid a one-size-fits



all approach, while strengthening national ownership, priority setting and national means of implementation.

The lessons learned from the MDGs have established a number of expectations on the SDGs, and UN Member States have agreed in the Rio+20 outcome document that SDGs must:

1. Be based on the Agenda 21 and the Johannesburg Plan of Implementation;
2. Fully respect all the Rio Principles;
3. Be consistent with international law;
4. Build upon existing commitments;
5. Contribute to the full implementation of the outcomes of all major summits in the economic, social and environmental field;
6. Focus on priority areas for the achievement of sustainable development, being guided by the outcome document;
7. Address and incorporate in a balanced way all three dimensions of sustainable development and their inter-linkages;
8. Be coherent with, and integrated into, the UN post-2015 agenda;
9. Not divert focus or effort from the achievement of the MDGs'; and,
10. Include active involvement of all relevant stakeholders, as appropriate, in the process.

The IRF2015 has further suggested eight shifts needed for a new approach to development (Source: IRF2015⁷ (2013)):

FROM		TO
Development assistance	▶	A universal global compact
Top-down decision making	▶	Multi-stakeholder decision-making processes
Growth models that increase inequality and risk	▶	Growth models that decrease inequality and risk
Shareholder value business models	▶	Stakeholder value business models
Meeting “easy” development targets	▶	Tackling systemic barriers to progress
Damage control	▶	Investing in resilience
Concepts and testing	▶	Scaled up interventions
Multiple discrete actions	▶	Cross-scale coordination

Other such shifts that relate to water specifically include a move from stand-alone goals towards integrated interventions and nexus thinking, embedding monitoring and evaluation within the process, and bringing water issues into political economy.

REFERENCES

1. See e.g Vandermoortele (2012) “Advancing the Global Development Agenda Post-2015; some thoughts, ideas and practical suggestions” DG for External Policies (2013) “Millennium Development Goals and Beyond 2015: A Strong EU Engagement” <http://www.europarl.europa.eu/delegations/en/studiesdownload.html?languageDocument=EN&file=92130>
2. Vandermoortele (2012) “Advancing the Global Development Agenda Post-2015; some thoughts, ideas and practical suggestions”
3. EC (2012) Public Consultation “Towards a post-2015 development framework”
4. Bond (2012) “Sustainable Development Goals: Building the Foundations for an Inclusive Process”
5. A Japanese initiative with the stated objectives to; explore possible shapes/models/modalities of a new global framework for development beyond 2015, pursue synergy among other initiatives; produce solid recommendations in preparation for more formal international discussion over the post-MDGs; and provide the general public and civil society organizations with thought-provoking visions and ideas on the post-MDGs.
6. Vandermoortele (2012) “Advancing the Global Development Agenda Post-2015; some thoughts, ideas and practical suggestions” http://www.un.org/millenniumgoals/pdf/jan_vandemoortele_Aug.pdf
7. Independent Research Forum (2013) “Post-2015: Framing a new approach to substantial development” <http://pubs.iied.org/G03559.html?k=framing%20a%20new%20approach>

1.4 PRINCIPLES FOR A POST-2015 AGENDA

Based on the preceding analyses of lessons learned from the MDGs and expectations on the SDGs, we derive two sets of principles that can guide the formulation of SDGs. These are outcome-based principles that reflect aspirations and ambitions, and attribute-based principles that focus on practical dimensions essential to the success of SDGs. In addition to these, principles that relate to the process of transition from the MDGs to SDGs have also emerged. For example, there

is general agreement that the process of transition should be balanced and inclusive. Moreover, the process needs to ensure legitimacy and ownership. Therefore the SDGs and their implementation must guarantee the active participation of stakeholders, especially that of marginalized groups. Relating to this, debates need to reflect the southern orientation of recent economic growth and overcome the one-sided emphasis on either social development or economic growth. We argue that four outcome-based and four attribute-based principles must be incorporated into the SDG process if the goals are going to meet needs and be acceptable to the international community.



Photo Credit: Eskinder Debebe, UN Photo

Outcome-based principles

1. Poverty eradication.

The future framework must retain the overall purpose of the MDGs to reduce poverty. This would recognize the marginalized in High Income Countries, the majority of the world's poor in Middle Income Countries, and at the same time recognize the extreme poverty in Sub-Saharan Africa and South Asia. The post-2015 framework should be more integrated in its approach to poverty reduction – tackling root causes at source in ways that more strongly integrate the three dimensions of sustainable development and their unique and mutual contributions to development. Such integration towards a common purpose would provide a more holistic framework and support progress on policy coherence for development. It would also mean that water would be more directly and comprehensively connected to poverty reduction, as well as help develop understanding of the different value chains associated with water.

2. Equity.

The post-2015/SDG framework should decrease inequality and risk, focusing on a better (pro-poor) distribution of wealth, redressing imbalances in resource access within and between countries, and by promoting equality (including gender equality, income equality and inter-generational equality). The post-2015/SDG framework should be consistent with international law and be responsive to rights-based approaches, including marginalized populations, such as women and indigenous peoples' groups – a principle that would accommodate the significant differentiation between accessing water (directly) and accessing the (indirect) benefits of water (e.g. income, food, energy).

3. Sustainability.

The SDG framework should address environmental and resource sustainability, while at the same time promote conservation and the sustainable use and regeneration of natural resources. This must be tied to the promotion of sustained, inclusive and equitable global growth. It

means that the SDGs will have to address the ostensible tension between resource limitations and rights-based responsibilities, and between social and competing economic demands, particularly in water-scarce regions of the world.

4. Economic Growth.

Growth of economic opportunities and job creation have achieved a much more central role in the current political discourse. Investments in water and sanitation provisioning, infrastructure development and renewal, development of national capacities, and management of water resources must therefore assume a central role in delineating water-related targets and the underlying indicators.



Photo Credit: Craig Murray, UNU-INWEH

Attribute-based principles

1. Universality.

A common framework should be applicable in, and relevant to, all countries. The framework should be globally agreed upon and include global overarching goals, but be flexible enough that countries develop their own pathways to reach goals. Accordingly, and in line with the principle of common but differentiated responsibility, while the goals would be universal obligations with clear accountability, targets may vary between countries with respect to national contexts. Accountability must be clear at all levels.

2. Measurable and time-bound.

Targets and indicators (both quantitative and qualitative) should be clearly defined and transparent; be established against a recent baseline; be measurable at appropriate scales to record inequalities; be measurable with an appropriate social differentiation; and be compatible with regular reporting.

3. Sensitive to external drivers.

Targets must recognize pressures from other sectors and external forces, such as the demand for biofuel and climate change. This should, in turn, enable governments to understand the cost-benefit trade-offs of different policies and decisions.

4. Grounded in good governance.

Governance at all scales should be addressed and include genuine participation and access to information, including multi-stakeholder decision making processes and stakeholder value business models backed by awareness-raising and sensitization. There needs to be stronger cohesion with national poverty-reduction strategy-paper processes so that development stakeholders are bound to national aspirations. Mid-term planning and investment scheduling, backed by results-based frameworks and public expenditure plans that address political economy-level issues as well as tackle the causes of, and building resilience to, corruption and conflict, are equally important.



Photo Credits: Zafar Adeel, UNU-INWEH

WATER WITHIN THE SDGS AND POST-2015 FRAMEWORK: AN ASSESSMENT OF PROPOSALS

2.1 Recent Proposals on Goals, Targets and Indicators for Water

2.2 A Continuum of Clusters

2.3 Assessment of Clusters Against Key Principles

2.4 A Cross-cluster Framework: “Catalyzing Water for Sustainable Development and Growth”

SUMMARY:

This chapter presents recent proposals on water goals, targets and indicators generated by post Rio+20 “think-pieces” and consultation processes (2.1). These proposals fall into three clusters based on their overall intent, and are demonstrated to form a broad continuum with regards to their characteristics stemming from their different entry points (2.2). In section 2.3 we assess the clusters of proposals against the established principles outlined in 1.4. In concluding that many characteristics are shared across clusters and that no single cluster alone meets the established principles, we establish a cross-cluster framework for a post-2015 water agenda (2.4.)

2.1 RECENT PROPOSALS ON GOALS, TARGETS AND INDICATORS FOR WATER

Fourteen water-based proposals, from as many stakeholders, had emerged by mid-2013. These proposals fall naturally into three groupings – or clusters – based on their entry point and primary focus; Water as a Sector, Water as an Enabler, and Water as a Supporter (to development and economic growth). The narratives of these clusters are introduced below with their related proposals listed underneath.

Water as a Sector

Notions of this cluster have been emerging from dialogues linked to The Future We Want (the outcome document adopted at Rio+20), a JMP post-2015 consultation and building from progress on the MDGs, the Johannesburg Plan of Implementation and Millennium Declaration, as well as on the human right to safe drinking water and sanitation. Proposals within this cluster tend to prioritize WaSH, water resources management, wastewater, water quality and/or pollution whereas the linkages to the overall development agenda and economic growth are not explicit. Some proposals suggest extended and expanded targets for water while others suggest a unified water goal. The former have built principally on the MDG 7c target and included additional water targets and indicators, while the latter are based on the “MDG-compact” scenario of a single, unifying, goal on water. Notwithstanding these differences, all of the proposals in this cluster can be described to have the water sector *per se* as their main interest and delimitation.

Proposal 1a: Safe and sustainable sanitation, hygiene and drinking water used by all.¹

JMP suggests an extended time period of existing drinking water and sanitation targets, as well as an expanded focus to include schools and health care settings, and adds hygiene in addition to current MDGs. Time extensions are up to 2040.

Proposal 1b: Towards a wastewater sub-goal of the goal on water.² Aquafed suggests a sub-goal for urban wastewater, main industrial and breeding facilities and agricultural inputs.

Proposal 1c: Manage wastewater wisely – minimize its generation and pollution.³ Researchers at SEI suggest targets and indicators on wastewater collection, wastewater treatment, wastewater generation and reuse.

Proposal 1d: Ensure a water secure world for all.⁴ AMCOW suggests a unifying goal for water that includes WaSH, water resources management, and wastewater management and water quality.

Proposal 1e: A Water Secure World.⁵ Swiss Agency for Development and Cooperation (SDC) suggests a unifying goal for water that includes WaSH, water resources management, and wastewater management and water quality.

Proposal 1f: Water and Sanitation for All.⁶ UN Global Compact suggests a dedicated goal for water, sanitation and wastewater.

Proposal 1g: “Chapter 18 of Agenda 21”. An option exists to reinstate the Agenda 21 Chapter 18 on Freshwater, with its overarching aim to attain all freshwater sub-sectoral targets by 2025.

Proposal 1h: “Water efficiency”. Further proposals may emerge linked to a single goal on water efficiency.

Water as an Enabler

The Water as an Enabler cluster is informed by international development commitments, but is aimed at tackling key obstacles to increasing economic growth and productivity.



Emphasis is on water development that can unlock agricultural growth, energy production, water in industry and commerce as well as create employment. Thus, water is seen as an enabler for development by making diverse contributions to the rate and equity of economic growth. Critically, the framing of water in this cluster intimately ties water to key processes of state implementation, such as public expenditure, institutional roles and responsibilities, sector-wide approaches, and government reform. It also helps to open up space for non-state actors such as the private sector and civil society, as well as interfaces with development partners through sector coordination groups, Country Strategy Papers, more predictable external financing, and the aid effectiveness and output-based aid agenda.

Proposal 2a: Growth and Poverty Reduction. This is less of a formal proposal than an encapsulation of the current framing of water within prevailing Growth and Poverty Reduction Strategies (G&PRS) in more than 50 nations. Such a goal would focus on ‘both sides of the growth coin’; these being water’s contribution to inclusive, poverty reducing growth (both in terms of rates and equity) and access by the poor to the benefits of such growth. As Figure 2.1 shows, this approach is based on three mutually supportive pillars that allow water to be integrated across the sectoral development approaches.

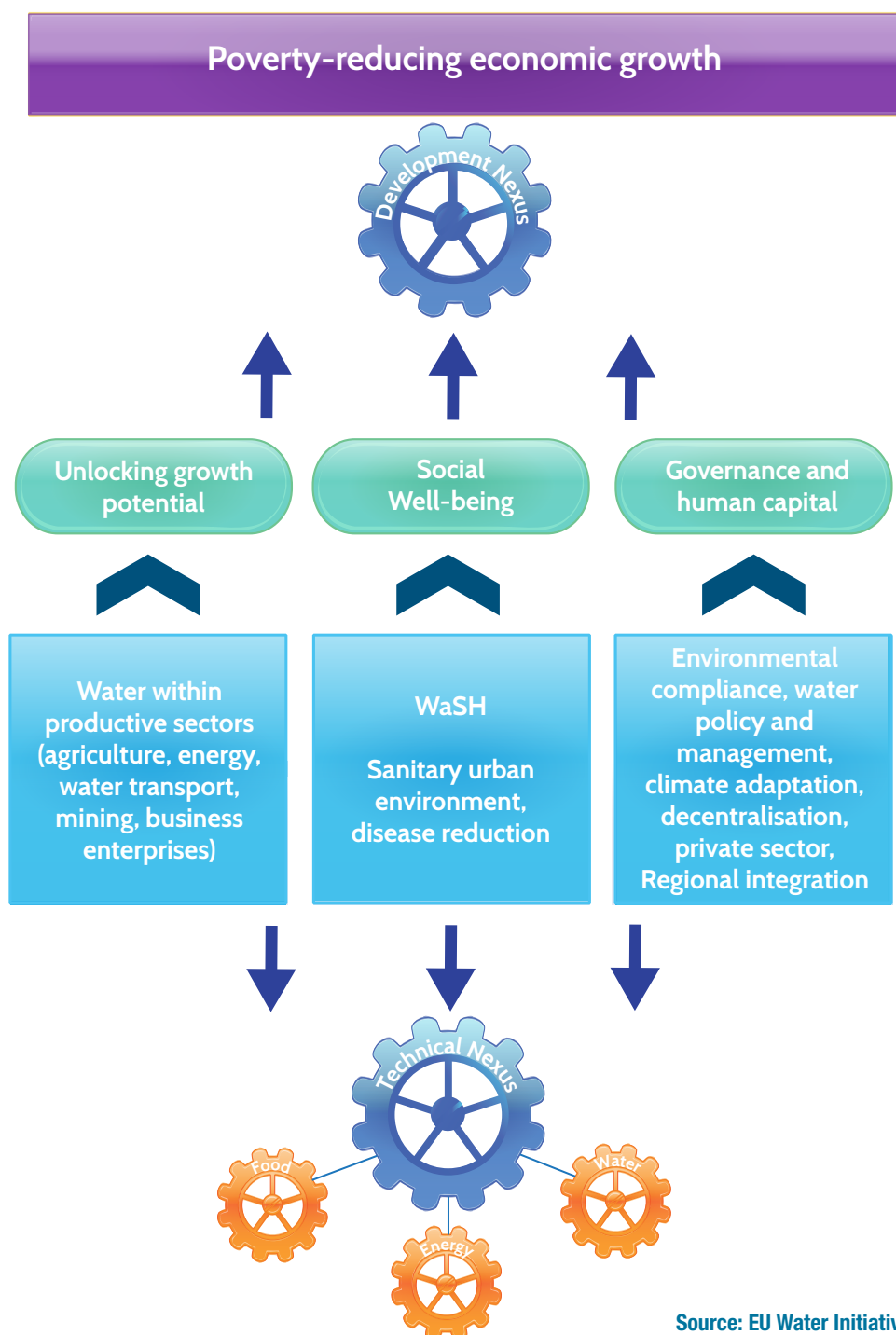
Proposal 2b: Integrated Water Management for Sustainable Growth.⁸ Governments of Colombia, Peru, and United Arab Emirates include a goal for integrated water management for sustainable growth in their indicative listing of SDGs at Rio+20. The goal suggested issues to be covered and included improvements in water supply and sanitation access, water resources and ecosystem quality, water efficiency and water-related health.

Proposal 2c: Water value chains.⁹ This proposal emerges from a water management concept and focus on water value chains. It illustrates how water in nature can generate value by being stored for multipurpose use, then used for primary water services before contributing to secondary and tertiary level goods and services (see Figure 2.2). Thus, the management and development of water resources adds value to a society and provides for different activities and outcomes as part of the value chain. For societies to become sustainable, water needs to be managed in all aspects according to its different values along the chain.



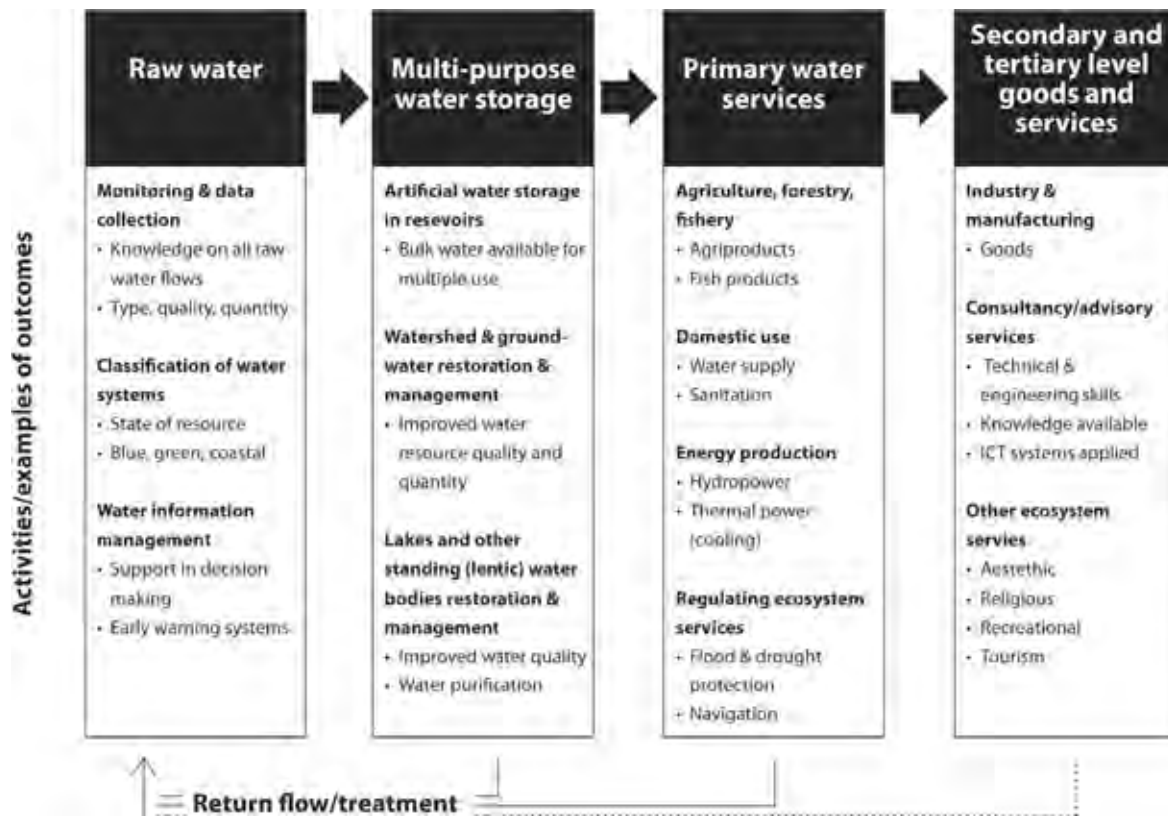
Photo Credit: Kibae Park, UN Photo

Figure 2.1. Poverty-reducing economic growth – generalization of framing within prevailing National Growth and Poverty Reduction Strategies



Source: EU Water Initiative (2012)⁷

Figure 2.2. The Water Value Chain



Source: Granit, J. (2012)¹⁰

Water as a Supporter

The Water as a Supporter cluster focuses on the high-level development agenda and the principal transformational changes in global development assistance. It aims to set a wider enabling environment for future action on, for example, poverty reduction, sustainable development and global governance. This development agenda may be applied to a water agenda, embedding water issues in other high-level goals or targets (e.g. for health or agriculture), and/or be introduced as lower-level targets or indicators. Water can thus be seen as a supporter to achieve overarching policy objectives for development.

Proposal 3a: A New Global Partnership. Eradicate Poverty and Transform Economies through Sustainable Development.¹¹

The HLP has called for a new global partnership to eradicate poverty and transform economies through sustainable development. The proposal builds on the MDGs, recognising that unprecedented progress has been driven by a combination of economic growth, better policies and global commitment to the MDGs. It does not propose isolated action on specific goals or national targets; rather these will be driven by, and drive, transformational shifts (equity, sustainability, growth, accountability and partnerships). While the HLP goals

and targets relate strongly to water, the implications of the transformational changes for water have yet to be worked through. An illustrative goal on universal access to water and sanitation is included in the proposal.

Proposal 3b: An Action Agenda for Sustainable Development.¹²

The SDSN acknowledges that providing access to safe water and sanitation, ensuring sound management of freshwater resources, and preventing water pollution are priority challenges of sustainable development. It does not suggest a specific goal for water but addresses it at target level under goals to (i) Improve agriculture systems and raise rural prosperity; (ii) Empower inclusive, productive and resilient cities; and (iii) Secure ecosystem services and biodiversity, and ensure good management of water and other natural resources.

Proposal 3c: Getting to Zero – Finishing the Job the MDGs Started.¹³

World Economic Forum proposes absolute goals that are intended to achieve equality and universality across groups, including those disadvantaged by geography, ethnicity, socio-economic status and gender. Some goals will merit near-zero targets, others (e.g. child mortality) should be assessed by the standards of today's advanced economies, while other goals will merit ambitious positive targets (e.g. universal access to secondary education). Water is addressed at target level across urban, rural and ecosystems goals.

Proposal 3d: Bellagio Goals.¹⁴

The Centre for International Governance Innovation / Korea Development Institute suggests 11 goals that aim to move the development agenda beyond meeting basic human needs to promote dynamic, inclusive and sustainable development. Within the goals framework water is addressed primarily within a combined goal for water and food, but also at indicator level under goals for Quality Infrastructure for Access to Energy, Transportation and Communication.

REFERENCES

1. 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-definitions-and-indicators_version7_Nov22_final.pdf
2. Aquafed (2013) "Post-2015 Global Goals – Towards a wastewater sub-goal of the goal on water" <http://www.worldwewant2015.org/node/306022>
3. Kvarnström, E., Jönsson, H., Fogde, M. (2013) "Suggestions for targets and indicators on wastewater management post-2015" (concept note)
4. 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
5. SDC (2012) "Outline of a future Global Water Goal, DRAFT 17th March version. Developed by the Water Division of the Swiss Agency for Development and Cooperation in collaboration with the Swiss Water Partnership"
6. 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
7. EU Water Initiative (2012) "Water within African National Growth and Poverty Reduction Strategies" (Internal Note)
8. 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
9. Granit, J. (2012) "The Collective Action Dilemma in Managing Transboundary Freshwaters – An analysis of an outcome-driven framework" Dissertations from the department of Physical Geography and Quaternary Geology, No 33. Stockholm: Stockholm University
10. Granit, J. (2012) "The Collective Action Dilemma in Managing Transboundary Freshwaters – An analysis of an outcome-driven framework" Dissertations from the department of Physical Geography and Quaternary Geology, No 33. Stockholm: Stockholm University
11. 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
12. SDSN (2012) "An Action Agenda for Sustainable Development" Report for the UN Secretary-General <http://unsdsn.org/files/2013/06/130613-SDSN-An-Action-Agenda-for-Sustainable-Development-FINAL.pdf>
13. WEF/GAC (2012) "Getting to Zero – finishing the job the MDGs started" <http://www.brookings.edu/~media/research/files/papers/2012/4/17%20millennium%20dev%20goals%20mcarthur/0417%20millennium%20dev%20goals%20mcarthur.pdf>
14. CIGI/KDI (2012) "Post-2015 Development Agenda: Goals, targets and indicators" Special report http://www.cigionline.org/sites/default/files/MDG_Post_2015v3.pdf

2.2 A CONTINUUM OF CLUSTERS

Reviewing the various clusters of proposals for water in the post-2015 agenda, it becomes clear that they more or less lie along a continuum. At one end proposals suggest a continuation and/or expansion of the water sector focus of existing MDGs but with an extended timeline, and run through to proposals where water is seen as an enabler by unlocking growth potentials and is tied to key processes of state implementation (by national development and growth plans), to proposals where water supports a comprehensive high-level development agenda at the other end. Figure 2.3 illustrates this continuum.

The different entry points of each cluster imply different characteristics in addressing water issues. On the other hand, the clusters generally address a common cause and they therefore share some characteristics. The table below summarizes each

cluster's characteristics in addressing a number of select criteria, in order to settle where the clusters converge and diverge.

As shown in Table 2.1, the clusters' characteristics and emphases in addressing key select criteria vary. There is weaker convergence on stakeholder engagement, how resources are to be mobilized and, for example, the scale of evaluation of water availability and how poverty reduction is addressed. The clusters are all relevant as they highlight different perspectives of water for development along the continuum. Generally, there can be seen to be points of convergence between Water as a Sector and Water as an Enabler as well as between Water as an Enabler and Water as a Supporter. For example, with regards to stakeholder engagement (see Table 2.1) community level engagement and empowerment (a focus for Water as a Sector), is included as parts of national multi stakeholder compacts (a focus for Water as an Enabler), but are not explicit in global partnerships (a focus for Water as a Supporter).

Figure 2.3. The three clusters of proposals on a continuum

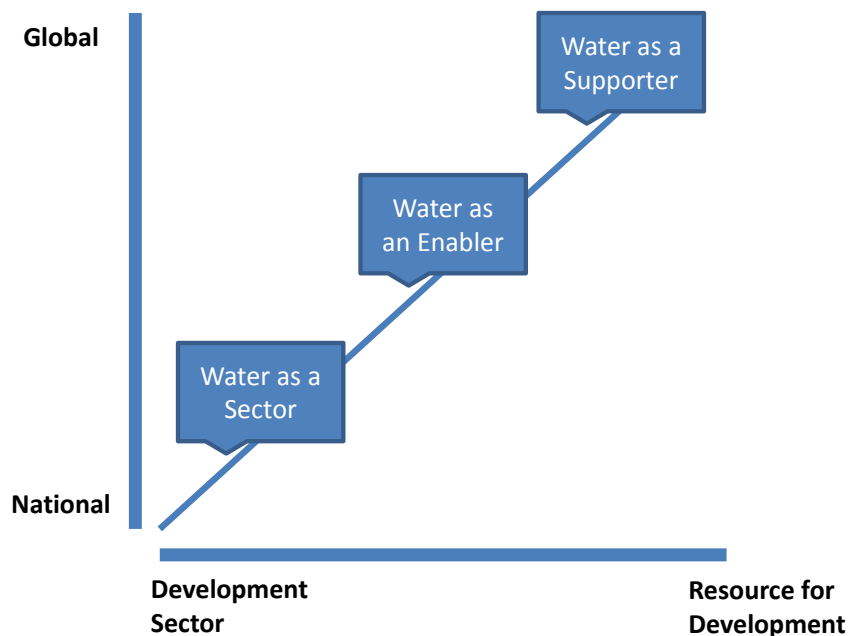


Table 2.1. Comparative analysis across clusters, showing convergence according to select criteria

	Water as a Sector	Water as an Enabler	Water as a Supporter
Goal outcome	<ul style="list-style-type: none"> Water security Human security 	<ul style="list-style-type: none"> Inclusive economic growth that enables poverty reduction 	<ul style="list-style-type: none"> Global transformations that support transparency, accountability, growth, sustainability and equity Eradicating poverty
Delimitation of “water”	<ul style="list-style-type: none"> Sector (WaSH, Wastewater, IWRM) 	<ul style="list-style-type: none"> Role in unlocking economic growth Nexus-interlinkages 	<ul style="list-style-type: none"> Supporting resource to achieving policy objectives
Addressing water availability	<ul style="list-style-type: none"> Water security challenges Local and transboundary 	<ul style="list-style-type: none"> Regional integration Regional markets Global trade in goods and services 	<ul style="list-style-type: none"> Transboundary waters and international cooperation Within “planetary boundaries”
Addressing poverty reduction	<ul style="list-style-type: none"> Implicit (focus on impacts of poverty) 	<ul style="list-style-type: none"> Water as enabler and contributor to poverty reduction and inclusive economic growth by unlocking growth potentials 	<ul style="list-style-type: none"> Sustainable development for poverty eradication (focus on root causes)
Addressing equity	<ul style="list-style-type: none"> Human rights 100% WaSH coverage 	<ul style="list-style-type: none"> Pro-poor inclusive growth (equity of growth as important as rate of growth) 	<ul style="list-style-type: none"> Elimination of barriers Reduced gaps in outcomes between poorest and richest
Addressing accountability	<ul style="list-style-type: none"> Water governance 	<ul style="list-style-type: none"> Peer reporting Multi-stakeholder compacts around G&PRS 	<ul style="list-style-type: none"> Transparent and accountable governance
Addressing capacity development	<ul style="list-style-type: none"> Capacity development 	<ul style="list-style-type: none"> Human capital (on water) 	<ul style="list-style-type: none"> Capacity development
Addressing stakeholder engagement	<ul style="list-style-type: none"> Community level engagement and empowerment 	<ul style="list-style-type: none"> Multi-stakeholder compacts (civil society, private sector, country-level development partners) 	<ul style="list-style-type: none"> Global partnerships
Mobilising financial resources	<ul style="list-style-type: none"> Donor and/or public expenditure driven 	<ul style="list-style-type: none"> Public expenditure frameworks Private sector engagement Markets for goods and services of water 	<ul style="list-style-type: none"> Global economic growth; alternative financial flows

2.3 ASSESSMENT OF CLUSTERS AGAINST KEY PRINCIPLES

The framing of water post-2015 should also be aligned with the key principles that have emerged from section 1.4. This section therefore assesses the three clusters against the four outcome-based and four attribute-based principles (Table 2.2).

It is clear from Table 2.2 that the clusters have relative strengths and weaknesses in meeting the principles.¹ Targets and indicators included in a water goal would need to be positioned along the continuum in order to meet the principles; for example an indicator for universal access to WaSH may be derived from the one end of the continuum and a governance-indicator from the other end. A framing of water post-2015 that is successful in meeting the established principles would thus need to draw upon all three clusters. Indeed, elements that may be represented within individual clusters or proposals may gain added ‘strength’ from stronger connectivity between technological issues, country or regional implementation agenda and high-level development pathways. For example, the Water as an Enabler cluster could interface with a “technical” water agenda to achieve development outcomes, for example by incorporating the Water as a Sector cluster directly as sub-goals. Indeed, this is essential not only to achieve economic growth and productivity, which require human capital, but also to measure up against the principles for a post-2015 agenda.



Photo Credit: Martine Perret, UN Photo

REFERENCES

1. UNOSD/UNU/SEI (2013) “Catalyzing water for sustainable development and growth”

Table 2.2. Assessment of clusters against the outcome-based and attribute-based principles

	Water as a Sector	Water as an Enabler	Water as a Supporter
OUTCOME PRINCIPLES			
Poverty reduction	Mixed >>	Strong >>>	Strongest >>>>
Equity	Mixed >>	Strong >>>	Strongest >>>>
Sustainability	Strong >>>	Strong >>>	Strongest >>>>
Economic growth	Weak >	Strongest >>>>	<<< Strong
ATTRIBUTE PRINCIPLES			
Universality	Mixed >>	Strong >>>	Strongest >>>>
Measurable and time bound	<<<< Strongest	<<< Strong	<<< Strong
External drivers	Weak >	Strongest >>>>	<<< Strong
Governance	Mixed >>	Strong >>>	Strongest >>>>

2.4 A CROSS-CLUSTER FRAMEWORK: “CATALYZING WATER FOR SUSTAINABLE DEVELOPMENT AND GROWTH”

One of the shortcomings of the MDGs was the constraint on any single goal, target or indicator to be sufficiently multi-dimensional in scope – even on a single issue such as water. The challenge of capturing all dimensions of water for a post-2015 development agenda in one particular framing has been shown in the previous sections. None of the entry points are wrong and all are relevant; it is simply that it is not possible for one cluster alone to capture all dimensions of water that are relevant for development. Taken all together, however, the clusters can be seen to compose the water agenda that is needed to support and fully backstop goals related to water in the post-2015 agenda. A cross-cluster framework is therefore needed, and to satisfy the principles and issues identified in Chapter 1 it must address:

- Universal access to water, sanitation and hygiene, as a moral imperative that drives equitable social development and poverty reduction as well as a demonstrated necessity for human wellbeing and therefore economic productivity which links directly to national economic growth.
- Water for food and energy security, as key elements of a healthy population and economy and drivers of poverty reduction, but which have to be managed in a sustainable and equitable manner.
- Water for industry to sustain economic growth.
- Water for ecosystem services as well as pollution reduction strategies which protect and preserve ecosystem functions that support food security, economic activity and mitigation of natural disasters.
- A strong governance structure based in transparency, co-operation and integration which manages water both

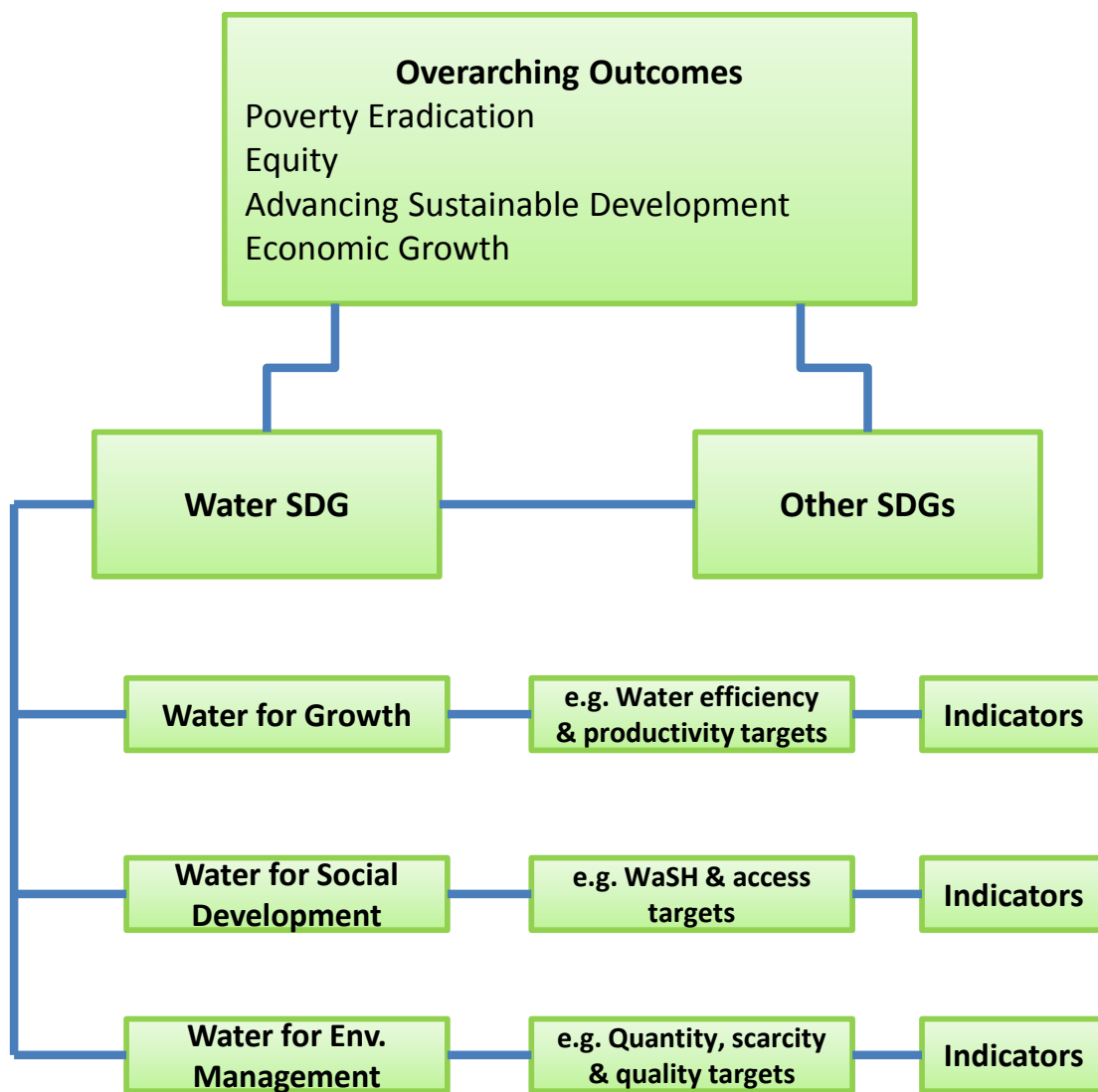
as a resource and sector, allocating water fairly between competing demands within the context of a changing, transboundary resource with regard to full cost accounting.

Figure 2.4 provides a schematic and illustrative description of how the cross-cluster framework can begin to be articulated into a dedicated water goal, while establishing and maintaining its links to targets and indicators in other related goals. As with all goals, based on our principles for a post-2015 agenda, the overarching outcomes are fixed. Within the dedicated water goal, sub-goals establish the linked elements of water for social development, economic growth and environmental sustainability.



Photo Credit: Sylvain Liechti, UN Photo

Figure 2.4. A schematic description of a possible framing of water that addresses the water agenda as defined across clusters.



PRELIMINARY NEEDS ASSESSMENT

3.1. Needs Assessment: Catalyzing Water for Sustainable Development and Growth

3.2. Estimated Cost of Investment

SUMMARY:

The previous chapter identified, synthesised and analyzed three clusters of proposals for water in the SDG/post-2015 agenda. These were assessed against eight principles that build on lessons learned from the MDGs and expectations for the SDGs, which the framing of water within an SDG framework will need to meet. A cross-cluster framework was presented as a tool to address the fact that any one cluster cannot fully address the necessary water agenda, neither in terms of the elements required, nor in terms of desired outcome- or attribute principles. This chapter presents a preliminary assessment of what is needed to meet the principles and expectations for water using the cross-cluster framework. The outcomes of this chapter are seen as essential elements of the continued dialogue and choices around water beyond 2015. Specifically, these outcomes are important in order to avoid a four-year implementation gap similar to that which ensued after the launch of the MDGs and, to provide a strong basis from which to start the harmonisation process between the various post-2015 agendas that so many stakeholders are calling for.

3.1. NEEDS ASSESSMENT: CATALYZING WATER FOR SUSTAINABLE DEVELOPMENT AND GROWTH

In order to understand the global needs associated with the Post-2015 water framework, the elements identified in Section 2.4 have been disaggregated into requirements associated with enabling environments, institutions and policies, and human and technological capacity, as well as expected expenditure / revenue sources (Table 3.1). In turn, these elements form the basis of the cost estimates presented in Section 3.3, as broken down into elements associated with governance, WaSH, wastewater, agriculture and energy, etc.

Governance

Political will, legal frameworks and integrated planning will be essential for managing and utilising water to support a sustainable post-2015 social and economic development framework.¹ Indeed, globally almost 60% of improved policy, planning and legal frameworks have had a significant impact upon water resources management.² FAO points to the need for governance mechanisms that are evidence-based and integrative to deal with the long-term planning issues identified in Section 4.1.³ However, it also provides a reminder that these need to be balanced against short-term needs as well as those at different governance scales and for different stakeholders.

Across the developing world, there are a plethora of institutions and legislation with overlapping mandates and aims that constrain water governance and management. The capacity, institutions and infrastructure needed to manage and mitigate key challenges and handle balance between uses remain inadequate and as of 2009 investment levels were far below those needed. With respect to drinking water and sanitation, the GLAAS report⁴ reveals a complex governance picture: “What

makes sanitation and drinking-water perhaps more complex still is the involvement of a broad range of government bodies (frequently two or three ministries at the national level, further multiplied at lower levels of administration). This institutional infrastructure is complemented by parastatal authorities and nongovernmental entities, including the private sector and civil society organizations, that are directly involved in planning, design and implementation.” Unfortunately, in many regions of the world, such co-ordination mechanisms are not yet implemented.⁵

As Doczi et al. point out, “Rather than catalyzing action, the importance of water, and sanitation, to human health, livelihoods, ecosystems and economic productivity means that while everyone has an interest in water issues, these interests are often at odds or fragmented.”⁶ Indeed, in the Future We Want country consultations facilitated by GWP, “non-water sector” participants constituted approximately 20% of consulted partners. These “non-water sectors” included environment, agriculture, energy, health, tourism, mining, forestry and trade. “It is clear that after many years of promoting an integrated approach many countries recognise the importance of cross sector coordination.”⁷

Realization of human rights, gender equity, and full cost accounting should be at the core of the governance framework. The right to water is recognized by almost 80% of countries, and more than 50% recognize the right to sanitation. This right tends to be embedded in non-discrimination and equality policies at the national level⁸, but it is well known that women bear the greater burden of poor access to drinking water and sanitation. Furthermore, women constitute less than 10% of employees in the WaSH sector in more than half of countries surveyed. Thus, investments in capacity must include incentives for female participants, especially in higher-level positions.



Photo Credit: Kibae Park, UN Photo

Accountability and transparency

An enabling environment will not be achievable in the absence of accountability and transparency. Water, being trans-sectoral and a resource under stress, is an easy target for corruption.¹⁰ Its management is dispersed and its infrastructure requires large financial investments, both of which can facilitate corruption, as can the involvement of private and informal entities.¹¹

Much of the impact of this corruption falls on the poor and those without access to water, and Transparency International has studied the human cost of corruption within the context of access to drinking water and sanitation. For a given investment over 20 years, corruption could result in 30% fewer households being connected, which in turn is linked to the survival of 113 children.¹² Corruption associated with water does not only impact on access to drinking water and sanitation, yet it almost always benefits the powerful at the expense of those in real need, from irrigation subsidies and resettlement payments from dam construction to unfair international water treaties.¹³

WaSH

While the MDG for access to improved drinking water was met in 2010, more than 0.7 billion people remain unserved and over 2.5 billion do not have access to adequate sanitation.¹⁴ According to Transparency International, two thirds of the population without water access and half of those without sanitation live below US\$2 per day. Moreover, 10% of the global burden of disease is linked to lack of access.¹⁵ However, achievement of the MDG for drinking water indicates that financial commitment and effective implementation can make a difference.¹⁶ This implementation includes the need for human capacity and for adequate operation and maintenance of infrastructure once in place.

In terms of timelines, one estimate suggests that universal access will not be achieved by 80% of sub-Saharan African countries before 2050, and 30% will still be without universal access by 2100.¹⁷ Alternative approaches may help to bridge this gap, even if they are “second-best”. Technological solutions such as

standpipes require less investment than piped household water, yet are significant improvements over current water sources for many families in LMICs. However, these solutions still have very poor coverage rates.¹⁸

Infrastructure

Even in high-income countries, historical cost accounting that ignored buried infrastructure (drinking water distribution and wastewater collection systems) has led to a future price tag in the trillions of dollars. While many financial models exist for charging for water services, from the user pays model to full subsidies, it is essential to understand and account for the full cost of securing, treating and delivering potable water and removing wastes.

Wastewater¹⁹

Wastewater treatment is most limited in LMICs²⁰ because investments in treatment facilities have not kept pace with persistent increases in population and water access and the consequent increases in wastewater volume in many countries. Thus, much of the wastewater generated is not treated. While more wastewater is treated in high-income countries, it is not always treated to maximum levels²¹ and some cities still rely on dilution in large water bodies.

Policy-makers, researchers and practitioners, as well as public institutions, need to develop national action plans aimed at wastewater treatment and productive use of wastewater in agriculture, aquaculture and agroforestry in order to conserve the environment and protect human health.

Given the importance of better management of wastewater at the local and national levels, there is a need for updated national data on wastewater generation, treatment and use, which would also assist in regional and global assessments, as only 55 countries have data available on all three aspects of wastewater – generation, treatment and use.²² Of the available information, only 37% of the data could be categorized as recent (reported during 2008 to 2012). Nonetheless, recent global estimates suggest that total

annual municipal wastewater volume generation at 450 km³ (with 70% originating from the domestic sector)²³ and 595 km³,²⁴ almost a third of which (187 km³) is treated.

Wastewater re-use

Freshwater resources and population densities are unevenly distributed worldwide. As a result, water demands already exceed supplies in regions with more than 40% of the world's population. By 2025, as much as 60% of the global population may experience physical water scarcity. The competition for freshwater allocation already exists among municipal, industrial and agricultural sectors, particularly in water scarce areas. As a result, agriculture has been yielding its share gradually to non-agricultural uses. As the use of freshwater for non-agricultural activities generates wastewater, the volume of wastewater has been increasing, commensurate with a rapidly growing population, urbanization, improved living conditions and economic development.

Irrigation with wastewater supports agricultural production, and the livelihoods of millions of smallholder farmers in many parts of the world who have little ability to optimize the volume or quality of the wastewater they receive. Many farmers in water scarce developing countries irrigate with wastewater because: (i) it is the only water source available for irrigation throughout the year; (ii) wastewater irrigation reduces the need for purchasing fertilizer; (iii) wastewater irrigation involves less energy cost if the alternative clean water source is deep groundwater; or, (iv) wastewater enables farmers in peri-urban areas to produce high-value vegetables for sale in local markets.

Wastewater is being used for irrigation on an estimated 4.5 million ha of land worldwide. Other estimates suggest that about 200 million farmers irrigate with treated and untreated wastewater, on an estimated 20 million ha. With large variation, these estimates suggest that wastewater accounts for about 1.5% to 6.6% of the global irrigated area of 301 million ha. However, there is a need for better hygiene education, as well as an action plan supported by policies that would help to improve water quality and promote the use of protective measures in handling



wastewater and/or its products. This should be done in such a way as to cause minimum impact on the economy of farmers in wastewater-irrigated areas.



Photo Credit: Corinne Schuster-Wallace, UNU-INWEH

Water resources management

Given that two out of every five people live in a trans-boundary river basin and that 800 million people depend on water sources outside their national borders,²⁵ international co-operation around water resources is of paramount importance. Management of water resources at the regional, national and international level requires investment in technical and managerial capacity as well as in stakeholder relations. The fact that 200 multilateral water treaties have been signed since the 1950s supports this.²⁶ Two thirds of countries have developed national integrated management plans and half of these are at advanced stages of implementation.²⁷ However, it is difficult to assess the costs of development and implementation associated with these plans, especially if land use change and/or re-settlement is required.

On a related note, climate change is not necessarily the biggest driver of scarcity even in the most vulnerable regions. For example, the World Bank recently estimated that future water shortages in the MENA region will be enormous in the next decades, with about 20% attributed to climate change but 80% to a steep increase in demand from economic development in a fast-growing population.²⁸

Agriculture

By 2050 the world will require 60% more food produced to maintain current consumption patterns, given anticipated increases in population and incomes.²⁹ ³⁰ This is set against the backdrop of climate change, which is altering global patterns of precipitation and therefore water resources. Agriculture is the only mechanism by which to eradicate poverty for up to 70% of rural, dollar-poor families.³¹ This is supported by TST³², which suggests that agriculture-based increases in GDP have double the impact on poverty reduction over growth generated in other sectors, increasing to a five-fold impact in low-income countries outside sub-Saharan Africa and an eleven-fold impact within Sub-Saharan Africa.

Estimates suggest that irrigation increases crop productivity two-fold over conventional agriculture, a proportion that increases in water-scarce regions. For example, 20% of the value of Africa’s agricultural products comes from irrigated lands, which constitute less than 5% of the total cultivated area.³³ Yield increases have been demonstrated to be as much as four-fold.³⁴ Globally, an average of just over 20% of cropland is irrigated³⁵ and the total global cultivated area is almost 1,550 million ha³⁶, meaning that some 310 million ha globally are under some form of irrigation.

However, traditional irrigation techniques are extremely inefficient, with only 30–40% of irrigation water actually going to crop uptake.³⁷ Clearly this will require attention if irrigation is to play a key role in feeding the world in the future. Technologies such as drip irrigation are affordable, accessible and significantly increase water efficiency. Moreover, the costs of environmental degradation related to irrigation in the Middle East and North Africa (MENA) has been estimated to be of the order of US\$ 9 billion per year, or 2.1–7.4% of the range of the MENA countries’ GDP.³⁸ Southeast Asia faces similar environmental challenges, following the Green Revolution in which more than 60% of agricultural investment was spent on irrigation, leaving the region to face the emerging challenge of using water more efficiently in other sectors to serve ever-increasing food demand, and to resolve environmental trade-offs.

In order to achieve the required scale, FAO calls for “much greater public investment at global, regional and national levels aimed at expanding research and extension to underpin the shift to more sustainable systems” as well as public-private partnerships to “stimulate research and development, technology development and uptake, and knowledge management – including metrics for sustainability.”³⁹ Despite this, many national agriculture plans with a water resources component are still either under development or not yet implemented.⁴⁰

“**As water scarcity is becoming a global crisis, the inefficient performance of the dominant water user – irrigation – is the gorilla in the room.**”

Transparency International Global Corruption Report 2008 Corruption in the Water Sector

Energy

Energy generation requires large amounts of water for cooling purposes; even though this is not a consumptive use of water, access to large volumes of water is essential. Water can be used to generate electricity (hydropower), and contributes approximately one sixth of the world's energy.⁴¹ Hydropower tends to be associated with large-scale dams, of which there are more than 45,000 around the world.⁴² These dams are also relied upon as a water source for 30–40% of irrigated land.⁴³ In addition to its co-dependence on large water storage, the food sector is a large energy consumer (approximately 30%).⁴⁴

Environmental services

Our environment provides benefits ranging across culture and recreation to water treatment and climate change mitigation. These benefits have been valued at more than \$33 trillion per year.⁴⁵ Environmental degradation is threatening the resilience of our environment⁴⁶ and degrading our ecosystem services. While the investment required to restore these services is unknown, we have reached tipping points on many individual

plant and animal species, which are now extinct. Current policy status suggests that despite the urgent need for investment and rehabilitation, governments are still slow to respond.⁴⁷

Capacity

Human capacity will underpin all aspects of water development, both for social and economic gain. The current and prospective shortfall in capacity for the water sector is unknown, but the subject of several current initiatives. GLAAS has highlighted the perceived shortage of people in the WaSH sector as well as the shortfall in technical capacity for operation and maintenance⁴⁸; most of this shortfall exists in LMICs. In addition to the need for in-country capacity to train the required staff, chronic low wages and lack of political will exacerbate the shortfall and contribute to brain drain. One of the first investments required at the national level is a complete assessment of sector capacity and needs, as well as the institutional capacity to meet those needs. Currently, only 30% of countries within GLAAS were able to anticipate staffing needs.⁴⁹



Photo Credit: Harriet Bigas, UNU-INWEH

Table 3.1. Needs Assessment broken down by Enabling Environment, Institutions and Policies, People and Technology with Associated Expenditure/Revenue Sources

Enabling Environment ▶	Institutions/Policies ▶	People ▶	Technology ▶	Expenditures/Revenues
GOVERNANCE				
Integrated Planning	Multi stakeholder compacts	Management		Training
	Inter-ministerial mechanisms	Cross-disciplinary trainees		
		Technical- impact assessments		
Equitable policies (pro-poor; vulnerable populations)	National and regional strategies for growth and poverty reduction	Management		Training
	Knowledge sharing	Extension/outreach	ICTs	Training
		Teachers		Curriculum and outreach materials
Enforcement and Compliance	Training and certification	Field technicians	Instrumentation	Training
	Laboratories (testing)	Laboratory technicians	Instrumentation	Salaries
	Enforcement	Legal	ICTs	Laboratories
	Monitoring and data management	Management	Data management	Equipment
	Process based management			
	Policies and standards			Fines - revenue
Finance mechanisms	Financial management			PPPs - infrastructure
				Subsidies
				Incentives
				Loans
				Cross-subsidisation

Table 3.1. Needs Assessment broken down by Enabling Environment, Institutions and Policies, People and Technology with Associated Expenditure/Revenue Sources

Enabling Environment ▶	Institutions/Policies ▶	People ▶	Technology ▶	Expenditures/Revenues
WaSH				
Supply Chains	Manufacturing	Skilled workforce	Manufacturing	Incentives
	Transportation			Taxes - revenue
		Construction		
Behaviour Change	Knowledge sharing	Outreach / education	Information repositories and decision support tools	Incentives
				Outreach
Financing Mechanisms	Financial management			Cross-ministry cost savings
				Micro loans
				Subsidies
				Incentives
				Cost recovery - revenue
WASTEWATER MANAGEMENT				
Infrastructure	Research	Research and development	Treatment	Subsidies
	Training and certification	Skilled workforce	Reuse	Training
		Construction	Digestion	Salaries
				Cross-sector revenues (energy and agriculture)
Enforcement and Compliance	AS ABOVE			
Regulation and Oversight	AS ABOVE			
Financing Mechanisms	AS ABOVE			

Enabling Environment ►	Institutions/Policies ►	People ►	Technology ►	Expenditures/Revenues
WATER RESOURCES MANAGEMENT				
Regulation and Oversight	AS ABOVE			
	International memberships	Management	ICTs	
	Trans-ministry mechanisms			
Enforcement and Compliance	AS ABOVE			
Water Allocation Mechanisms	Impact assessments	Technical – impact assessment		Training
	Inter-ministerial mechanisms			Equipment
	Water prioritisation/ allocation policies		Water efficiency	Licensing fees (revenue)
	Monitoring and data management	Technical - hydrometeorology; modeling	Instrumentation	Fines (revenue)
	Enforcement and Compliance	Technical; management; legal	Data management	
ECOSYSTEM SERVICES				
Enforcement and Compliance	AS ABOVE			
	Environmental Protection Policies			
	Payment for Environmental Services	Impact Assessment		
Behaviour Change	AS ABOVE			

Table 3.1. Needs Assessment broken down by Enabling Environment, Institutions and Policies, People and Technology with Associated Expenditure/Revenue Sources

Enabling Environment ▶	Institutions/Policies ▶	People ▶	Technology ▶	Expenditures/Revenues
WATER FOR FOOD PRODUCTION				
Regulation and Oversight	AS ABOVE			
Water Resources Allocation	Research	Technical	Water and energy efficiencies	Subsidies and loans
	Economic	Financial		Efficiency savings - revenue
	Cost recovery			Cost recovery - revenue
Enforcement and Compliance	AS ABOVE			
Financing Mechanisms				Cross ministry subsidies (e.g. energy)
WATER FOR INDUSTRY				
Integrated planning	AS ABOVE			
Regulation and Oversight	AS ABOVE			
	Foreign Investment policies			
	Social Justice			
WATER FOR ENERGY PRODUCTION				
Integrated planning	AS ABOVE			
	Bi ministry mechanisms			
	Cost recovery			
Regulation and oversight	AS ABOVE			

Rapid assessment

The need for flexibility is a key lesson learned from the MDG process, and it is vital in order for a global agenda to be internalised and prioritised at the national level. Whether countries are classified according to geography, political system, economy or development, it is clear that there are different starting points, needs, challenges and opportunities for implementing a post-2015 agenda. Table 3.2 provides a rapid assessment of the current status of elements required to deliver on a post-2015 water framework which addresses the 8 key principles and related sector development. These focus on the Organisation for Economic Co-operation and Development (OECD), Mexico, Indonesia and Chile and, Brazil, India, and China (MIC and BRIC) and Least Developed Countries (LDCs), which are analysed separately according to continent (i.e. Africa and Asia). Countries and regions with different levels of development will face different entry points to the common challenges, will be building from different strengths, and will therefore engage in the implementation process in different ways. Clearly these starting points will have implications for the regional and national investment requirements. A next step in this analysis would be specific case studies articulating both needs and the cost of meeting those needs.

REFERENCES

1. Doczi J., Dorr T., Mason N. and Scott A. (2013) "The post-2015 delivery of universal and sustainable access to infrastructure services. ODI Working Paper" <http://www.odi.org.uk/sites/odi.org.uk/files/odi-assets/publications-opinion-files/8445.pdf>
2. UN-Water (2012) "Status Report on the Application of Integrated Approaches to Water Resources Management" http://www.un.org/waterforlifedecade/pdf/un_water_status_report_2012.pdf
3. FAO (2012) "Towards the Future We Want: End hunger and make the transition to sustainable agricultural and food systems" <http://www.fao.org/docrep/015/an894e/an894e00.pdf>
4. WHO/UN-Water (2012) "GLAAS 2012 Report UN-Water Assessment of Sanitation and Drinking Water" http://www.un.org/waterforlifedecade/pdf/glaas_report_2012_eng.pdf
5. WHO/UN-Water (2012) "GLAAS 2012 Report UN-Water Assessment of Sanitation and Drinking Water" http://www.un.org/waterforlifedecade/pdf/glaas_report_2012_eng.pdf
6. Doczi J., Dorr T., Mason N. and Scott A. (2013) "The post 2015 delivery of universal and sustainable access to infrastructure services. ODI Working Paper"
7. GWP (2013) "National Stakeholder Consultations on Water: Supporting the Post-2015 Development Agenda GWP" <http://www.worldwewant2015.org/node/349243>
8. WHO/UN-Water (2012) "GLAAS 2012 Report UN-Water Assessment of Sanitation and Drinking Water" http://www.un.org/waterforlifedecade/pdf/glaas_report_2012_eng.pdf
9. WHO/UN-Water (2012) "GLAAS 2012 Report UN-Water Assessment of Sanitation and Drinking Water" http://www.un.org/waterforlifedecade/pdf/glaas_report_2012_eng.pdf
10. Transparency International (2008) "Global Corruption Report 2008 - Corruption in the Water Sector" http://issuu.com/transparencyinternational/docs/global_corruption_report_2008?e=2496456/2011923
11. Transparency International (2008) "Global Corruption Report 2008 - Corruption in the Water Sector" http://issuu.com/transparencyinternational/docs/global_corruption_report_2008?e=2496456/2011923
12. Transparency International (2008) "Global Corruption Report 2008 - Corruption in the Water Sector" http://issuu.com/transparencyinternational/docs/global_corruption_report_2008?e=2496456/2011923
13. Transparency International (2008) "Global Corruption Report 2008 - Corruption in the Water Sector" http://issuu.com/transparencyinternational/docs/global_corruption_report_2008?e=2496456/2011923
14. Joint Monitoring Programme (2013) "Progress on Sanitation and Drinking Water: Update 2013" WHO and UNICEF http://www.wssinfo.org/fileadmin/user_upload/resources/JMPReport2013.pdf



Photo Credit: Natasha Lazic

Table 3.2. Rapid assessment of current status against requirements for Catalyzing Water for Sustainable Development and Growth

	OECD	MIC/BRIC	LDC Africa	LDC Asia
Governance	Established	Established	Exist, but require expansion	Poor
Accountability ¹	Established	Exist, but require expansion	Poor	Poor
Transparency	Established	Exist, but require expansion	Poor	Poor
Regulation and oversight	Established	Exist, but require expansion	Poor	Poor
Fiscal management	Established	Exist, but require expansion	Exist, but require expansion	Poor
Gender equity	Exist, but require expansion	Exist, but require expansion	Exist, but require expansion	Exist, but require expansion
Pro-poor	Established	Exist, but require expansion	Exist, but require expansion	Poor
Social justice	Established	Exist, but require expansion	Exist, but require expansion	Poor
Access to services	Established	Exist, but require expansion	Poor	Poor
Technical capacity	Established	Exist, but require expansion	Exist, but require expansion	Exist, but require expansion
Management capacity	Established	Established	Exist, but require expansion	Exist, but require expansion
Training capacity	Established	Established	Poor	Poor
Private sector / supply chains	Established	Established	Poor	Poor
Trade	Established	Exist, but require expansion	Poor	Poor
Infrastructure ²	Exist, but require expansion	Exist, but require expansion	Poor	Poor
Food security	Established	Exist, but require expansion	Poor	Exist, but require expansion
IWRM	Established	Exist, but require expansion	Poor	Poor
Environmental protection	Exist, but require expansion	Exist, but require expansion	Poor	Poor
Financial resources ³	Established	Exist, but require expansion	Poor	Poor

LEGEND	Established, unlikely to require new investment; investments must be maintained	Exist, but require expansion, implementation and additional investment	Poor, require significant planning and investment to establish mechanisms / institutions
	Established	Exist, but require expansion	Poor

1. Both within and outside country, especially considering OECD and MIC/BRIC water footprints and international commercial activities

2. Water supply and sanitation; energy; water storage; wastewater treatment etc.

3. E.g. stable tax base, income, and productivity.

REFERENCES CONTINUED

15. Prüss-Üstün A., Bos R., Gore F. and Bartram J. (2008) "Safer water, better health : costs, benefits and sustainability of interventions to protect and promote health WHO" http://whqlibdoc.who.int/publications/2008/9789241596435_eng.pdf
16. WHO/UN-Water (2012) "GLAAS 2012 Report UN-Water Assessment of Sanitation and Drinking Water" http://www.un.org/waterforlifedecade/pdf/glaas_report_2012_eng.pdf
17. Foster, V. and Briceño-Garmendia, C. (Eds.) (2010) "Africa's Infrastructure – A Time for Transformation. The International Bank for Reconstruction and Development/The World Bank"
18. Foster V. and Briceño-Garmendia C. (Eds.) (2010) "Africa's Infrastructure – A Time for Transformation. The International Bank for Reconstruction and Development / The World Bank"
19. Wastewater definition varies from country to country and there are different versions of the definition in scientific literature. We consider 'domestic, commercial, and industrial effluents, storm water, and other urban run-off' as wastewater.
20. Sato, T., Qadir, M., Yamamoto, S., Endo, T. and Ahmad, Z. (2013a) "Global, regional, and country level need for data on wastewater generation, treatment, and use" *Agricultural Water Management* Vol. 130 p.1-13
21. Wastewater treatment has various levels, i.e. primary, secondary, and tertiary. Several developing countries are unable to achieve the satisfactory levels of treatment found in most developed countries. We consider treated wastewater to be 'wastewater receiving any physical or chemical treatment process'.
22. Sato, T., Qadir, M., Yamamoto, S., Endo, T. and Ahmad, Z. (2013a) "Global, regional, and country level need for data on wastewater generation, treatment, and use" *Agricultural Water Management* Vol. 130 p.1-13
23. Flörke M., Kynast, E., Bärlund, I., Eisner, S., Wimmer, J., Alcamo, J. (2013) "Domestic and industrial water uses of the past 60 years as a mirror of socio-economic development: A global simulation study" *Global Environmental Change* 23: 144–156.
24. Sato, T., Qadir, M., Yamamoto, S., Endo, T. and Ahmad, Z. (2013b) "Estimation of global municipal wastewater generation and treatment" (unpublished data)
25. Transparency International (2008) "Global Corruption Report 2008 - Corruption in the Water Sector" http://issuu.com/transparencymagazine/docs/global_corruption_report_2008?e=2496456/2011923
26. Transparency International (2008) "Global Corruption Report 2008 - Corruption in the Water Sector" http://issuu.com/transparencymagazine/docs/global_corruption_report_2008?e=2496456/2011923
27. WHO/UN-Water (2012) "GLAAS 2012 Report UN-Water Assessment of Sanitation and Drinking Water" http://www.un.org/waterforlifedecade/pdf/glaas_report_2012_eng.pdf
28. World Bank/FutureWater (2011) "Middle-East and Northern Africa Water Outlook"
29. FAO (2012) "Towards the Future We Want: End hunger and make the transition to sustainable agricultural and food systems" <http://www.fao.org/docrep/015/an894e/an894e00.pdf>
30. Technical Support Team/UN-Water (2013) "TST Issues Brief: Water and Sanitation" <http://sustainabledevelopment.un.org/content/documents/1801ststissueswater.pdf>
31. Transparency International (2008) "Global Corruption Report 2008 - Corruption in the Water Sector" http://issuu.com/transparencymagazine/docs/global_corruption_report_2008?e=2496456/2011923
32. Technical Support Team/UN-Water (2013) "TST Issues Brief: Water and Sanitation" <http://sustainabledevelopment.un.org/content/documents/1801ststissueswater.pdf>
33. Foster V. and Briceño-Garmendia C. (Eds.) (2010) "Africa's Infrastructure – A Time for Transformation" The International Bank for Reconstruction and Development / The World Bank
34. FAO World Food Summit (1996)
35. FAO AquaStat data
36. FAO AquaStat data
37. Foster V. and Briceño-Garmendia, C. (Eds.) (2010) "Africa's Infrastructure – A Time for Transformation" The International Bank for Reconstruction and Development / The World Bank
38. World Water Assessment Programme (2009) "Chapter 1: Getting out of the box – linking water to decisions for sustainable development" In the United Nations World Water Development Report 3: Water in a Changing World. Paris: UNESCO and London: Earthscan.
39. FAO (2012) "Towards the Future We Want: End hunger and make the transition to sustainable agricultural and food systems" <http://www.fao.org/docrep/015/an894e/an894e00.pdf>
40. UN-Water (2012) "Status Report on the Application of Integrated Approaches to Water Resources Management" http://www.un.org/waterforlifedecade/pdf/un_water_status_report_2012.pdf
41. Transparency International (2008) "Global Corruption Report 2008 - Corruption in the Water Sector" http://issuu.com/transparencymagazine/docs/global_corruption_report_2008?e=2496456/2011923
42. Transparency International (2008) "Global Corruption Report 2008 - Corruption in the Water Sector" http://issuu.com/transparencymagazine/docs/global_corruption_report_2008?e=2496456/2011923
43. Transparency International (2008) "Global Corruption Report 2008 - Corruption in the Water Sector" http://issuu.com/transparencymagazine/docs/global_corruption_report_2008?e=2496456/2011923
44. FAO (2012) "Towards the Future We Want: End hunger and make the transition to sustainable agricultural and food systems" <http://www.fao.org/docrep/015/an894e/an894e00.pdf>
45. Costanza, R. *et al.* (1997) "The value of the world's ecosystem services and natural capital" *Nature* vol. 387 (May) p.253-60
46. UN-Water (2012) "Status Report on the Application of Integrated Approaches to Water Resources Management" http://www.un.org/waterforlifedecade/pdf/un_water_status_report_2012.pdf
47. UN-Water (2012) "Status Report on the Application of Integrated Approaches to Water Resources Management" http://www.un.org/waterforlifedecade/pdf/un_water_status_report_2012.pdf
48. WHO/UN-Water (2012) "GLAAS 2012 Report UN-Water Assessment of Sanitation and Drinking Water" http://www.un.org/waterforlifedecade/pdf/glaas_report_2012_eng.pdf
49. WHO/UN-Water (2012) "GLAAS 2012 Report UN-Water Assessment of Sanitation and Drinking Water" http://www.un.org/waterforlifedecade/pdf/glaas_report_2012_eng.pdf

3.2. ESTIMATED COST OF INVESTMENT

The future investment costs for the needs identified in Section 3.1 are estimated in this section. These estimates are based on assumptions (as established in this section), current status, global trends and projections, where data are available. In some cases data are only available for a region and scaled up under the assumption that values hold at the global scale, despite obvious differences between regions and countries. It is clear from this section that the future needs, and therefore financial investments, associated with many elements identified in the previous section as required for delivering on a “Catalyzing Water for Sustainable Development and Growth” Framework are not well articulated, even at the national level.

Governance

It is impossible to put a price tag on the development of an enabling environment, but it is clear that management and legal capacity, skilled trans-disciplinary / trans-sectoral negotiators and accountable fiscal managers are necessary. Alongside this capacity there is a need for transparent institutions and mechanisms for planning and delivering on commitments and for ensuring trans-government and trans-national facilitation and multi-stakeholder dialogues. Both individual and institutional capacity are required for successful implementation.

Accountability and transparency

According to Transparency International, water is much more capital intensive than other utilities, and almost all growth markets for water investment are in countries at high risk of corruption. It is estimated that corruption costs between 10 and 30% of investments in water.¹

WaSH

The price tag for universal access is significant, at an estimated US\$536 billion for water and sanitation infrastructure², with three fifths of this required for sanitation. In reality, only one fifth



of current WaSH financing is directed at sanitation.³ In addition to operation and maintenance to support this infrastructure investment, hygiene is a neglected element in reducing morbidity and mortality related to poor water quality. Very little is known about hygiene expenditures, but it is typically very low; perhaps 2% of total WaSH expenditure, on average.⁴ Bangladesh has been quite successful in improving sanitation coverage through their national sanitation plan, which earmarks 10% of investments for so-called “software” or outreach activities.⁵ Currently, the most spent on hygiene education and promotion is 8.2% of WaSH expenditure.⁶ The cost of inaction is equally significant, with lack of access costing governments anywhere from 1-7% of GDP annually.⁷ In 2009, the cost for achieving MDG access for water and sanitation was estimated to be approximately 3.3% of Africa’s GDP.⁸

More importantly, one third of this investment was earmarked as the maintenance requirement, compared with the 10% estimated



Photo Credit: Molly Whalen-Browne, UNU-INWEH

by Hutton (2012). The GLAAS survey suggests that only 7% of aid is directed at service maintenance, even though ignoring operation and maintenance undermines the sustainability of services. Indeed, inefficiencies in supplying drinking water, such as overstaffing and system leakage, could cost Africa US\$0.9 billion per year, while cost recovery could add an additional US\$1.8 billion in revenue.⁹ Social and economic benefits accrue from investment in WaSH. The most recent estimates suggest that returns on investment for every dollar invested in water and sanitation is \$4.3 at the global level.¹⁰

Water infrastructure

Capital expenditures in the water sector are high, and were estimated to be \$140 billion in 2007.¹¹ Much of this infrastructure implementation is for water supply and hydropower.¹² Beyond basic access, there is significant investment required globally to maintain and upgrade existing systems, especially in HICs. This

investment is estimated to cost US\$482 billion per year in the period 2010–2029, but could be offset by savings as a result of reduced municipal water leakage, estimated at US\$167 billion.¹³

Wastewater treatment cost

The cost of wastewater treatment largely depends on the type of its treatment, which may be primary, secondary, or tertiary. In addition it depends on the treatment technology used, as there is a range of treatment technologies used for wastewater treatment. Based on the estimates of treating wastewater from Ottawa (Robert O Pickard Environmental Centre – Wastewater Treatment Plant), the overall wastewater treatment cost may reach \$1.64 per m³ (1 m³ = 1000 liters). The cost components consist of wastewater treatment (\$0.244), wastewater and storm water collection (\$0.261), customer service and billing (\$0.079), storm water treatment and drainage (\$0.061), property taxes (\$0.014), capital and rehabilitation (\$0.755), corporate services (\$0.174), and planning and engineering (\$0.05).¹⁴ Estimates from Middle Eastern countries put wastewater treatment costs in Saudi Arabia for tertiary treated wastewater at \$0.30 per m³. In the United Arab Emirates, the costs for tertiary treated wastewater was estimated to be \$0.43 per m³, and in Kuwait, costs for secondary treated wastewater were estimated at \$0.18 per m³.¹⁵ Based on an analysis of technical efficiency and cost analysis in wastewater treatment processes in 338 treatment plants in Spain, the cost of secondary treatment of wastewater was estimated to be in the range of € 0.40 to € 0.77 per m³.¹⁶

Assuming that the estimated volume of annual wastewater generated ranges from 450 km³¹⁷ to 595 km³¹⁸ and the cost of treatment ranges from \$0.30¹⁹ to \$1.64²⁰ per m³, then the estimated annual cost of treating wastewater can be assumed to range from \$135 to \$975 billion. Only 31% of this wastewater is currently treated, so in addition to annual treatment costs, there is an infrastructure cost that is not accounted for in this analysis.

Health cost of non-treatment

Studies have shown a range of food safety and health risks stemming from vegetable or fruit crops irrigated with raw wastewater. Most farmers and some government agencies are not fully aware of these impacts. Although health implications of wastewater use have been the subject of several studies around the world for several years, fewer studies have been undertaken in developing countries. In addition, health implications for a particular section of the population, such as children, from uncontrolled wastewater irrigation in developing countries have not been investigated. A recent study in Syria²¹ found that prevalence rates of gastroenteritis in children living in a freshwater-irrigated area had significantly lower rates (13%) than those in a wastewater-irrigated area (75%) and the annual health cost per child in the wastewater-irrigated area was 73% higher than the annual health cost per child in freshwater-irrigated areas. Despite this higher cost, the farmers in wastewater-irrigated areas rely on wastewater irrigation because of the perceived overall economic gains in the form of less or no expenses on fertilizers and field application, less energy costs for wastewater pumping, and additional benefits through greater income from crop intensification and diversification.

Irrigation

Notwithstanding gains in efficiencies, in terms of investment, there are more than 503 million hectares of land with irrigation potential around the world.²² It is estimated that US\$0.6 billion per year is required for maintenance of infrastructure in Africa. If this is scaled up, the global cost would be \$31 billion per year²³ (Table 3.3). Human benefits of scaling up irrigation include a reduction in malnutrition. For example, tripling irrigation in Africa would reduce the number of malnourished children by 2 million.²⁴ Efficiencies in food production as well as water use for irrigation could result in additional savings. Reducing food wastage by 50% would result in water savings of 1,350km³ per year,²⁵ while irrigation efficiencies could result in \$15 billion in savings.²⁶ Moreover, protection from floods and droughts can reduce negative impacts on annual GDP.²⁷ However, donor investments have decreased over time, despite the investment opportunities that exist.²⁸

According to AquaStat data, 76% of the global agricultural area equipped for irrigation is actually irrigated. While this could be for many reasons, including a lack of need to irrigate unless a region is experiencing a drier than usual period, for the purposes of this study it is assumed that 20% of the remaining area is in need of rehabilitation.

Table 3.3. Agriculture cost estimates

	Irrigated area (mill hectares)	Maintenance (billion per year)	Maintenance per unit hectare	Area requiring rehabilitation (million hectares)	Rehabilitation cost (billions)	Rehabilitation per unit hectare	Expansion potential (million hectares)	Expansion per hectare	Expansion cost (billions)
Africa¹	6	0.6	100	1.6	6	3,750	6.8	2,000-4,000	
World²	310	31		62	2,325		503.7	2,000 4,000	1,007 2,015

1. Foster V. and Briceño-Garmendia C. (Eds.) (2010) "Africa's Infrastructure – A Time for Transformation." The International Bank for Reconstruction and Development /The World Bank

2. Calculated assuming that Africa costs can be used as global estimates applied to 2011 data sourced from AquaStat (www.fao.org/nr/aquastat/)

Table 3.4. Estimated annual costs of global investments in a post-2015 water for development agenda (20 yr period)

	Investments required (billions US\$) (rounded)	Benefits from cost saving (billions US\$)	Net cost (investments minus cost savings) (billions US\$)	Additional benefits provided (billions US\$)
Enabling Environment	Unknown			
Capacity¹	95-184		95-184	
WaSH²	36		36	260 ⁹
Water Infrastructure³	482	167	315	
Wastewater Treatment⁴	135-975		135-975	221-292 ¹⁰
Water Resources Management	Unknown			
Agriculture (irrigation)⁵	198-248	115	83-133	350-700 ¹¹
Energy⁶	62.5		62.5	
Environmental Services⁷	113		113	33,268 ¹²
Corruption⁸	452-631		452-631 ¹³	
TOTAL INVESTMENTS REQUIRED			1,292 - 2,274	

1. Calculated as 10% of minimum or maximum expenditures (WaSH, water infrastructure, wastewater treatment, agriculture, energy and environmental services) after Foster V. and Briceño-Garmendia C. (Eds.) 2010. *Africa's Infrastructure – A Time for Transformation*. The International Bank for Reconstruction and Development / The World Bank

2. Hutton G. (2012) “Global costs and benefits of drinking-water supply and sanitation interventions to reach the MDG target and universal coverage WHO” http://www.who.int/water_sanitation_health/publications/2012/globalcosts.pdf

3. Lloyd Owen (2009) estimate for water supply and sanitation in developed regions in Doczi J., Dorr T., Mason N. and Scott A. (2013) “The post-2015 delivery of universal and sustainable access to infrastructure services” ODI Working Paper <http://www.odi.org.uk/sites/odi.org.uk/files/odi-assets/publications-opinion-files/8445.pdf>

4. Calculated based on assumption that 408 km³ is untreated every year (Sato et al., 2013) with cost per cubic metre ranging from \$0.30 (minimum) to \$1.64 (maximum)

5. Calculated according to estimates presented in Table 3.3

6. Transparency International (2008) “Global Corruption Report 2008 - Corruption in the Water Sector” http://issuu.com/transparencyinternational/docs/global_corruption_report_2008?e=2496456/2011923

7. Brown, L. (2007) “Plan B 3.0: Mobilising to Save Civilisation” Earth Policy Institute Available from: http://www.earth-policy.org/images/uploads/book_files/pb3book.pdf

8. Calculated as 30% of minimum or maximum expenditures (WaSH, water infrastructure, wastewater treatment, agriculture, energy and environmental services) after Transparency International (2008)

9. Hutton G. (2012) “Global costs and benefits of drinking-water supply and sanitation interventions to reach the MDG target and universal coverage WHO” http://www.who.int/water_sanitation_health/publications/2012/globalcosts.pdf

10. The environmental benefits of wastewater treatment are valued at € 0.36 (US\$ 0.49) per m³ treated: Molinos-Senante M., Hernández-Sancho F. and Sala-Garrido R. (2010) “Economic feasibility study for wastewater treatment: A cost–benefit analysis” *Science of the Total Environment* 408:4396-4402 doi:10.1016/j.scitotenv.2010.07.014

11. Rijsberman F. (2004) “The Challenge of Sanitation and Water” in *Global Crises, Global Solutions: First Edition* Lomborg B. (Ed.) Cambridge University Press

12. This value represents many different natural capital and ecosystem services, including, for example, US\$ 2,807 billion for water regulation and supply, US\$ 2,277 billion for waste treatment, US\$ 1,386 billion for food supply and US\$ 17,075 billion for nutrient cycling. It should be noted that these services do not always show up in markets. Costanza R. et al. (1997) “The value of the world's ecosystem services and natural capital” *Nature* 387:253-260

13. These costs will be zero if corruption is eliminated



Photo Credit: Martine Perret, UN Photo

Energy

Hydropower is a significant growth sector, with investments estimated at US\$50–60 billion annually, or almost \$2 trillion of the \$11 trillion investment in energy infrastructure between 2005 and 2030.²⁹ If pursued to its full economic potential, regional trade could reduce the annual costs of developing and operating power systems in sub-Saharan Africa by US\$ 2 billion per year (about 5% of total power system costs); a reduction that would be achieved largely by substituting hydropower for thermal power, which would substantially reduce operating costs.³⁰

Environmental services

A conservative estimate puts annual investments required for ecosystem restoration at \$113 billion per year.³¹

Capacity

While investment requirements are unknown, a recent African study suggests investments in institutions and information costs would be 10% of infrastructure investments.³²

3.2.1 The Bottom Line

The evidence and assumptions established in Section 3.2 have been used to estimate the costs associated with delivering on a Catalyzing Water for Sustainable Development and Growth Framework before being used to present various scales and durations of investment linked to various proposed timelines within the post-2015 dialogue. Conservative estimates of global investments in a post-2015 water for development agenda range between approximately US\$ 1.25 and 2.25 trillion dollars per year over a 20-year period (Table 3.4). This estimate accounts for benefits from cost savings, such as efficiencies in systems, but not benefits provided, for example through time, health savings and ecosystem services. These investments can be contextualised

against 2012 global GDP, which was over \$71 trillion. At 1.8–2.5% of global GDP, this is up to triple current median annual WaSH expenditures of 0.73%.³³

There are different time frames proposed for the achievement of post-2015 goals. In general, these fall within a 10 to 25 year time frame. The annual cost of investment will vary according to these timeframes (Table 3.5). It should be noted that some of the investments included in these estimates are recurring annual costs (i.e. for maintenance) which will not change regardless of the investment period. Moreover, this level of investment reflects a minimum requirement to maintain services as established through the investment period. Indeed, these maintenance costs are likely to increase as infrastructure expands and ages.

Table 3.5 Annual Investments for Different Investment Periods

	ANNUAL COST (BILLIONS US\$)		% 2011 GLOBAL GDP	
	Min Estimate	Max Estimate	Minimum	Maximum
2015-2030 (15 years)	1,689	2,112	2.4	3.0
2015-2035 (20 years)	1,292	1,820	1.8	2.5
2015-2050 (35 years)	782	1,444	1.1	2.0



Photo Credit: Andrew Dansie, UNU-INWEH

REFERENCES

1. Transparency International (2008) "Global Corruption Report 2008 - Corruption in the Water Sector" http://issuu.com/transparencymagazine/docs/global_corruption_report_2008?e=2496456/2011923
2. Hutton G. (2012) "Global costs and benefits of drinking-water supply and sanitation interventions to reach the MDG target and universal coverage WHO" http://www.who.int/water_sanitation_health/publications/2012/globalcosts.pdf
3. WHO/UN-Water (2012) "GLAAS 2012 Report UN-Water Assessment of Sanitation and Drinking Water" http://www.un.org/waterforlifedecade/pdf/glaas_report_2012_eng.pdf
4. WHO/UN-Water (2012) "GLAAS 2012 Report UN-Water Assessment of Sanitation and Drinking Water" http://www.un.org/waterforlifedecade/pdf/glaas_report_2012_eng.pdf
5. People's Republic of Bangladesh (2005) "National Sanitation Strategy" [http://www.watersanitationhygiene.org/References/EH_KEY_REFERENCES/SANITATION/General%20Sanitation%20References/Bangladesh%20National%20Sanitation%20Strategy%20\(MRDC\).pdf](http://www.watersanitationhygiene.org/References/EH_KEY_REFERENCES/SANITATION/General%20Sanitation%20References/Bangladesh%20National%20Sanitation%20Strategy%20(MRDC).pdf)
6. WHO/UN-Water (2012) "GLAAS 2012 Report UN-Water Assessment of Sanitation and Drinking Water" http://www.un.org/waterforlifedecade/pdf/glaas_report_2012_eng.pdf
7. World Bank Water and Sanitation Programme (2012) Economics of Sanitation Initiative (ESI) <https://www.wsp.org/content/economic-impacts-sanitation#top>
8. Foster V. and Briceño-Garmendia C. (Eds.) (2010) "Africa's Infrastructure – A Time for Transformation" The International Bank for Reconstruction and Development / The World Bank
9. Foster V. and Briceño-Garmendia C. (Eds.) (2010) "Africa's Infrastructure – A Time for Transformation" The International Bank for Reconstruction and Development / The World Bank
10. Hutton G. (2012) "Global costs and benefits of drinking-water supply and sanitation interventions to reach the MDG target and universal coverage WHO" http://www.who.int/water_sanitation_health/publications/2012/globalcosts.pdf
11. Transparency International (2008) "Global Corruption Report 2008 - Corruption in the Water Sector" http://issuu.com/transparencymagazine/docs/global_corruption_report_2008?e=2496456/2011923
12. UN-Water (2012) "Status Report on the Application of Integrated Approaches to Water Resources Management" http://www.un.org/waterforlifedecade/pdf/un_water_status_report_2012.pdf
13. Doczi J., Dorr T., Mason N. and Scott A. (2013) "The post-2015 delivery of universal and sustainable access to infrastructure services" ODI Working Paper <http://www.odi.org.uk/sites/odi.org.uk/files/odi-assets/publications-opinion-files/8445.pdf>
14. City of Ottawa. (2013) "Wastewater Treatment at Robert O Pickard Environmental Centre – Wastewater Treatment Plant" Available at <http://ottawa.ca/en/residents/water-and-environment/sewers-and-septic-systems/wastewater-treatment>
15. Husain, T., and Ahmed, H. (1997) "Environmental and Economic Aspects of Wastewater Reuse in Saudi Arabia" *Water International* 22: 108-112
16. Hernández-Sancho, F. and Sala-Garrido R. (2009) "Technical efficiency and cost analysis in wastewater treatment processes: A DEA approach" *Desalination* 249: 230–234



Photo Credit: Nina Weitz, SEI

17. Flörke M., Kynast, E., Bärlund, I., Eisner, S., Wimmer, J., Alcamo, J. (2013) “Domestic and industrial water uses of the past 60 years as a mirror of socio-economic development: A global simulation study” *Global Environmental Change* 23: 144–156
18. Sato, T., Qadir, M., Yamamoto, S., Endo, T. and Ahmad, Z. (2013a) “Global, regional, and country level need for data on wastewater generation, treatment, and use” *Agricultural Water Management* Vol. 130 p.1-13
19. Husain, T., and Ahmed., H. (1997) “Environmental and Economic Aspects of Wastewater Reuse in Saudi Arabia” *Water International* 22: 108-112
20. City of Ottawa (2013) “Wastewater Treatment at Robert O Pickard Environmental Centre – Wastewater Treatment Plant” Available at <http://ottawa.ca/en/residents/water-and-environment/sewers-and-septic-systems/wastewater-treatment>
21. Grangier, C., M. Qadir, and M. Singh. (2012) “Health implications for children in wastewater-irrigated peri-urban Aleppo, Syria” *Water Quality, Exposure and Health* 4 (4): 187-195.
22. FAO AquaStat data
23. You L.Z. (2008) “Irrigation Investment Needs in Sub-Saharan Africa” *Africa Infrastructure Country Diagnostic Background Paper* 9
24. Foster V. and Briceño-Garmendia C. (Eds.) (2010) “Africa’s Infrastructure – A Time for Transformation” *The International Bank for Reconstruction and Development / The World Bank*
25. FAO (2012) “Towards the Future We Want: End hunger and make the transition to sustainable agricultural and food systems” <http://www.fao.org/docrep/015/an894e/an894e00.pdf>
26. Doczi J., Dorr T., Mason N. and Scott A. (2013) “The post-2015 delivery of universal and sustainable access to infrastructure services” *ODI Working Paper* <http://www.odi.org.uk/sites/odi.org.uk/files/odi-assets/publications-opinion-files/8445.pdf>
27. Brown C., Meeks R., Ghile Y. and Hunu K. (2010) “An Empirical Analysis of the Effects of Climate Variables on National Level Economic Growth” *Policy Research Working Paper #5357* World Bank <http://elibrary.worldbank.org/docserver/download/5357.pdf?expires=1378784365&id=id&accname=guest&checksum=15A7B2C9916BA9B85090BB7D313A9F5B>
28. Foster V. and Briceño-Garmendia C. (Eds.) (2010). “Africa’s Infrastructure – A Time for Transformation.” *The International Bank for Reconstruction and Development / The World Bank*
29. Transparency International (2008) “Global Corruption Report 2008 - Corruption in the Water Sector” http://issuu.com/transparencyinternational/docs/global_corruption_report_2008?e=2496456/2011923
30. Transparency International (2008) “Global Corruption Report 2008 - Corruption in the Water Sector” http://issuu.com/transparencyinternational/docs/global_corruption_report_2008?e=2496456/2011923011923
31. Brown L. (2008) “Plan B 3.0: Mobilizing to Save Civilization. *Earth Policy Institute*” http://www.earth-policy.org/images/uploads/book_files/pb3book.pdf
32. Foster V. and Briceño-Garmendia C. (Eds.) (2010) “Africa’s Infrastructure – A Time for Transformation” *The International Bank for Reconstruction and Development / The World Bank*
33. WHO/UN-Water (2012) “GLAAS 2012 Report UN-Water Assessment of Sanitation and Drinking Water” http://www.un.org/waterforlifedecade/pdf/glaas_report_2012_eng.pdf



IMPLEMENTATION CHALLENGES FOR A CATALYZING WATER FOR SUSTAINABLE DEVELOPMENT AND GROWTH FRAMEWORK

4.1 Implementation Scenarios

4.2 The Challenges of Implementation

4.3 Moving Forward on Implementation

SUMMARY:

Based on the Incheon Expert Consultation, it is obvious that the ongoing post-2015 discussions have not yet focused much on implementation scenarios of potential goals. Acknowledging this, we provide a final chapter that discusses how the selection of goals will affect implementation in relation to evolving factors such as population, water demand and climate change, as well as operation and maintenance requirements. We further provide some of the challenges that will be faced, as well as options for overcoming potential barriers, such as indicator measurability and financing.

4.1 IMPLEMENTATION SCENARIOS

Figure 4.1 presents a schematic overview of different implementation scenarios developed for the purposes of this report. The scenarios take into account factors that would impact on eventual outcomes, and which are both inherent to the Catalyzing Water for Sustainable Development and Growth Framework dynamics as well as external risk and benefit factors. The following points should be noted in relation to the scenarios presented in Figure 4.1:

- The “business-as-usual” (BAU) scenario does not emerge from the post-2015 dialogues, but is simply a projection based on progress made in the MDG era. It may be reasonable to assume that these trends would continue in the absence of new initiatives, although achieving the intent of the new SDGs through this mode would likely take a very long time.
- An ideal scenario is one in which all required resources become available together with a perfect enabling environment, implying that the global community is able to meet the short-term (e.g. 5-year) targets or milestones at pre-established time intervals, arriving at the SDGs on time and on-target.
- The quick and slow-start scenarios can also be expressed as “easy” and “difficult” pathways to implementation, underlining the different entry points and processes that may be required to achieve goals. Trajectories may change if implementation is facilitated or impeded in any way.

The discussion at the Incheon Expert Consultation suggested several conditions needed for implementation, including but not limited to are: promoting successful stakeholder engagement, building vertical and horizontal linkages, feasibility assessment and prioritization. Also suggested in the discussion were policy-focused implementation guidelines, country case studies, and

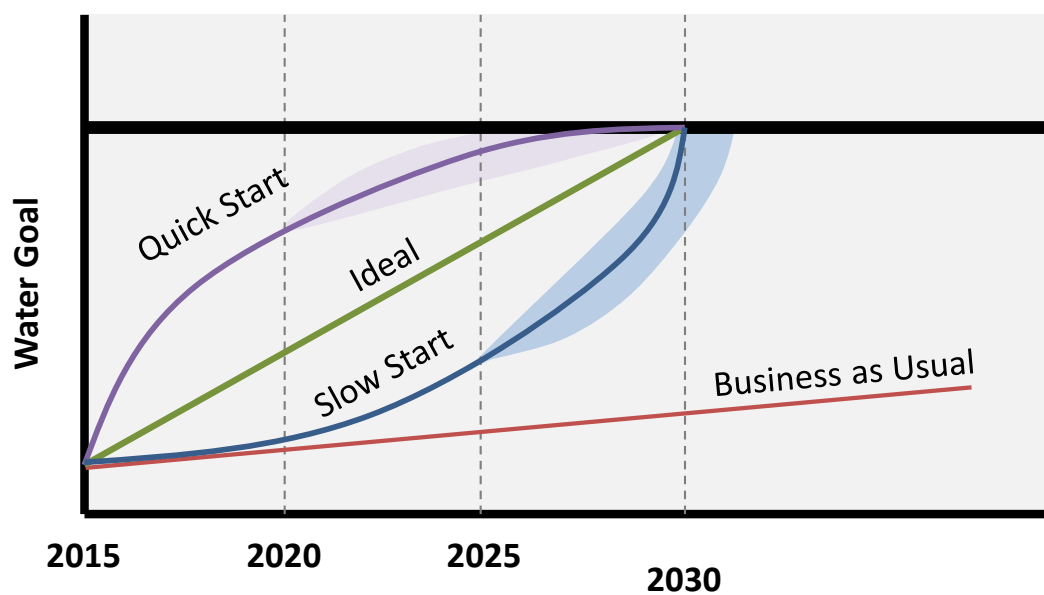
the need for bottom-up, participatory processes as well as high-level political commitment and ownership.



Photo Credit: Savitri Jetoo, UNU-INWEH



Figure 4.1. A schematic description of implementation scenarios



- Implementation Requirements**
- Funding
 - Technology
 - Capacities
 - Enabling Environment:
 - Governance
 - Policy
 - Institutional reforms

- External Risk Factors**
- Major environmental changes
 - Global Security
 - Energy
 - Economic
 - Conflicts

4.2 THE CHALLENGES OF IMPLEMENTATION

Monitoring and report of targets

Because implementation of SDGs may be phased in, and proceed at different rates in different regions and countries, it is essential to establish both targets and robust systems to monitor them. Targets and milestones should, of course, be set in a transparent fashion, thus challenging countries to plan explicitly and carefully. As was the case with MDGs, the major responsibility for data gathering, analysis and reporting would likely fall to the UN system. A number of the monitoring/reporting systems are already in place, including JMP, IWRM monitoring and GLAAS. Given the potentially integrated nature of the SDGs, it is likely that the monitoring processes may need to be re-tooled to analyze a broader array of indicators at different scales. Thus the monitoring process will be the subject of serious discussion, not just within the context of the post-2015/SDG dialogue but, more importantly, as part of the High Level Political Forum (HLPF) on successor arrangements for the UN Commission on Sustainable Development (CSD).

Stakeholder engagement

Implementation of SDGs, as well as their monitoring and assessment, would require the engagement of a wider spectrum of stakeholders compared to what was the case with the MDGs. It is foreseeable that in addition to governments, donor agencies, civil society and the UN, the general public, private sector, lending institutions and research/academic communities would be involved in implementing, monitoring and assessing the SDGs. Such broad engagement would require new institutional mechanisms, or for existing ones to be revamped. These mechanisms must include horizontal linkages to ensure ownership and to fill the roles needed for integrated service provision, and vertical linkages from community to global level to provide technical, institutional, financial and political assistance for effective action. The modus operandi for such engagement would be principally based on developing

and deploying networks – both horizontally and vertically. Integrated, well-performing communities of interest must be created on a large scale around the world to create and sustain such engagement, harnessing the power of social media as well as (existing) formal mechanisms.

The array of processes ongoing for formulation of the SDGs is described in Section 2.3.1. All of these processes will offer avenues for member states to engage and build ownership. At the same time, there are opportunities to establish new coalitions and mechanisms for securing ownership.

Mobilizing financial resources

The most critical challenge for financing the implementation of SDGs is the scale and continuity of investment. Whatever financing mechanisms are used – taxation at the local and national levels, user charges, cross-subsidies, private investment or targeted ODA and FDI – a very large absolute increase in funding is essential (see Chapter 3).

In the recent past, most of the financing for water-related infrastructure has been raised at the local level. This is likely to continue. During the 1990s, for example, most financing of water and sanitation originated from domestic public sectors (65–70%) and private sectors (5%), with only 10–15% from international donors and 10–15% from international private companies.¹ If one observes the economic development in China and India, which are home to more than half of the global unserved population, it can be argued that the source of funds for SDG targets in those countries would probably remain domestic; similar arguments can be made for other rapidly-developing economies.

For the poorer countries, ODA must be greatly increased, targeted more strategically, and used more effectively and sustainably to support national tariffs, taxes and trade. Over the past decade, investment in MDGs through ODA has been low and declining, a trend that must be reversed. As an example,



ODA should be better targeted at the 30% of the world's population making little or no progress on MDGs. It is in these poorest countries, primarily in Africa, where funding shortfalls and need are the greatest. Lastly, ways must be found to sustain these investments over the long term, both for infrastructure and, of equal importance, for SDG operations and maintenance.

Once funding is mobilized, it must be more effectively channelled to the local level where the SDG initiatives would be implemented. A number of measures could be used to do this, including:

- Multilateral financial institutions lending directly to sub-sovereign entities
- Decentralized funds for local initiatives and “catalytic” funds to mobilize other flows, empower players, and for reporting on impacts, aid efficiency and leverage

- Revolving funds using grants to finance the public preparation and structuring costs of complex projects, such as private participation projects
- ODA finance for water project start-up costs

However, caveats still exist, especially with respect to pro-poor initiatives. For example, governments of low-income countries are unlikely to be able to afford service subsidies, and would be better served by one-off capital subsidies to help households to access utilities.² Moreover, ineligible subsidy capture is a significant source of corruption,³ which undermines efforts to support marginalised groups.

REFERENCES

1. Prynne P. and Sunman H. (2000) “Getting the water to where it’s needed and getting the tariff right” FT Energy Conference, Dublin
2. Foster V. and Briceño-Garmendia C. (Eds.) (2010) “Africa’s Infrastructure – A Time for Transformation” The International Bank for Reconstruction and Development / The World Bank
3. Transparency International (2008) “Global Corruption Report 2008 - Corruption in the Water Sector” http://issuu.com/transparencyinternational/docs/global_corruption_report_2008?e=2496456/2011923

“Alongside governance, finance – both new and more economically and socially efficient – will be a crucial contributor towards achieving universal and sustainable access to water services in the post-2015 context.”

Doczi J., Dorr T., Mason N. and Scott A., (2013) “The post-2015 delivery of universal and sustainable access to infrastructure services” ODI Working Paper

4.3 MOVING FORWARD ON IMPLEMENTATION

Non-traditional engagement mechanisms

A number of established and emerging international coalitions offer alternative modes of delivery and implementation for SDGs – including regional groupings like the Association of Southeast Asian Nations (ASEAN), the Arab League, the EU and global groups such as the G20, OECD and the Organisation of Islamic Cooperation (OIC). Among these global groups, the G20 at the summit level offers the greatest promise. This is so because: water and sanitation challenges are the greatest among G20 countries like China and India; there would be tremendous gains in other challenge areas like health, poverty, food and energy security; it is a politically non-polarizing issue and most leaders can rally around it; and, there is a development multiplier dimension. In terms of economic and technological capacity of its member states the G20 is superbly equipped to implement the SDGs. In its current composition, the gross national income of the G20 countries is estimated at more than US\$ 25 trillion, and the number of scientists, engineers and technicians is estimated to be over 3 million.

Global mechanisms

Currently, service provision (water supply and sanitation) is a profoundly “disaggregated” and primarily local process, occurring in rural districts, small communities, peri-urban areas and cities, or portions of cities of various sizes. Action beyond 2015, whatever form and scale it takes, must acknowledge and respond to this reality. Scaling up and aggregating these local processes to the global level in a responsive and effective manner is an enormously complex challenge. As such, it makes sense that different institutional mechanisms are engaged to deliver on different key actions, since they play to relative strengths. For example, the G20 leaders and other regional government groups are well placed to advocate for the public, as well as a spectrum of stakeholders (from policy-makers to community leaders), that

action on the chosen agenda is imperative and immediate. The UN is well placed to develop and implement a mechanism for monitoring and evaluating the societal impact of the advocacy campaign and to partner with other global mechanisms to track progress against financial commitments and their outcomes (e.g. Sanitation and Water for All for the WaSH sector). A Global Capacity Building network would connect the UN with other institutions that provide education and professional, technical training to deal with immediate capacity needs, while higher education institutions would be responsible for training the “next generation”. A joint multilateral institution could undertake global implementation, driven by, for example, the G20 in partnership with Bretton-Woods institutions, the UN System, regional development banks and bilateral aid agencies. Alternatively, an overarching global water agency could be established that would manage and finance the preparation and promulgation of a “global master action plan” for water.



Photo Credit: Molly Whalen-Browne, UNU-INWEH



Innovative Financing

As a resource, water generates income, while as a sector it requires subsidies, particularly to reach marginalised populations and communities. Thus it is important that water in the post-2015 agenda is underpinned by financial transfer mechanisms so that a significant portion of funds are sourced within the water agenda itself.

In addition to traditional financing mechanisms, and reflecting the changing ownership of water issues, from government to grass roots, there are several innovative financing mechanisms that could become increasingly important in implementing a post-2015 agenda:

- **Micro-credit schemes** to provide seed capital, initial reserves and guarantees support bottom up improvements and can be used to catalyse large scale change at the local level.
- **Online “crowdsourcing”** allows individuals and informal groups to provide financial assistance to individuals and communities, particularly in LMICs. Harnessing social conscience and media, many of these are set up as revolving loans, so that one donation touches the lives of many.
- **Reinvestment of efficiency savings** and other revenues generated through sector by-products, e.g. biosolids, while not new, is an important mechanism in the post-2015 agenda.

Monitoring and Reporting

A key enabling mechanism that will underpin the broad post-2015 agenda is monitoring and reporting, closely tied to the development of SMART indicators, in order to monitor progress and hold the global community accountable. This requires a balance between utilising variables that are currently monitored on a regular basis and variables which should have a strong expectation of being collected. For example, every country should be striving towards key essential monitoring and surveillance systems that provide socio-economic data,

hydro-meteorological data, health data and financial flows data, which are rolled up from local to national scales through established reporting mechanisms. Having said this, when formulating indicators for post-2015, we must ensure that we are not relying on variables whose collection will never be feasible at the global scale (e.g. because of prohibitive cost or the time required to collect the data).

In an ideal world, the following indicators (Table 4.1) could be used to support monitoring and reporting. It is interesting to note that much of the data required are useful for reporting on multiple elements of a post-2015 water agenda, again emphasising the many inter-linkages.

With respect to reporting, an information portal where countries post reports / targets and achievements would demonstrate progress against commitments.



Photo Credit: ZAK/UNICEF, UN Photo

Table 4.1. Exemplar Indicators of Status and Change

ELEMENT	REPORTING ON PROGRESS
Governance	<ul style="list-style-type: none"> • CC / GEC projections and associated national RA/RM plans • RBM accounting against RA/RM and G&PRS • Monitoring and reporting systems • Trans ministerial mechanisms • Investment efficiency • Water efficiency • Cross sector flows (benefits; cross sector support) • Institutional capacity and training (positions available versus existing / trainee capacity to fill)
WaSH	<ul style="list-style-type: none"> • # people served / unserved • Level of service (including access, reliability, quality) • # and type of institutions served • Level of service (including access, reliability, quality) • Health improvements achieved (community and health care settings) • Human productivity improvements (per unit time and absolute time spent) • Sustainability metrics (financial flows and capacity) • School absenteeism
Wastewater	<ul style="list-style-type: none"> • % wastewater treated / untreated (household and industry) • Level of treatment • % wastewater for energy generation • % wastewater for food production (irrigation, fertilisers, soil amendment) • Sustainability metrics (financial flows and capacity)
Infrastructure	<ul style="list-style-type: none"> • Shortfall against full cost accounting • Storage for energy, irrigation, drought and flood mitigation • Functionality / efficiency • Oversight capacity

Table 4.1. Exemplar Indicators of Status and Change

ELEMENT	REPORTING ON PROGRESS
Agriculture	<ul style="list-style-type: none"> • Crop productivity per unit volume (domestic / export volumes) • Wastewater reuse (treated / untreated) • % marginal land farmed versus water use / productivity • Water related drought mitigation (storage; sources)
Water Resources	<ul style="list-style-type: none"> • Groundwater extraction versus recharge
Energy	<ul style="list-style-type: none"> • % water used versus energy generation (by generation type) • HEP generation versus potential (incorporating CC projections) (large and small scale) • HEP co-benefits (flood alleviation, irrigation/drought mitigation) • Wastewater energy generation
Industry	<ul style="list-style-type: none"> • % treated / untreated effluent discharge (by type) • Level of treatment • Compliance • Energy (co)generation • Water quality • Efficiency - % water use compared to economic productivity and employment (and effluent generated) by type
Ecosystem services	<ul style="list-style-type: none"> • % water for ecosystem services (supply – withdrawal) – sufficiency • Current versus future predicted • Raw water quality • RBM against basin scale water resources management plans – economy, people, environment • Environmental improvement • Valuation/accounting of specific services

Representing Integration

Compound indicators, with clear articulation of expected attribution from different sectors / goals would go a long way to highlighting and mainstreaming water connectivities. Some possible suggestions include:

- Infant mortality reduced by 3 per 1000 live births, with a reduction of 1 per 1000 associated with access to drinking water and sanitation¹
- Diarrhoea rates reduced by 50%²
- Source water quality does not exceed selected (chemical and microbiological) WHO guidelines in 8/10 samples
- Every country incorporates integrated water resources management plans into their G&PRS that address universal access, economic growth, allocation (including transboundary) and climate change impacts
- Improved water efficiency in different sectors (less drops per dollar or more dollars per drop)

Externalities

Given the impacts of climate change and other global external drivers, it is essential to understand current and future state of the water resource and sector. Countries need to be able to benchmark and monitor both in order to be able to understand and plan for risks to the resource (water quality, quantity and reliability), demands upon the resource (basic needs, industry, agriculture, energy, ecosystems, transboundary), the state of the sector as well as to derive and implement protection strategies.

Capacity development

Limited, but focused, capacity building would be undertaken to support North-South technology transfer, South-South information exchange and local-scale implementation. The primary targets for this exercise would be local and national governments and their agencies. Broader-scale capacity building, as well as service provisioning, would be undertaken by other international, multilateral mechanisms and implemented locally. The magnitude of the SDGs water challenge is so immense that hundreds of thousands of professionals, technicians and managers will be needed at all levels. With only a short time to achieve the MDGs, many argue that the focus of capacity building must be on adult education directed to the current generation of water practitioners. Relying solely on education of the next generation – undoubtedly essential in its own right – may be too little, too late.



Photo Credit: Ramadan Mohamed Hassan, UN Photo



Policy implications for implementation

Successfully achieving any of the combination of SDGs presented in Figure 2.3 requires an overhaul of the policy environment at both national and international levels. Two broad modifications would be essential: implementing a holistic, integrated economic and development planning; and, re-tooling means of measuring success. Considerable discussion took place at the Rio+20 Summit around the notion of green economy and ways of accounting for social, economic and environmental development at various scales. The findings of that dialogue, encapsulated in “The Future We Want,” need to be implemented by governments.

In order to utilize the innovative financing options described in section 4.3, national development policies would need to be re-configured, and a more enabling environment created.

Regional coalitions, interconnected to global mechanisms, would likely be needed for optimized sharing of financial, human and technological resources. It remains open to further debate whether existing regional conglomerations would serve this purpose; or does the UN play a more enhanced role in mobilizing South-to-South collaborations.

Overall, as can be discerned from Figure 4.1, business-as-usual policy frameworks would not be sufficient for achieving SDGs. The paradigm shift may take place through a hit-and-trial approach, yet sufficient knowledge and experience already exists and should be utilized to shape up the new policy paradigm – not just listing of aspirational goals and targets. We believe that the UN system could play an instrumental role in achieving consensus on the policy frameworks that would work best.

REFERENCES

1. This is based on Cheng et al. (2012) “An ecological quantification of the relationships between water, sanitation and infant, child, and maternal mortality” <http://www.ehjournal.net/content/11/1/4> which found that for every quartile improvement in WSS, infant mortality rates were reduced by 1.4 per 1000 live births
2. Links to WaSH as well as food safety, which will be increasingly important with climate change as well as to access to public health

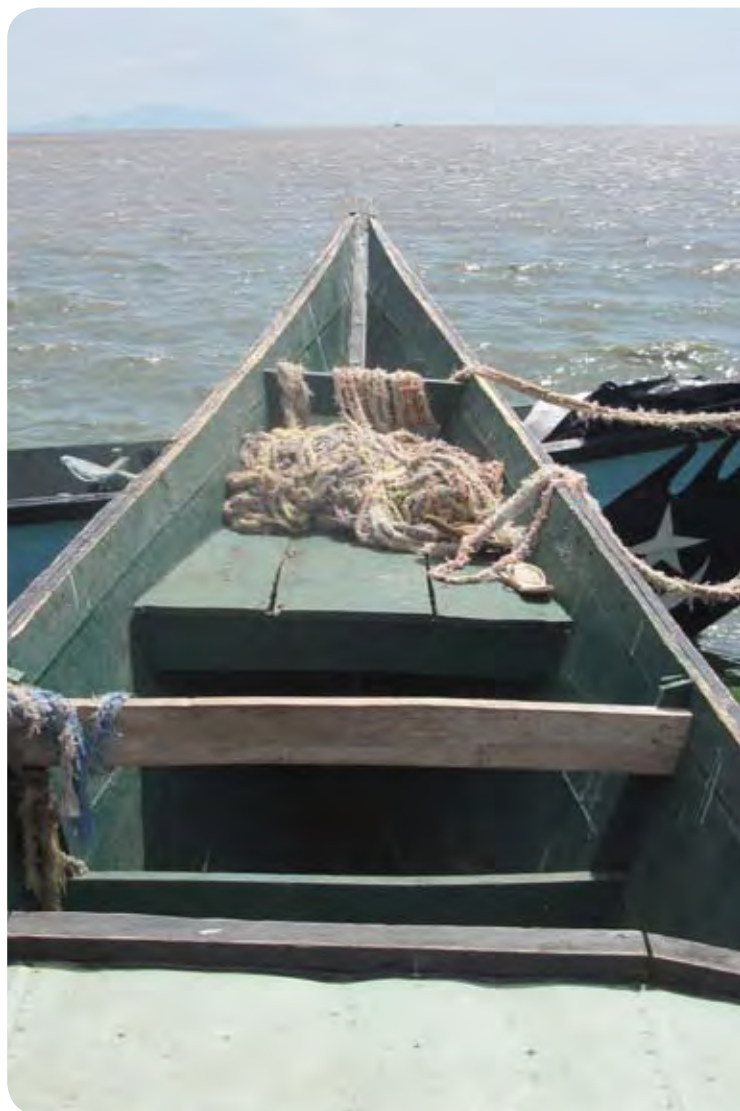


Photo Credit: Corinne Schuster-Wallace, UNU-INWEH



UNITED NATIONS
UNIVERSITY

UNU-INWEH

Institute for Water,
Environment and Health



United Nations Office for
Sustainable Development
Incheon - ROK



SEI

STOCKHOLM
ENVIRONMENT
INSTITUTE

United Nations University
Institute for Water, Environment and Health
175 Longwood Road South, Suite 204
Hamilton, ON Canada L8P 0A1
1.905.667.5511 • <http://inweh.unu.edu>
[Facebook.com/UNUINWEH](https://www.facebook.com/UNUINWEH) • [Twitter.com/UNUINWEH](https://twitter.com/UNUINWEH)

ISBN: 978-92-808-6040-5