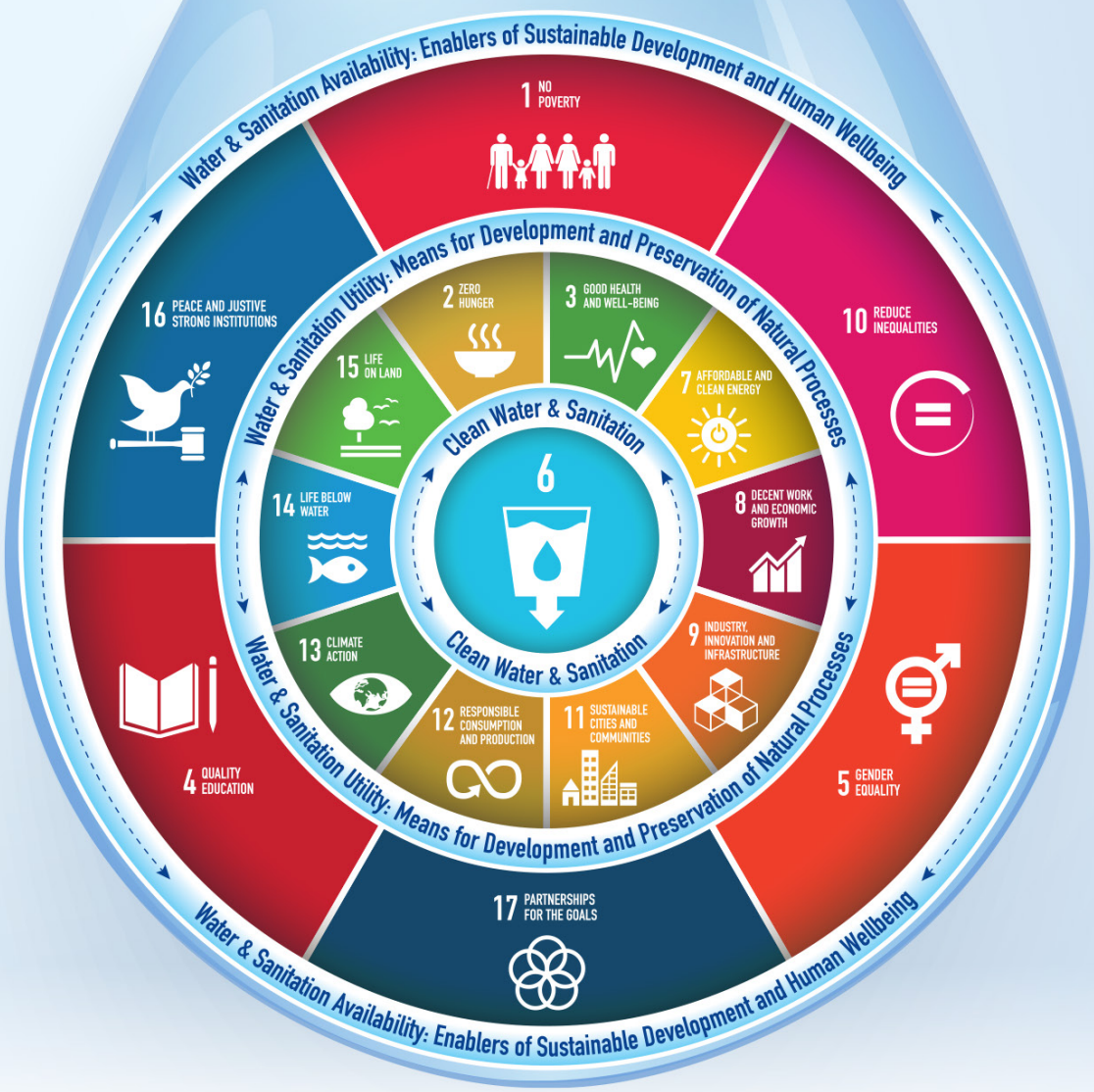
Integrated Approaches for Sustainable Development Goals Planning: The case of Goal 6 on Water and Sanitation



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SUSTAINABLE DEVELOPMENT GOALS

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Katinka Weinberger, Chief of Environment and Development Policy Section, Environment and Development Division, headed the publication team, which encompassed the writing team of Aneta Nikolova, Environment Affairs Officer, Aida Karazhanova, Economic Affairs Officer and Nina Schneider, consultant, as well as the modelling support provided by Watkana Thongrueng, Programme Manager, Systainability Asia, Joao Lopes Resende and Borja Fernandez Martinez. Stefanos Fotiou, Director of the Environment and Development Division provided overall guidance. Peer review was provided by Hitomi Rankine, Environment Affairs Officer, Environment and Development Division, Lawrence Surendra, Chair of The Sustainability Platform in India, Kareff Rafisura, Economic Affairs Officer, Information and Communication Technologies and Disaster Risk Reduction Division, and Nobue Amanuma, Centre for the Alleviation of Poverty through Sustainable Agriculture.

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Sustainable Development Goals

End poverty in all its forms everywhere

End hunger, achieve food security and improved nutrition and promote sustainable agriculture

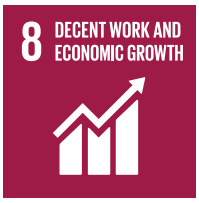
Ensure healthy lives and promote well-being for all at all ages

Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

Achieve gender equality and empower all women and girls

Ensure availability and sustainable management of water and sanitation for all

Ensure access to affordable, reliable, sustainable and modern energy for all



Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

Reduce inequality within and among countries

Make cities and human settlements inclusive, safe, resilient and sustainable

Ensure sustainable consumption and production patterns

Take urgent action to combat climate change and its impacts

Conserve and sustainably use the oceans, seas and marine resources for sustainable development

Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss

Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels

Strengthen the means of implementation and revitalize the global partnership for sustainable development

THE GLOBAL GOALS
For Sustainable Development

Abbreviations

CED	Centre for Environment and Development
ESCAP	United Nations Economic and Social Commission for Asia and the Pacific
FAO	Food and Agriculture Organization of the United Nations
GEMI	UN-Water's Integrated Monitoring of Water and Sanitation-Related SDG Targets Initiative
ICSD	Interstate Commission on Sustainable Development in Central Asia
ICSU	International Council for Science
ICT	Information and Communications Technology
ICWC	Interstate Commission on Water Cooperation in Central Asia
IGES	Institute of Global Environment Strategies
IUWM	Integrated Urban Water Management
IWMI	International Water Management Institute
MSDW	Ministry of Sustainable Development and Wildlife
OECD	Organisation for Economic Co-operation and Development
SDGs	Sustainable Development Goals
SIC	Scientific Information Centre-Tajikistan
UN DESA	United Nations Department of Economic and Social Affairs
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UN Habitat	United Nations Human Settlements Programme
UNICEF	United Nations International Children's Emergency Fund
UNIDO	United Nations Industrial Development Organization
WHO	World Health Organization
WTO	World Trade Organization

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Executive Summary

Since the adoption of the 2030 Agenda for Sustainable Development in 2016, scientist have been studying its "indivisible whole" nature, with the objectives to propose viable methods and tools for integrated planning of the implementation of the 17 SDGs. The three dimensions of sustainable development as outlined by the 2030 Agenda—economic prosperity, social justice and environmental protection—are viewed as "intertwined", like three strands of the DNA. The 17 SDGs have a clear starting point in one of the three dimensions of sustainable development and embed all three dimensions within their targets. Furthermore, their 169 targets were developed through an inclusive and comprehensive process that considered diverse sector-based specializations and perspectives. As such the 17 SDGs and their targets are closely interlinked and require innovative and unconventional policy approaches, such as those focusing on the intersections (meeting points), interlinkages and complex causal relationships, which require multidisciplinary methods for developing implementation strategies to achieve the complex but aspirational 2030 Agenda.

This publication introduces methods available to describe, understand and measure relationships and interconnectivity among the SDGs and options for their application. The core of the publication explains how the systems thinking approach was applied by the ESCAP team of experts from the Environment and Development Division of the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) to analyse the interlinkages and dependencies among the 17 SDGs and their 169 targets. To simplify the explanation, the ESCAP team of experts singled out SDG 6 on water and sanitation to demonstrate how its targets are interlinked with each other and with other SDG targets. Lessons learned through piloting modelling in Sri Lanka, Tajikistan and Fiji are shared and further analyses with other SDGs at the focus are provided.

The systems thinking approach is most suitable to complex problems; it enables a bird's-eye view of the whole system by applying systems dynamics to the connections between the components of the system—in this situation, the environmental, social and economic or policy-related components—and understanding the behaviour or interests these connections generate. It also allows better engagement of stakeholders and their active participation in imagining plural and dynamic descriptions of pathways of societal change, rather than a static vision of the future.

This comprehensive methodology developed will assist policymakers in:

- reviewing existing institutional architecture and mandates to determine their relationship with the 17 SDGs;
- assessing the impacts of policies and identifying effective policy interventions (leverage points) for impactful investment and use of scarce resources; and
- stakeholder mapping and engagement in collectively developing the aspirational qualitative vision for societal change.

In conclusion, the application of the analytical framework identified needs for capacity development and technical assistance and generated a request for support from ESCAP and other United Nations agencies that were voiced at the national workshops and the regional seminar, including:

- Strengthening capacities for data collection and for improving existing data sources to generate data sets comparable at the regional and global levels.
- Developing capacities for both quantitative and qualitative data collection and analysis for design of integrated policies.
- Enhancing capacity for setting up national SDG implementation monitoring and evaluation processes and in an integrated manner.
- Capacity development support at the provincial and city levels, with training materials translated into the local languages.
- Developing skills and mechanisms for the successful involvement of a wide range of stakeholders to ensure coordinated and concerted action at the national, regional and global levels.

The systems thinking approach applied beyond the integration of SDG 6 on water and sanitation has proven particularly conducive to strengthening and enhancing the capacity of policymakers for adaptive governance to better address the complex challenges of the 2030 Agenda and the SDGs. ESCAP will continue to provide technical and advisory services, tools and methodologies to policymakers in the region to build up their capacity for the integrated implementation of the three dimensions of sustainable development.

1. The 17 Sustainable Development Goals as one indivisible system

"The 17 Sustainable Development Goals and 169 targets … seek to build on the Millennium Development Goals and complete what they did not achieve. They seek to realize the human rights of all and to achieve gender equality and the empowerment of all women and girls. They are integrated and indivisible and balance the three dimensions of sustainable development: the economic, social and environmental." – General Assembly Resolution 70/1

This publication was put together as inspiration and a toolbox for policymakers to come to grips with the complexity of developing strategies and plans for the overwhelming task of implementing the 2030 Agenda for Sustainable Development and the 17 Sustainable Development Goals (SDGs) in an integrated and holistic manner. The publication introduces methods available to describe, understand and measure relationships and interconnectivity among the SDGs and options for their application. The core of the publication explains how the systems thinking approach was applied by the team of experts from the Environment and Development Division of the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) to analyse the interlinkages and dependencies among the 17 SDGs and their 169 targets. To simplify the explanation, the ESCAP team of experts singled out SDG 6 to demonstrate how its targets are interlinked with each other and with other SDG targets.

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The SDGs as an indivisible system

In September 2015, the United Nations General Assembly adopted Resolution 70/1 on Transforming Our World: The 2030 Agenda for Sustainable Development. As spelled out by the Resolution: "The interlinkages and integrated nature of the Sustainable Development Goals are of crucial importance in ensuring that the purpose of the new Agenda is realized." To harness the power of these interlinkages, policymakers need to understand the complex dynamic of the SDGs as an indivisible system and then design implementing strategies and approaches in a balanced and integrated manner across the three dimensions of sustainable development—economic, social and environmental. The 2030 Agenda integrates those three dimensions throughout the targets of each SDG, which thus creates a web of interlinkages and dependencies.

The 17 SDGs and their 169 targets were developed through an inclusive and comprehensive process that considered diverse sector-based specializations and perspectives. This created a platform for the application of systems thinking approaches into policymaking at the global, national and local levels to ensure no one is left behind.

The complexity of today's world, characterized by unpredictable changes to the natural environment, induces the need for innovative and unconventional policy approaches, such as those focusing on the intersections (meeting points) of thematically diverse and often divergent SDG targets. Such inclusive focus on the interlinked nature of the SDGs and their targets allows for a multidisciplinary method to achieve the complex but aspirational 2030 Agenda.

An integrated approach simplifies and describes the interlinkages and potential cohesive actions and thus help policymakers better understand how targets could reinforce the achievement of each other and better manage the often-unpredictable interactions among stakeholders.

Integration of the three dimensions of sustainable development has been high on the agenda of regional policymaking in Asia and the Pacific. The nature of economic growth in the past decade or so in the region did not deliver on all promises made through the Millennium Development Goals. To a large extent, it brought about greater inequality and serious damage to environmental

Box 1. Green Growth – A pathway to achieving sustainable development in the Asia-Pacific region

The greening of the economy is recognized as the optimal path to achieve an inclusive, prosperous and sustainable future in the region.[a] *In March 2005 in Seoul, the Fifth Ministerial Conference on Environment and Development*[b] *adopted "green growth" as an approach for achieving sustainable development in the region. In September 2010, the Sixth Ministerial Conference on Environment and Development (in Astana, Republic of Kazakhstan), reaffirmed that green growth is a viable path for achieving sustainable development in the region, and the participants adopted the Astana Green Bridge Initiative for Europe, Asia and Pacific partnerships.*[c] *The Green Bridge Partnership Programme adopted at the Seventh Ministerial Conference on Environment for Europe in September 2011 (also in Astana) was the only programme of this scale included in the Rio+20*[d] *outcome document, The Future We Want.*

To assist member States in fulfilling these commitments to sustainable development planning and implementation, the Economic and Social Commission for Asia and the Pacific (ESCAP) is developing frameworks, tools and approaches to facilitate integration in policymaking. One of the first tools created thus far is the ESCAP Low Carbon Green Growth Roadmap for Asia and the Pacific, which was launched at the Rio+20 Summit in 2012. Methodologies for assessing the quality of economic growth, including through the application of green growth indicators, were subsequently developed and promulgated through training programmes.

a = Working towards a Balanced and Inclusive Green Economy: A United Nations System-Wide Perspective. UN EMG, Geneva, 2012 <http://unemg.org/images/emgdocs/publications/GreenEconomy-Full.pdf>; b = See http://mced6.org/en/objectives-and-focuses/mced5/ and http://www.iisd.ca/crs/mced/sdvol106num1e.html; c = The bridging seeks to better connect Europe, Asia and the Pacific; business and environment; industrialized and developing countries; science and practice; economic growth and conservation of natural resources; intellectual property and general accessibility to them; d = United Nations Conference on Sustainable Development.

sustainability. To address those challenges, ESCAP began in 2015 to develop tools for the integration of the three dimensions of sustainable development into policymaking and to support implementation of the then adopted green growth approach (see box 1).

This publication highlights how the systems thinking approach applied by ESCAP complements other tools created by experts as the most comprehensive method to develop strategies and plans for the integrated and holistic implementation of the 2030 Agenda and the SDGs. This short overview of the analytical framework developed by ESCAP describes how the many interlinkages and relationships were analysed (in three selected country case studies) using the systems thinking approach of causal loop interactions combined with the theory of leverage points to identify effective and impactful interventions at the policy level.

This publication provides, in Chapter 2, an overview of selected approaches to the integration of the three dimensions of sustainable development. Chapter 3 describes the analytical framework for the integration of those three dimensions among the SDG 6 targets using the systems thinking approach developed by ESCAP. Chapter 4 presents examples of applying the analytical framework at the country level in the Asia-Pacific region, while Chapter 5 highlights additional modelling on the integration of all the SDG targets, beyond the SDG 6-centric approach. Finally, Chapter 6 discusses the way forward in the application of the ESCAP approach for analysis and integration of the three dimensions across all 17 SDGs.

2. A selective review of methodologies and tools for integrated approaches to implementation of the SDGs

"The future is diverse and unexpected, and innovation happens at the intersections" –Frans Johansson[1]

2.1 Overview of methodologies and tools

For more than 70 years, integrated approaches have been promulgated as a way to balance the predominant linear development paradigm with more holistic thinking, which, if systemically applied, would eventually reduce and reconcile most of the trade-offs between the three dimensions of sustainable development.[2] Scientists have been advocating for greater application of both integrated and systems thinking principles as the means to achieving sustainable development and integrated resource management.[3] Unfortunately, short-term interests in policies and decisions with a short-time frame have discouraged mainstream use of such principles, at least until recently.

Using a focus on SDG 6, this chapter introduces a selection of academic research products, modelling methodologies and tools that were developed to manage the complex interplay between the SDGs and the interlinkages among the SDG targets. The details of these knowledge products are further discussed in the fact sheets that accompany this publication.

SDG 6 on water and sanitation was found most suitable for the application of the systems thinking approach, which best describes the complex interrelationship between the anthropogenic and the natural water cycles, and the need for holistic and integrated policymaking to ensure availability of water resources that are vital for human, industrial and natural ecosystems (figure 1).

1. Johansson, 2004. See also his TED talk at www.youtube.com/watch?v=nRAkko6WZbs.
2. UNESCO, 1997. Educating For A Sustainable Future: A Transdisciplinary Vision For Concerted Action.
3. Senge, 1990.

Figure 1. Anthropogenic and natural water cycles as described by the SDG 6 targets

Source: UN-Water, 2016

A framework for understanding SDG interactions[4]

A group of scientists who are also members of the International Council for Science (ICSU), which has advisory functions to the Open Working Group on the Sustainable Development Goals, have been studying the best way to scientifically explain the "indivisible whole" meaning of the 2030 Agenda for Sustainable Development. They view the three dimensions of sustainable development that the 2030 Agenda outlines—economic prosperity, social justice and environmental protection—as "intertwined", like three strands of DNA. Their preliminary scientific analysis concludes that while the 17 SDGs have a clear starting point in one of the three dimensions of sustainable development, most of them embed all three dimensions within their targets.[5]

4. This section is based on a contribution from David Griggs, member of the ICSU, and on ICSU, 2016.
5. ICSU, 2016.

To illustrate their conclusion, this group of scientists, based on proposal from ESCAP, singled out SDG 6, which specifies "Ensure availability and sustainable management of water and sanitation for all". The goal, as the collaborating scientists emphasize, contains targets related to the economic (integrated water resources management), social (universal and equitable access) and environmental dimensions (protect and restore water-related ecosystems), with significant interactions with other SDGs. The most commonly discussed set of interactions lies in the nexus between food, water and energy,[6] as reflected in the links between SDG 2, SDG 6 and SDG 7, with potential conflict in water use for energy production and generating hydropower with residential and industrial water use and for irrigation for food production.

The interactions, of course, can be both positive—with mutually beneficial outcomes—and negative—with trade-offs.

To better understand the nature and dynamics of those interactions, ICSU scientists and Nilsson and others[7] developed a framework tool to classify the extent to which a relationship is positive or negative, using a seven-point scale (table 1). The tool is intuitive and relatively easy to use as a first level of assessment of the interlinkages among the SDGs to determine potential synergies and trade-offs, which will help ensure that policymaking is more effective.

Table 1. Scoring scale for measuring the interaction between the SDGs and their targets

Interaction	Name	Explanation	Example
+3	Indivisible	Inextricably linked to the achievement of another goal.	Ending all forms of discrimination against women and girls is indivisible from ensuring women's full and effective participation and equal opportunities for leadership.
+2	Reinforcing	Aids the achievement of another goal.	Providing access to electricity reinforces water-pumping and irrigation systems. Strengthening the capacity to adapt to climate-related hazards reduces losses caused by disasters.
+1	Enabling	Creates conditions that further another goal.	Providing electricity access in rural homes enables education, because it makes it possible to do homework at night with electric lighting.
0	Consistent	No significant positive or negative interactions.	Ensuring education for all does not interact significantly with infrastructure development or conservation of ocean ecosystems.
-1	Constraining	Limits options on another goal.	Improved water efficiency can constrain agricultural irrigation. Reducing climate change can constrain the options for energy access.
-2	Counteracting	Clashes with another goal.	Boosting consumption for growth can counteract waste reduction and climate mitigation.
-3	Cancelling	Makes it impossible to reach another goal.	Fully ensuring public transparency and democratic accountability cannot be combined with national-security goals. Full protection of natural reserves excludes public access for recreation.

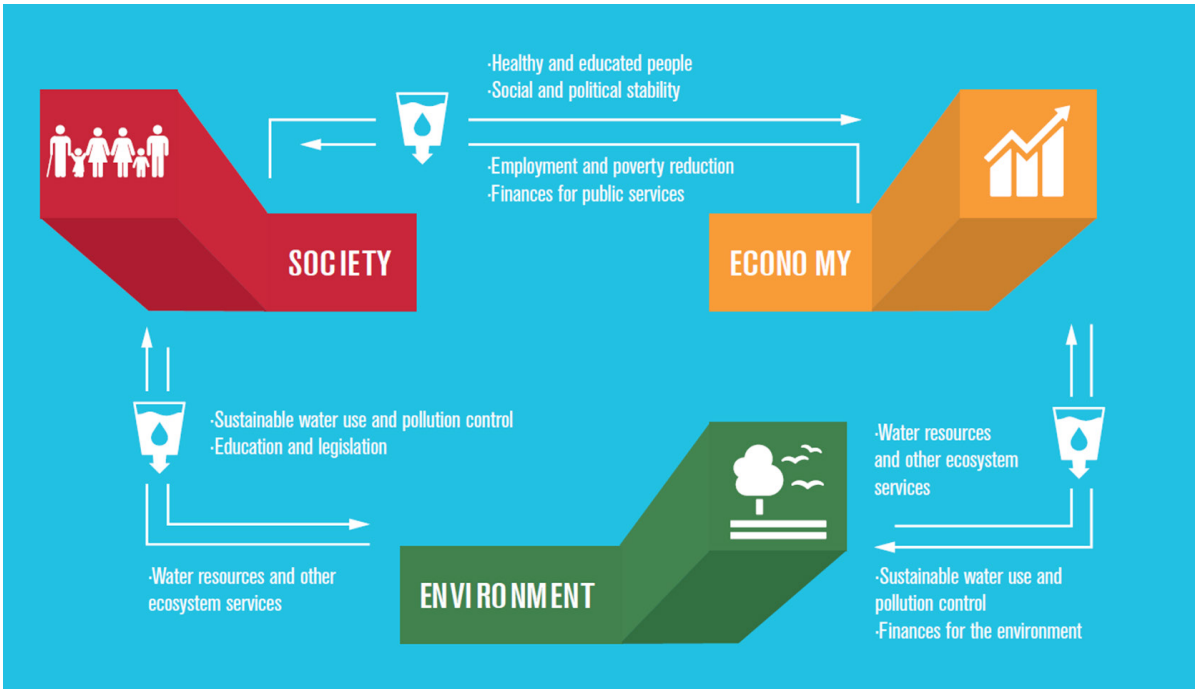
Source: UN-Water, 2016.

6. Weitz, Nilsson, and Davis, 2014.
7. ICSU, 2016; Nilsson, and others, 2016.

UN-Water integrated approaches[8]

To assist United Nations Member States in their efforts towards implementing the 2030 Agenda in an integrated manner, UN-Water[9] mapped out the water- and sanitation-related interlinkages across the 17 SDGs. This work is captured in the analytical brief Water and Sanitation Interlinkages Across the 2030 Agenda for Sustainable Development, which highlights the target-level relationships that are important to consider when developing implementation plans for SDG 6 (figure 2).

Figure 2. Interlinkages based on the three dimensions of sustainable development within the SDG 6 targets



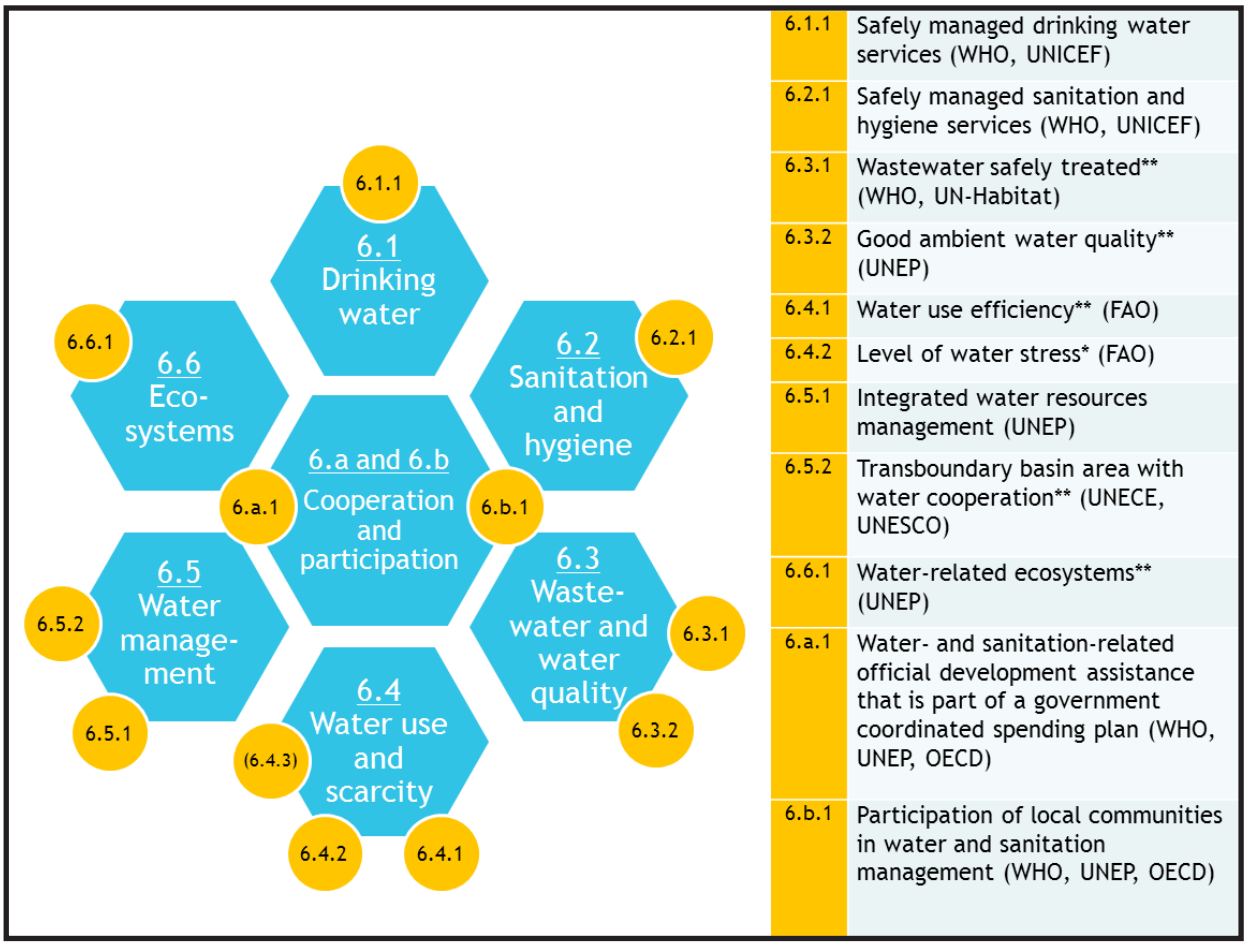
Source: UN-Water, 2016.

The UN-Water analysis concluded that most of the linkages between the SDG 6 targets and the other SDG targets are positive and mutually reinforcing. For example, by increasing access to drinking water, sanitation and hygiene, complemented by proper wastewater management, the risk of waterborne diseases and malnutrition will drop, with positive outcomes on education and the economy, which in turn contributes to the reduction of poverty and inequalities. Some interlinkages, however, were found to present potential conflicts. To ensure energy for all and sustain economic growth, for example, it may be necessary to use more water and land, which likely will generate more pollution.

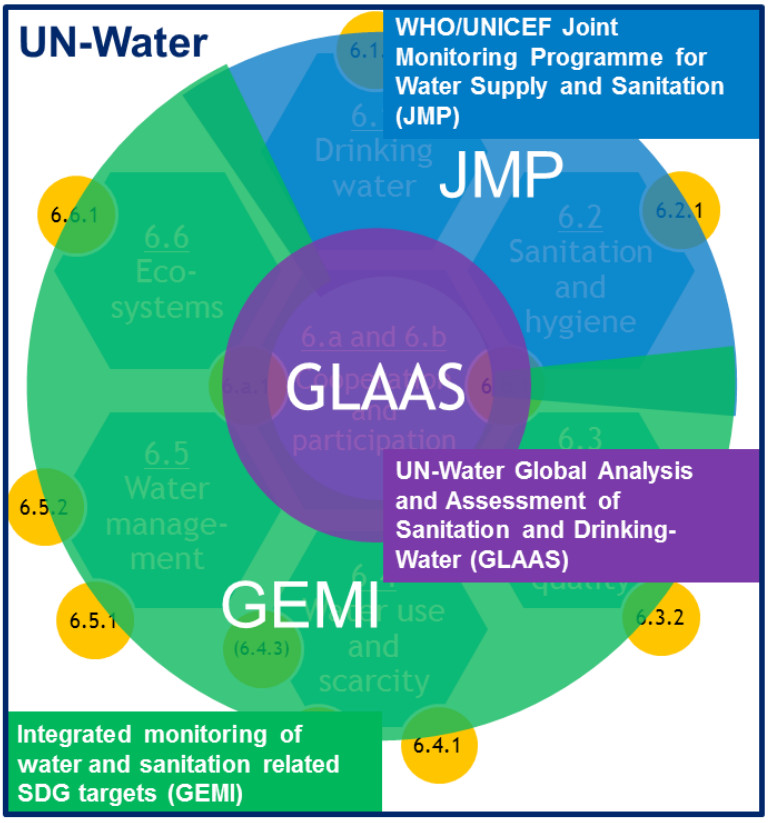
The UN-Water analysis also concluded that anticipating and understanding such potential conflicts, or trade-offs, allows for taking steps early on to ensure a just balance of available resources across the social, economic and environmental development objectives.

8. This section is developed based on a contribution by Maria Schade, UN-Water Technical Advisory Unit.
9. UN-Water is the entity that coordinates the work of the United Nations on water and sanitation. It comprises the United Nations bodies that focus on or have an interest in water- and sanitation-related issues as members and other international organizations as partners.

Figure 3. UN-Water integrated monitoring initiative for SDG 6



6.1.1	Safely managed drinking water services (WHO, UNICEF)
6.2.1	Safely managed sanitation and hygiene services (WHO, UNICEF)
6.3.1	Wastewater safely treated** (WHO, UN-Habitat)
6.3.2	Good ambient water quality** (UNEP)
6.4.1	Water use efficiency** (FAO)
6.4.2	Level of water stress* (FAO)
6.5.1	Integrated water resources management (UNEP)
6.5.2	Transboundary basin area with water cooperation** (UNECE, UNESCO)
6.6.1	Water-related ecosystems** (UNEP)
6.a.1	Water- and sanitation-related official development assistance that is part of a government coordinated spending plan (WHO, UNEP, OECD)
6.b.1	Participation of local communities in water and sanitation management (WHO, UNEP, OECD)



- Support countries to monitor water- and sanitation-related issues in an integrated manner
- Compile country data to report on global progress towards SDG 6

Source: UN-Water, 2016.

Another important tool developed by the UN-Water is the Integrated Monitoring of Water and Sanitation-Related SDG Targets Initiative (GEMI) (figure 3),[10] which was designed to help countries monitor their water and sanitation situations and to compile country data for reporting on global progress towards achieving SDG 6. To enable a comprehensive assessment and analysis of the state of water resources and the impacts of different development paths, the monitoring effort brings the information together in support of an integrated management approach that contributes towards reducing institutional fragmentation. And bringing together and cross-analysing different data sets from across sectors contributes towards a greater understanding of the scope and nature of the interlinkages.

Operating under the UN-Water umbrella and comprising the SDG 6 custodian agencies, the initiative's focus is to integrate and expand on monitoring efforts at the national, regional and global levels to ensure harmonized information for the whole water cycle.

UN-Water developed methodologies for monitoring the SDG 6 targets between 2014 and 2016, before the global indicators were agreed. Then, between August and October 2016, an external review and pilot tests were conducted, and the methodologies were readjusted in February 2017 to better assist countries in collecting data for establishing an integrated global baseline for SDG 6—in time for an in-depth review during the 2018 High-level Political Forum on Sustainable Development.

Access, efficiency and transformation as a progressive and pragmatic approach for implementing SDG 6 and other goals[11]

An approach developed by the Institute for Global Environmental Strategies advocates that effective implementation of SDG 6 hinges on three issues, which demand conceptual clarity. First, it is important to identify the interlinkages, synergies and trade-offs among the various targets within SDG 6 as well as across all 17 SDGs. Then these interlinkages need to be compared with the institutional and budgetary structures across the national government to devise institutional reform that can enhance efficiency and effectiveness of the institutional architecture of the 17 SDGs.

Second, it is better to break the absolute targets into gradual goal posts so that countries can more easily check their progress over time. National targets and local SDG road maps can be developed for the effective mobilization of resources, based on national circumstances. Thus, there should be immediate, medium-term and long-term priorities for the progressive achievement of the SDGs.

10. See www.sdg6monitoring.org.
11. This section is based on inputs by Binaya Raj Shivakoti and Simon Høiberg Olsen, who are with the Institute for Global Environmental Strategies.

Third, access, efficiency and transformation should be prioritized to guide policy decisions. Regarding SDG 6, there are two dimensions that should be prioritized for immediate water management: (a) For least developing countries, it is prudent to channel resources towards overcoming the challenges of access to clean water and services for sanitation and hygiene (targets 6.1 and 6.2), which closely relate to efficiency improvements and wastewater management to address water scarcity and pollution (targets 6.3 and 6.4). Early achievement of access and efficiency is the stepping stone to system transformation.

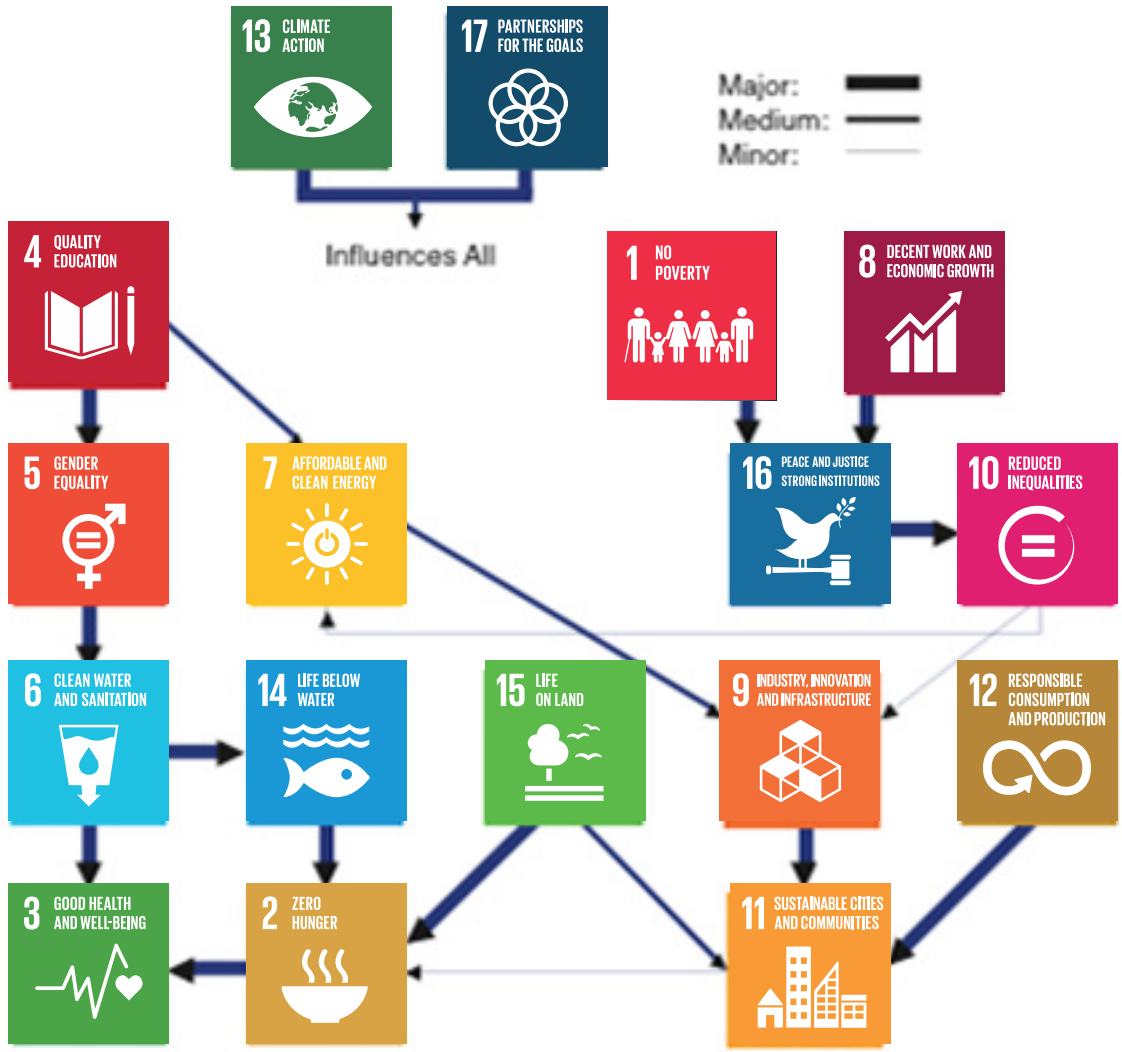
(b) The second dimension relates to governance and means of implementation. Industrialized countries should provide increased international support on finance, capacity building and technology transfer to developing countries and countries with special needs (target 6.a). Such support needs to address water management challenges by promoting innovative approaches, such as water harvesting, desalination, water efficiency, wastewater treatment, recycling, reuse and exchange programmes for sharing experiences of local innovation. Industrialized and developing countries need to create an enabling environment through good governance, institutional reform, transparency of financial flows and community participation to ensure that results address the needs of the general population (target 6.b).

Achieving the SDGs on water and beyond[12]

A research group from the Global Change Institute, at the University of Queensland in Brisbane, Australia, argued that there are considerable pitfalls in national planning strategies for implementation of the 17 SDGs due to a focus on a goal-by-goal and target-by-target approach, which neglects the mutual influences among them. Understanding the direct and indirect influences among the SDGs can support their attainment. The research group applied a transdisciplinary systems thinking approach to explore the relationships among all 17 SDGs and between the eight targets of SDG 6 (on water and sanitation)—in the Australian context. This allowed the group to identify relevant government administrative agencies, through which to identify priority SDGs for action and investment. A simplified Bayesian network approach was then used to produce a diagram that displays linkages between "nodes", also known as "directed acyclic graphs".[13] During two workshops, the research group created visual representations that clarified the cause-and-effect relationships among the goals and targets. They then ascribed the strength of influence between the goals and targets using a form of expert judgement to develop estimates, known as "expert elicitation".[14] The final stage, a simplified form of policy analysis, considered the relevant Australian Government portfolios that could progress the SDGs, both within Australia and overseas.[15] Figure 4 illustrates the relationships between the SDGs in the Australian context.

12. This section is based on the article by Hall, and others, 2016.
13. Cain, 2001; Nadkarni, and Shenoy, 2004.
14. Kuhnert, Martin, and Griffiths, 2010.
15. Wilson, 2006.

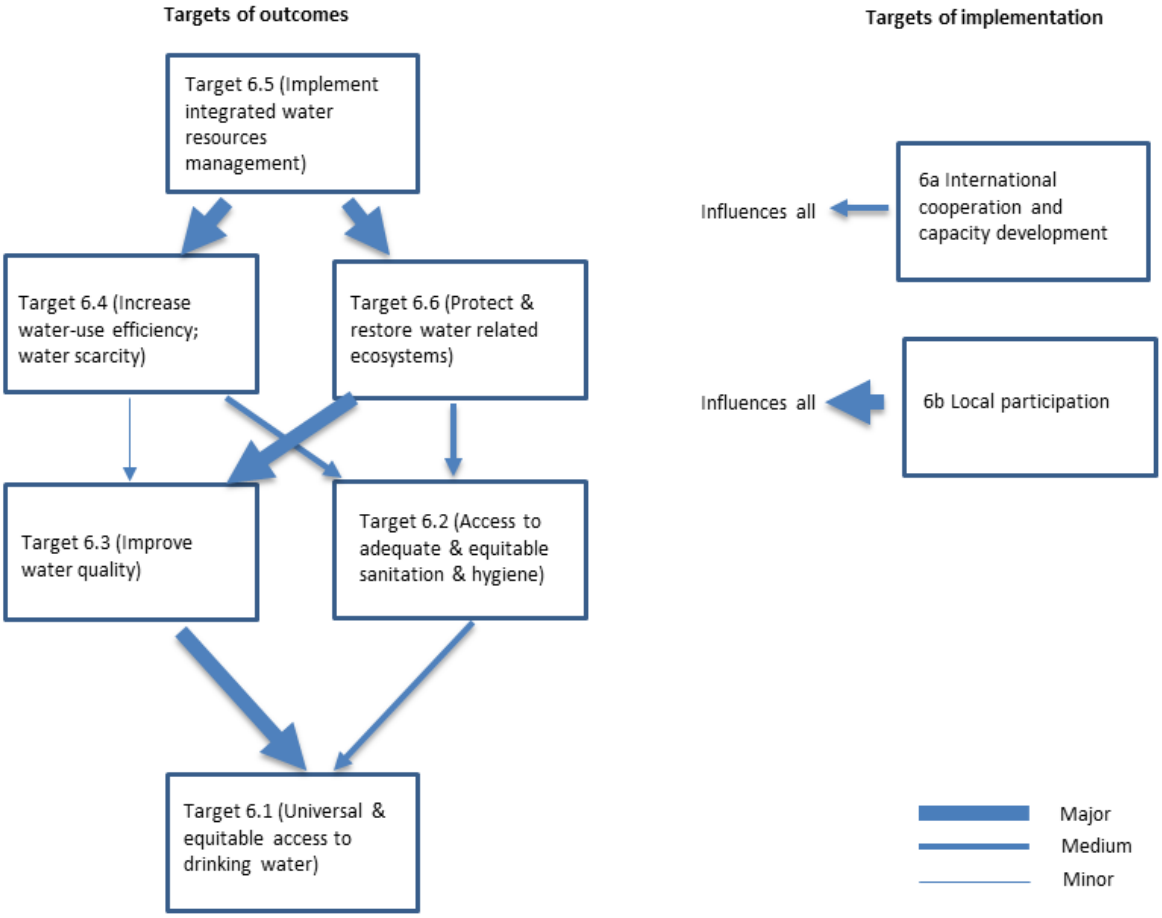
Figure 4. Interlinkages and strength of influences (as indicated by line thickness) between the 17 SDGs , in the Australian context



Source: Hall and others., 2016.

The overarching target of SDG 6 in the Australian context is safe, accessible and affordable drinking water (SDG 6.1), which contributes to health and well-being (SDG 3). Integrated water resources management (SDG 6.5) is the key influence for achieving all the other SDG 6 targets, and the "implementing" targets of cooperation and capacity (SDG 6.a) and local participation (SDG 6.b) are crucial to enabling the attainment of all the other SDG 6 targets. Figure 5 illustrates the findings of the analysis of the SDGs in the Australian context.

Figure 5. Relationships between the targets of SDG 6 on water and sanitation in the Australian context



The research group behind this policy analysis advised the Government of Australia on the importance of identifying and understanding the SDG interlinkages to avoid unintended negative consequences and to enhance benefits when planning implementation of the targets. Interagency collaboration was recommended as crucial at the local, national and international levels to attain the targets. In the initial plans, climate action (SDG 13) and partnerships (SDG 17) were identified as overarching SDGs that would ultimately facilitate achievement of the other SDGs.

The importance of an integrated approach to setting national SDG 6 targets[16]

The International Water Management Institute review and study concluded that the 2030 Agenda must be implemented as one system also at the country level. Countries will need to set their own national targets, of course, and they will need to be ambitious although realistic, maximize synergies[17] and minimize conflicts[18] with other targets. This will require an integrated approach and coordinated efforts at the national and subnational levels. Such an approach will require as a starting point an analysis of the synergies and conflicts between targets, together with thorough stakeholder analysis and engagement.

16. This section is based on the contribution of Javier Mateo-Sagasta and Kalanithy Vairavamoorthy, with the International Water Management Institute (IWMI).
17. Situations in which achieving one target or goal may negatively impact the achievement of another.
18. Conditions in which the achievement of one target or goal may favour the achievement of another.

Once all relevant stakeholders are involved, they can jointly generate hypothetical targets and assess, with the appropriate tools and technical support, the costs and benefits associated with their implementation to effectively select ambitious targets that maximize the benefits to society at minimal cost.

For example, for indicator 6.3.1, governments will need to set the percentage of the generated wastewater to be safely treated by 2030 and plan and invest accordingly. This national target will need to be ambitious so that it helps to substantially improve human and environmental health at the national level and contributes towards the global target, which all countries have committed to help achieve. At the same time, the national target needs to be within reach, reflective of national capacities (including financial) and supported by the buy-in of national stakeholders.

The setting of national targets will need to consider the interactions with other targets so that synergies are maximized and conflicts minimized and thus investments optimized. For example, an analysis of the national targets that will be associated with the SGD 6 global indicators (table 2) can show that an increase in wastewater treatment (SDG 6.3.1), together with increased access to sanitation (SDG 6.2.1), will support good ambient water quality (SDG 6.3.2) and healthy water-related ecosystems (SDG 6.6.1).

Table 2. SDG 6 global indicators and United Nations custodian agencies, as of April 2016

No	SDG 6 global indicators (short title)	Custodian
6.1.1	Safely managed drinking water services	WHO UNICEF
6.2.1	Safely managed sanitation services	WHO UNICEF
6.3.1	Wastewater safely treated*	WHO UN Habitat UN DESA
6.3.2	Good ambient water quality*	UNEP
6.4.1	Water use efficiency*	FAO
6.4.2	Level of water stress	FAO
6.5.1	Integrated water resources management	UNEP
6.5.2	Transboundary basin area with an operational arrangement for water cooperation*	UNECE UNESCO
6.6.1	Water-related ecosystems*	UNEP
6.a.1	Water- and sanitation-related official development assistance that is part of a government coordinated spending plan	WHO UNEP
6.b.1	Participation of local communities in water and sanitation management	WHO UNEP OECD

Source: UN- Water, 2016.

Additionally, good ambient water quality (SDG 6.3.2) will improve the provision of safe drinking water (SDG 6.1.1), which needs to be provided efficiently (SDG 6.4.1) and without negative impacts on water-related ecosystems (SDG 6.6.1). Conflicts between goals and targets also need to be assessed with care, for example, achieving SDG 2 (on ending hunger) will require an increase in agricultural productivity, which may lead to an increase in water demand and the overuse or misuse of agrochemicals (pesticides and fertilizers), with a consequent decline in water quality and quantity, if resources are not properly managed and sustainable agricultural practices are not adopted.

2.2 ESCAP approaches to the integration of the three dimensions of sustainable development and the SDGs

The methodologies and tools discussed previously provide important steps towards analysis of the interlinkages among the SDGs when developing implementation strategies. But they are mostly linear and hierarchical in their structure and do not provide mechanisms for feedback on the initial assumptions or for capturing the dynamism of complex changes in the contemporary socioeconomic and environmental conditions.

All concepts described earlier in this chapter provide useful insights and are available as tools for training programmes. For complex problems, the systems thinking approach is recommended because it allows engaging stakeholders in a genuine collective thinking process, as recommended by SDG 16.7 (on ensuring responsive, inclusive, participatory and representative decision-making at all levels for developing and analysing causal relationships and visualizing aspirational modelling) as well for identifying and classifying high-impact leverage points for effective policymaking.

Systems thinking is a critical foundation for the integration of the three dimensions of sustainable development. To provide more comprehensive support to ESCAP member States in their efforts to carry out the 2030 Agenda and the SDGs, ESCAP developed and piloted the use of a dynamic tool and participatory approaches in three countries. This dynamic approach and tool complements other tools,[19] such as scenario building and input-output analysis, which tackle the integration angle from the perspective of resource flows in various sectors, quantification of material footprints, etc. and meet different needs at different stages of policymaking.

19. See also ESCAP, 2015.

3. Analytical framework for integration of the SDG 6 targets with other SDGs using the systems thinking approach

"The 17 goals represent an indivisible tapestry of thinking and action that applies in every community everywhere in the world." –David Nabarro, Special Adviser on the 2030 Agenda for Sustainable Development[20]

This chapter provides an overview of the framework developed by ESCAP, which applies the systems thinking approach to the analysis of the interlinkages among the targets of the 16 SDGs and separately with those of the eight targets for SDG 6 on water and sanitation. The primary tools used to define the complex dynamics and behaviour in the 17 SDGs system and the results from the qualitative and quantitative modelling are described. Challenges in modelling and data collection and analysis at the pilot application level are also discussed.

The systems thinking approach allowed ESCAP to go beyond the linear analysis of the interlinkages among the SDGs and to describe the complex dynamics of natural and anthropogenic water cycles captured by SDG 6. It also allows taking a closer look at the causal relationships and direction of the interlinkages for the modelling and then adjusting with time and situation changes, like zoom-in and zoom-out.

The approach is most suitable to complex problems; it enables a bird's-eye view of the whole system by applying systems dynamics to the connections between the components of the system—in this situation, the environmental, social and economic or policy-related components—and understanding the behaviour or interests these connections generate. It also allows better engagement of stakeholders and their active participation in imagining plural and dynamic descriptions of pathways of societal change, rather than a static vision of the future.

At the piloting level, the systems thinking approach allowed for the development of an aspirational model, or a system's diagram, that describes the causal influences of a dynamic phenomenon through "team learning" and encourages dialogue and suspending assumptions. The system's diagram was then further interpreted to identify high-impact leverage points, following the principle of economy of means: whereby the best results come not from large-scale efforts and investments (economy of scale) but from small well-focused actions that enhance efficiency in the use of resources.

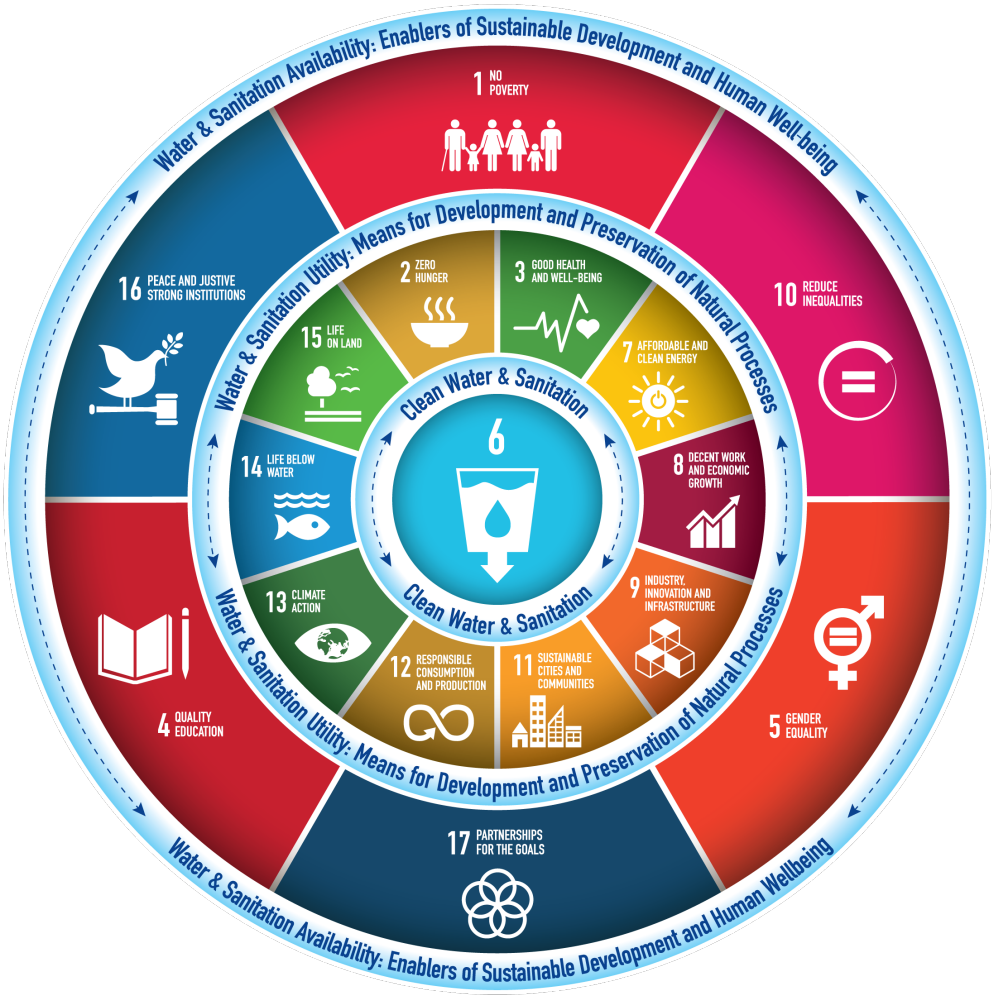
20. UNIDO, 2016.

The pilot application tool kit, developed by ESCAP and elaborated in detail in a working paper published in November 2016[21] consists of (a) a matrix of the relationships between the SDGs at the target level, which is used to identify direct and indirect linkages among goals and targets; (b) an online web-based system modelling and diagramming tool called Kumu[22] that enables users to visually map out the linkages among the targets; and (c) a tool for identifying and classifying high-impact leverage points based on academic literature on leverage points for system change.

3.1 Overview of the ESCAP methodology for application of the systems thinking

Whether at the stage of developing collaborative action, planning implementation or assessing the effects of existing or new programming, systems thinking offers a theoretical perspective and a suite of concrete and accessible strategies to create long-term sustainable solutions at multiple levels. Perhaps more importantly, systems thinking is an approach that creates a change in mindset, recognizing that the whole is greater than the sum of its parts, which contrasts with traditional, reductionist approaches. Thus, the 17 SDGs were analysed as one indivisible system, with two layers of interaction between the goals (figure 6). With SDG 6 at the core, water and

Figure 6. SDG 6 on water and sanitation is a core requisite goal for sustainable development



21. ESCAP, 2016.
22. See www.kumu.io.

sanitation were viewed as the means for development and preservation of natural processes for the inner circle of SDGs (SDGs 2, 3, 7, 8, 9, 11, 12, 13, 14 and 15), while the availability of water and sanitation was considered an enabler of sustainable development and human well-being for the outer circle (SDGs 1, 5, 4, 10, 16 and 17).

3.2 Distinct features of the analytical framework

The framework is based on a thorough initial analysis of the interlinkages between the eight targets of SDG 6 and the targets of the other 16 SDGs using a comparative SDG targets matrix.[23]

That analysis focused on four questions:

1. Is there a cause-and-effect relationship between the two intersecting targets that is within 1–2 degrees of causal influence?
2. If there is a causal relationship within the criteria, is the relationship a direct causal relationship (immediate and direct causal influence) or an indirect causal relationship (not one to one, but must pass through other factors first)?
3. What is the directional characteristic of the two related targets (parallel or inverse)?
4. Is the water and sanitation target for each causal relationship being driven or influenced by the other target, or is the water target a driver or influencer of the other target?

The analysis then mapped out and visualized the direct linkages among all the targets identified in the relationship matrix using Kumu, the web-based diagram-mapping tool, which resulted in an overall causal diagram of the system (figure 7).

Once the system's causal model was developed, further analysis looked at "what needs to change in the structure of the system to produce more of what we want and less of that which is undesirable".[24] Places in the system's structure in which a solution element or intervention could be best applied to achieve desired long-term sustainable results were identified. These places are commonly referred to as "leverage points"[25] in systems analysis. More details of the analysis are provided in the ESCAP publication.[26] The following illustrates the analysis that identified SDG 6.3 as one of the most important leverage points in the systems model of interlinkages.

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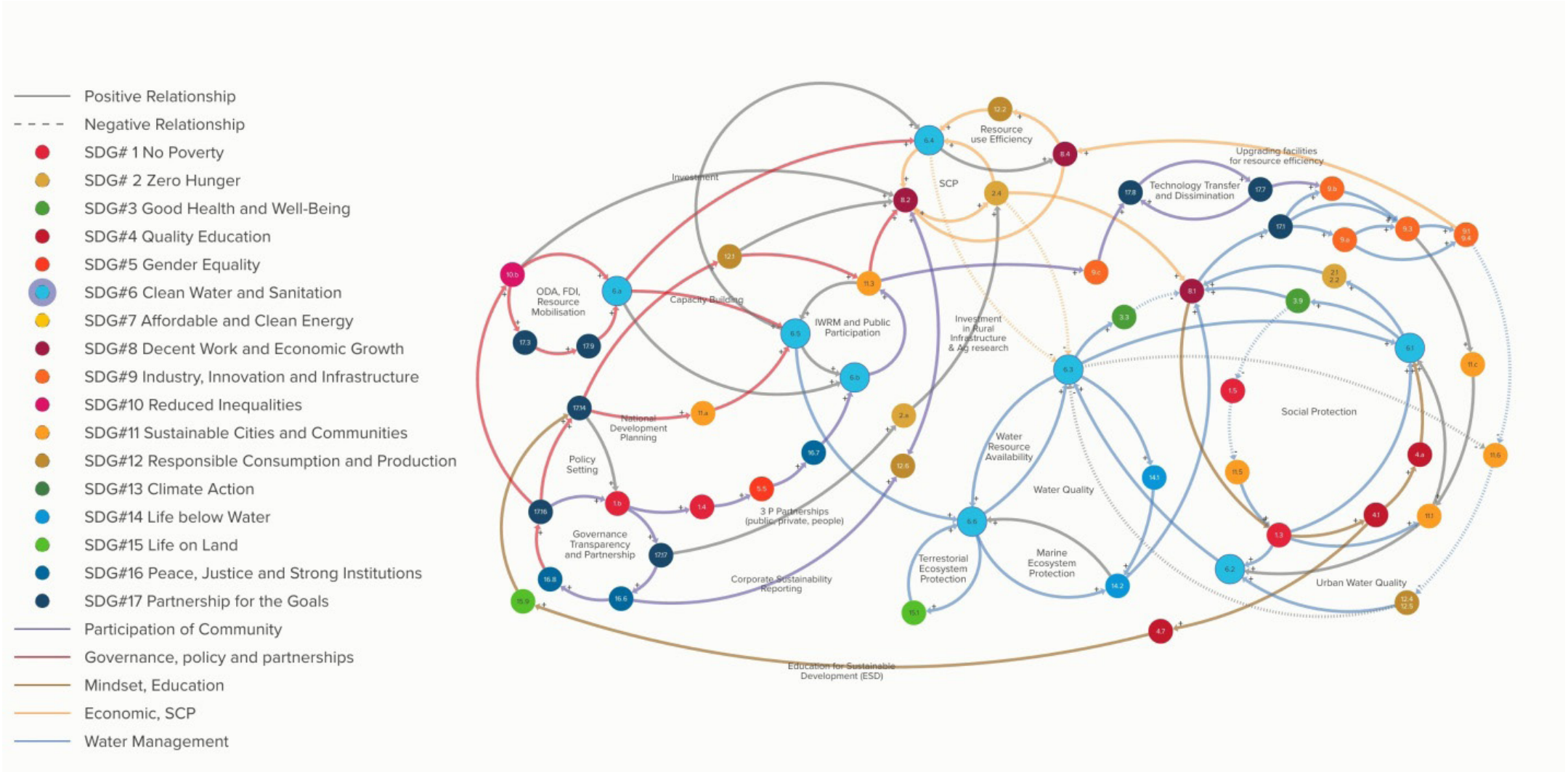
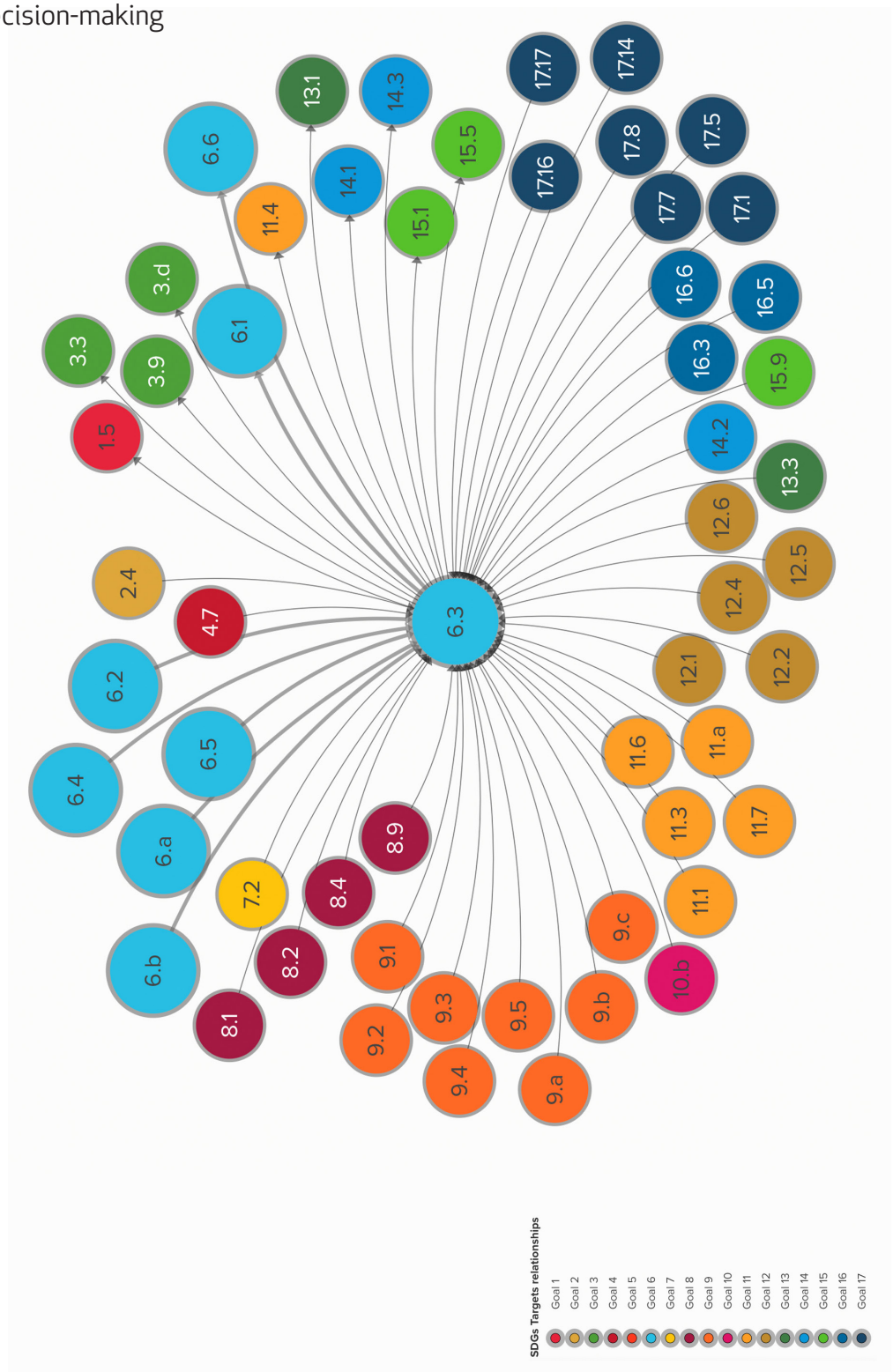
23. See https://sustdev.unescap.org/Files/resource/300add205ca64d4ee4b1c4d1116855ce.pdf.
24. See Meadows, 2009.
25.See Donella Meadows' 12-point leverage point impact framework. Available from https://sustdev.unescap.org/Files/resource/be091e7a9604024298e074d880312c16.pdf.
26. See https://sustdev.unescap.org/Files/resource/be091e7a9604024298e074d880312c16.pdf

Figure 7: Simplified system causal model



Target 6.3 focuses on improving water quality by reducing pollution, eliminating dumping, minimizing the release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally. This is the target with the most direct relationship with other targets—56 of which are direct and 12 of those are a driver type. The target is also indirectly linked to 31 other SDG targets and is also directly influenced by 44 other SDG targets (figure 8). Considering the total number of direct interlinkages found, target 6.3 has the most direct influence on SDG 3 (on human health and well-being), on other SDG 6 targets, as well as on SDG 11 (on cities and human settlements), on SDG 14 (on sustainable use of oceans, seas and marine resources) and on SDG 15 (on sustainable use of terrestrial ecosystems).

Figure 8. Target SDG 6.3 on improving water quality as a key leverage point for effective policymaking and investment decision-making



Furthermore, target 6.3 is strongly influenced by the other SDG 6 targets and by most of the targets of SDG 8 (on inclusive and sustainable economic growth), SDG 9 (on infrastructure and industrialization), SDG 11 (on cities and human settlements), SDG 12 (on sustainable consumption and production), SDG 16 (on peaceful, inclusive and just societies with accountable institutions) and by all of the targets of SDG 17 (means of implementation).

The validity and integrity of the systems thinking modelling largely depends on whether the process of its development allows for wider representation of diverse views of stakeholders who are "system thinkers" by the nature of their engagement. In addition, the approach allows for taking stock of where a group is at, at a given period, and for envisioning where the group would like to move to, hence the aspirational nature of the modelling. With the inclusion of a broad set of SDGs, stakeholders must represent multiple sectors, including NGOs, civil society, government, academia and interest groups.

With the creation of a successful system modelling, the next step is to apply data to quantitatively model the system's dynamics and quantitatively analyse the causal relationships and high-impact leverage points to determine effective interventions and modulate the course of movement of the system model. Quantitative modelling can establish a baseline reading of how the system reacts currently. But to do so, it must rely on trial and error, re-evaluating the direction of relationships and re-fitting the established system's diagram to fit the current state of affairs. It is ideologically helpful to retain a copy of the system's diagram to use as an aspirational model and compare it with the model generated with quantitative data.

In the process of developing the quantitative model for this study, various problems were encountered that related to the availability of data on the SDG indicators and the required use of proxy data sets that actually described only certain aspects of the relevant SDG. An overview of reputable and valid databases from ESCAP, the United Nations Environment Programme, the Food and Agriculture Organization of the United Nations and its AQUASTAT, the World Bank, the World Trade Organization and Yale and Columbia universities revealed significant statistical capacity issues regarding the collection, reporting and reviewing of the data on the integrity of water resources and their renewability. Paramount concerns were the timeliness and reliability of the data. It was concluded that to have reliable quantitative modelling that can accurately describe relationships between the SDG targets, guidelines on how to collect and construct the indicators are needed. The UN-Water's Integrated Monitoring of Water and Sanitation-Related SDG Targets Initiative (GEMI) and guidelines are a useful model for such support to data collection at the national level.

To develop an aspirational analytical model for implementation of SDG 6 in an integrated manner with the other 16 SDGs at the target level, the analytical framework was applied to the national context of three pilot countries—Sri Lanka, Tajikistan and Fiji. The model was considered aspirational by all stakeholders, who, in the processes of developing it, had visualized and modelled a "sustainable water for all" future of universal access to quality water resources and sustainable gender-segregated sanitation for all, while capturing and reusing wastewater and restoring the

natural balance in water ecosystems and also improving water services to industries and urban and rural inhabitants. There is still a long way to go for the pilot countries to reach this aspiration, as well as for most of the ESCAP member States, who are right at the beginning of defining their baseline for the SDG indicators.

The following sections describe the country approaches undertaken and preliminary results of the analysis in the pilot applications in Sri Lanka, Tajikistan and Fiji using SDG 6 on water and sanitation planning as the entry point. The evolution in the modelling process is also described, along with relevant best practices from the national workshops.

The national teams in the three pilot countries were introduced, familiarized and trained to use the ESCAP analytical framework and methodology. Each team interpreted the framework in line with their national circumstances and thus undertook different pathways in applying it. This illustrates the versatility of the systems thinking approach as "fit for purpose" for modelling complex realities and changing dynamics of governance at the national and local levels, as well as for identification of the leverage points for most effective policymaking and investment interventions.

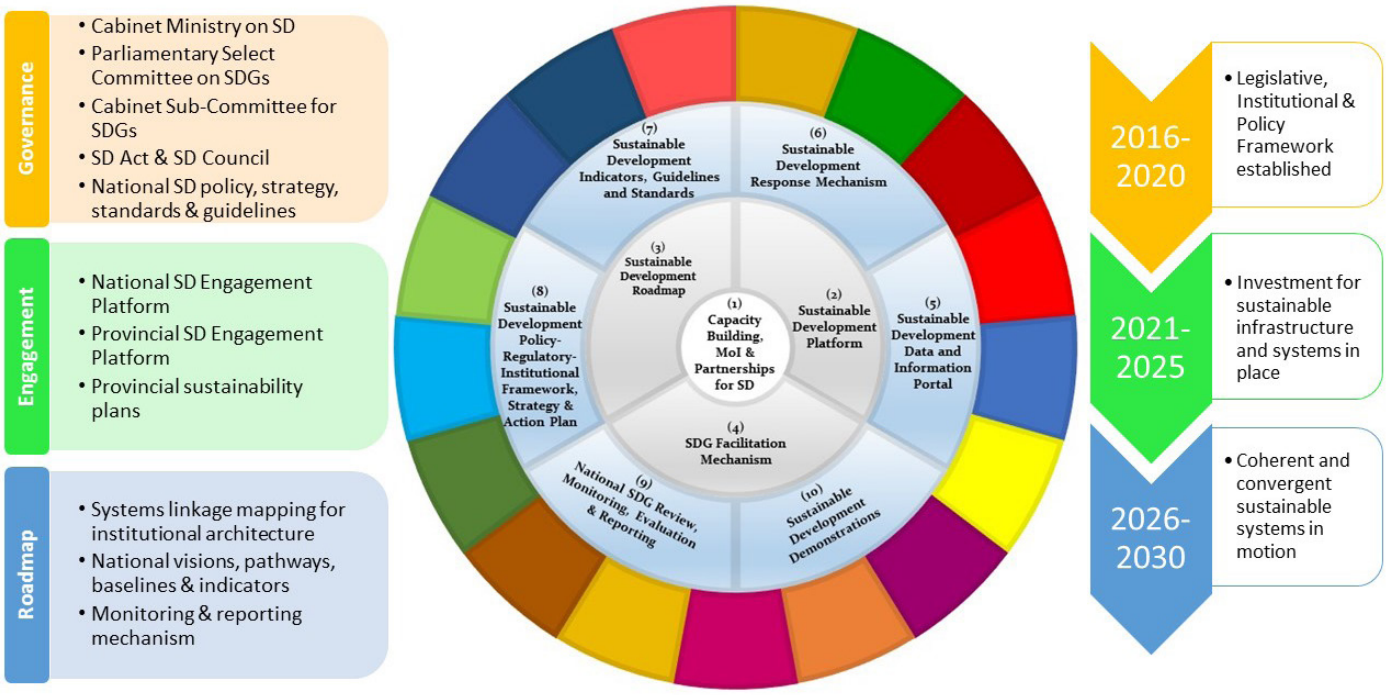
3.3 Pilot application in Sri Lanka[27]

Overview of the national planning for implementation of the 2030 Agenda for Sustainable Development and the SDGs

"Planning for an Inclusive Transformation" is the overarching theme of the national plan for implementation of the 2030 Agenda and the SDGs in Sri Lanka (figure 9). The Government established a Cabinet Ministry on Sustainable Development as a focal agency to coordinate the SDG-related national commitments. Towards strengthening progress accountability, a Parliamentary Select Committee on SDGs and the Cabinet Sub-Committee for SDGs were established. The Ministry of Sustainable Development and Wildlife (MSDW) engages all stakeholders in the planning and implementation of the SDGs via the National Sustainable Development Engagement Platform. The MSDW also initiated the formation of provincial sustainable plans and a national SDG road map to provide the required guidance for the development of sustainable development policy, monitoring, review, reporting and follow-up mechanisms.

27. This section is based on the inputs from a team lead by Uchita de Zoysa, Sustainable Development Advisor for the, Ministry of Sustainable Development and Wildlife, including Mihiri Thennakoon, Saffran Mihnar, Carolina Cirillo Benedetta Nimshani Khawe Thanthrige

Figure 9. A model of the planning process for inclusive transformation in Sri Lanka



Source: Uchita de Zoysa, Sustainable Development Advisor, Ministry of Sustainable Development and Wildlife, 2016.

Major challenges and how systems thinking and the ESCAP framework helped address them

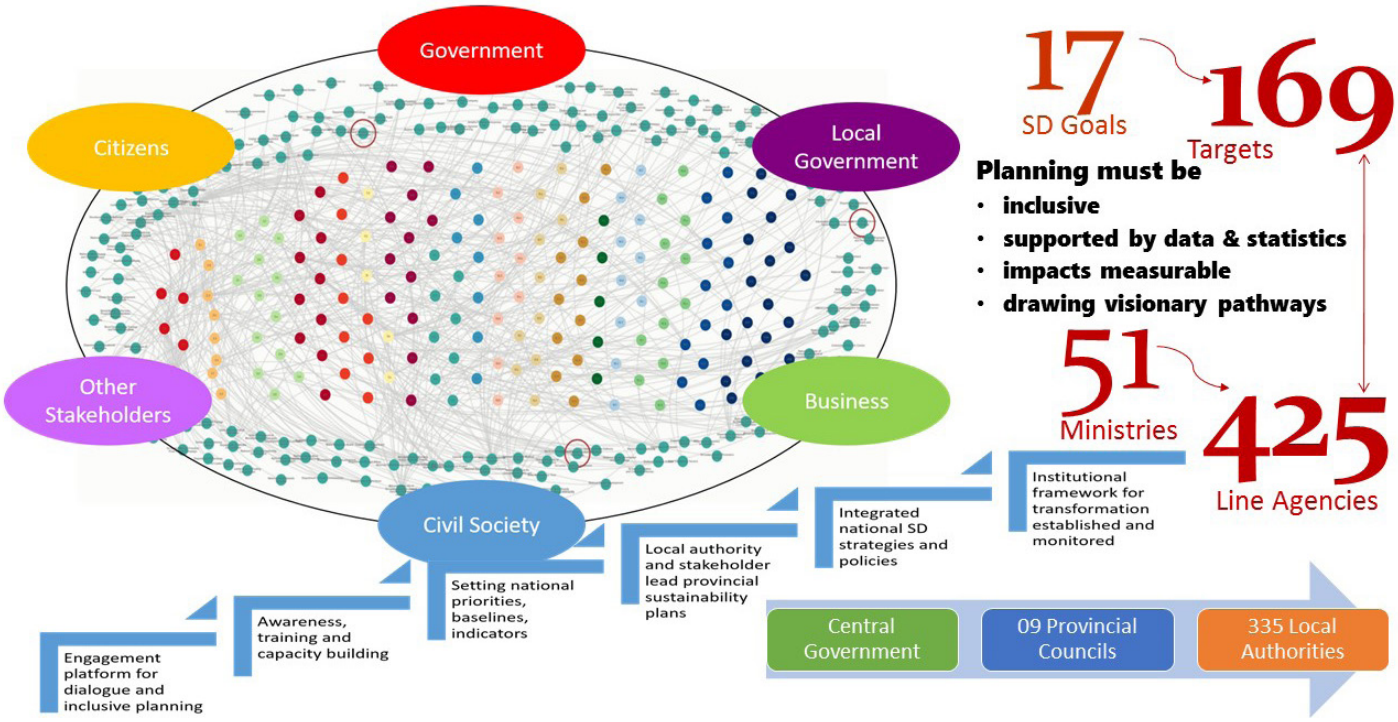
When planning how to improve the attainment rates of SDG 6, the national team in Sri Lanka realized that the water-related challenges including rapid urbanization, water scarcity and degradation, meeting investment needs and improving financial stability were, to a large extent, due to the institutional fragmentation across Sri Lanka's ministries. The systems thinking framework developed by ESCAP facilitated their understanding of the efficiencies of impact interventions, which they categorized as targeting high- and low-impact leverage points.

The team's further analysis revealed three core development and implementation challenges:

- fragmented institutional structure prevents integration;
- duplication of roles and even contradictory mandates obstructs the transformation; and
- multiple focuses, leading to incongruent investment and applications.

The MSDW now seeks options to address these challenges with the systems thinking approach and by mapping out the roles and responsibilities of the 425 implementing agencies under the 51 government ministries that have some relationship with the SDG 6 targets, along with other stakeholders, to improve sector collaboration, data transparency and create an opportunity for integration (figure 10).

Figure 10. Mapping of institutional convergences in Sri Lanka using the systems thinking approach



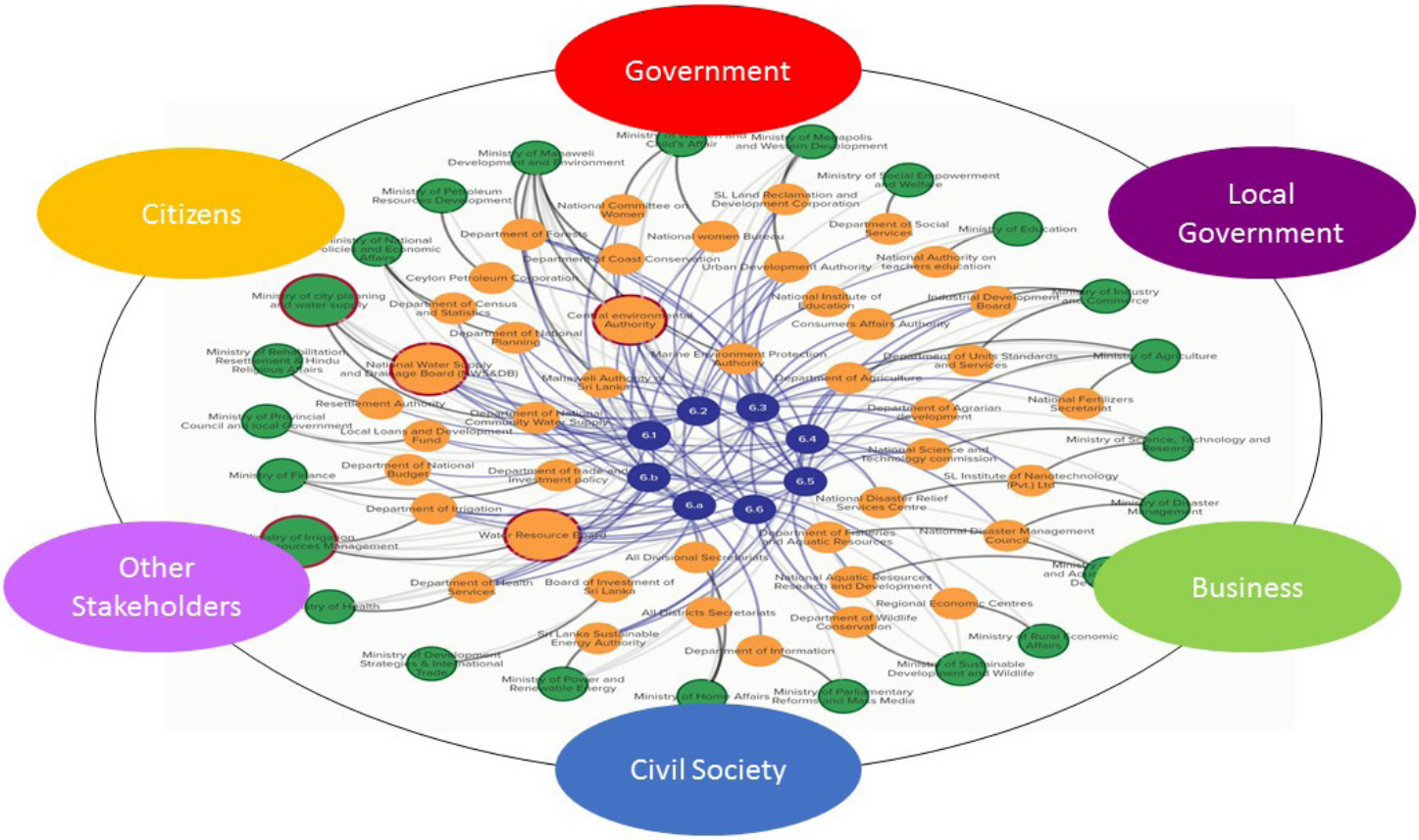
Source: Uchita de Zoysa, Sustainable Development Advisor, Ministry of Sustainable Development and Wildlife, 2016.

Process of developing the systems thinking modelling for addressing SDG 6 targets in an integrated manner with the rest of the SDGs

How was the ESCAP analytical framework applied in Sri Lanka, including institutional review, stakeholder involvement and consultations with relevant sub-sectors?

The National SDG 6 Workshop (in September 2016), organized by the Centre for Environment and Development (CED) in collaboration with the Ministry of Ministry of Sustainable Development and Wildlife and the Ministry of City Planning and Water Supply reflected the participatory and consultative aspect of building a valid systems model. It mobilized broad stakeholder participation from international organizations, civil society, local NGOs and the public and private sectors, contributing to the formation of the SDG 6 Roadmap for Sri Lanka. Applying a systems thinking approach to Sri Lanka's water and sanitation development has resulted in awareness that implementing the eight SDG 6 targets will require collaborative commitment from 43 agencies under 24 government ministries (figure 11). Keys to successful implementation include: (a) creating coherent and coordinated interagency institutional architecture for convergence planning, (b) integrated implementation, (c) political traction towards financial commitments, (d) inclusive planning and (e) embedding subsidiarity-based governance.

Figure 11. Systems mapping of agencies and stakeholder engagement



Source: Uchita de Zoysa, Sustainable Development Advisor, Ministry of Sustainable Development and Wildlife., 2016.

What challenges were experienced and how were they addressed?

The empirical assumptions behind the systems thinking approach naturally led to statistical experiments in quantitative modelling to observe to what extent Sri Lanka's water and sanitation developments could be influenced by other causal variables and vice versa. A key challenge was the lack of available data specifically on indicators representing water renewability (SDG 6.3) and its sustainable management (SDG 6.5), which could hinder valid policymaking. This challenge was addressed in two ways. First, ESCAP provided training on the UN-Water's Integrated Monitoring Guide for SDG 6: Targets and Indicators, which informs ministries on how data collection can occur. Second, it became evident during the National SDG 6 Workshop that many of the Inter-agency and Expert Group's SDG indicators were not feasible under Sri Lanka's national context. As a result, stakeholders and policymakers consulted in small working groups to consider more valid indicators and how to approach data collection and analysis.

Outcomes of the modelling and analysis

Overview of the full aspirational model for sustainable water use in Sri Lanka

The systems model revealed a key insight that Sri Lanka's sustainable water use is dependent upon strategically mobilizing resource capacities and accountable ministerial policies, especially in water renewability. Encouraging official financial flows (SDG 10.b) can promote greater economic risk diversification (SDG 8.2) and inducing sustainable food production systems (SDG 2.4) and water-use efficiency in the agriculture sector (SDG 6.4). Official development assistance (SDG 10.b) can also increase international support for capacity building (SDG 17.9), which can influence water- and sanitation-related activities (SDG 6.a). Sri Lanka's policy coherence (SDG 17.14) affects pro-poor policy frameworks (SDG 1.b), which feeds into the development of stronger national institutions (SDG 16.6) and their participation in international cooperation (SDGs 16.8 and 17.16).

Simultaneously, sustaining economic growth (SDG 8.1) increases the coverage of pro-poor social protection systems (SDG 1.3), which can improve both access to safe drinking water (SDG 6.1) and sanitation (SDG 6.2), thus feeding into better practice of safe water renewability (SDG 6.3). Improved water quality (SDG 6.3) will reduce marine pollution (SDGs 14.1 and 14.2) and strengthen water-related ecosystems (SDGs 6.6 and 15.1), which will help cultivate stronger environmental integrity in Sri Lanka.

Critical interlinkages and impacts on the overall implementation of the model (key feedback loops)

There are three key feedback loops: (a) policy setting and governance transparency, (b) water resource availability and (c) resource efficiency. For Sri Lanka's national water and sanitation development, relevant and valid policy is critical because it establishes strategic ministerial coherence towards targeting a common social and environmental problem. It also encourages transparency of governance to prevent duplicity of efforts and capacity wastage. At its core, water resource availability, quality and renewability significantly impact multiple dimensions of Sri Lanka's development, including vital economic sectors (such as agriculture), poverty reduction and ecosystem integrity (terrestrial and marine). Finally, because Sri Lanka's main economic sector is agriculture (tea, rice, textiles), sustainable and efficient water resource use can induce green growth, which can lead to multidimensional development impacts.

Important cross-sections for short- and long-term interventions (leverage points)

In the short term, Sri Lanka can benefit from targeted interventions to improve its national policy coherence (SDG 17.14), which can be done by strengthening interministerial resource sharing and cooperation, especially on data and monitoring frameworks. This is already being pursued by mapping the agencies responsible for the achievement of the SDG 6 targets. A longer-term strategy involves three additional interventions: to begin sustaining green economic growth

(SDG 8.1) via water-use efficiency (SDG 6.4) and improved water quality (SDG 6.3) through comprehensive wastewater treatment, which can improve water renewability and access-related issues for society.

3.4 Pilot application in Tajikistan[28]

Major challenges and how systems thinking and the ESCAP framework helped address them

Formation of sustainable development in Tajikistan is closely connected with the tasks of building a socially oriented market economy, effective management and careful use of natural resources, and the formation of a modern civil society.

The most important areas to achieve sustainable development parameters in Tajikistan is the need to ensure universal access to modern energy resources (services) and technology, energy efficiency and increased use of renewable energy sources. This is especially true for relatively small countries with a predominance of mountainous regions that are remote from the main infrastructure and are underdeveloped.

National consultations on the 2030 Agenda and the SDGs revealed that the main problematic areas of the country's development after 2015 were:

- education
- health care
- employment
- non-equality
- the fight against corruption
- food security and nutrition
- good governance
- social protection
- to prevention of potential conflicts and
- reliable energy, ecology and management of demographic processes.

The systems thinking model allowed for identifying the challenges to achieving sustainable inclusive development while addressing the interlinkages between SDG 6 with other objectives of the 2030 Agenda in Tajikistan. While developing the models and analysing linkages, the national team identified a critical relationship between SDG 6 and SDG 5 on gender equality. The analysis considered the efforts of the Government to achieve gender equality while addressing critical needs of the female population in rural areas. This modelling created opportunity for identifying

28. This section is based on the inputs from Malika Babdjanova, Head of Interstate Commission on Water Cooperation in Central Asia (ICWC) and the national team, including Saidov Ibragim, Senior Specialist, Secretariat of the Interstate Coordination Water Commission, Rangina Nazrieva, consultant on gender and social issues, and Djalil Buzrukov, Director, Scientific Information Centre-Tajikistan (SIC), Interstate Commission on Sustainable Development in Central Asia (ICSD)

leverage points for application of an inclusive and effective multi-sector integrated approach based on human rights and access to resources for all.

The use and presentation of the modelling allowed, for example, the Committee on Women and Family Affairs to successfully advocate for synergies with the work of the Working Group on Water and Sanitation and the importance of gender aspects influencing implementation of SDG 6. Recommendations for the improvement of cooperation mechanisms between the departments were formulated, based on the system thinking modelling and direct interlinkages between SDG 5 on gender equality, SDG 6 on water and sanitation, SDG 4 on education and SDG 16 on peace, justice and strong institutions.

Overview of the process of developing the systems thinking modelling for addressing SDG 6 targets in an integrated manner with the rest of the SDGs in Tajikistan

How was the ESCAP analytical framework applied in Tajikistan, including institutional review, stakeholder involvement, consultations with relevant sub-sectors?

The national team in Tajikistan, consisting of experts from the water sector as well as gender and social affairs specialists, was introduced to the tools developed by ESCAP, starting with the interlinkages matrix. The linkages were examined critically through the prism of the national circumstances; a system's diagram using Kumu was developed (figure 13). The model highlighting possible feedback loops was further discussed and, after identification of the leverage points, was further simplified. The model was also aligned with the national development strategy and other development plans.

To develop a quantitative model, data collection was initiated and based on guidance provided by ESCAP. Because collecting data for the globally agreed indicators had only just begun, proxy indictors were developed, and data collection was conducted.

In the process of the modelling and data collection, the national team, with support from the Ministry of Energy and Water Resources, mobilized participation and inputs from the following ministries and agencies: the Ministry of Health and Social Protection of the Population, the Ministry of Education, the Ministry of Finance, the Ministry of Economy and Trade, the State Statistics Committee, the Environmental Protection Committee, the state agency Tajikglavgeology, the state enterprise Khojagii Manziliyu Communaly, the Committee on Emergency Situations, the State Investment and State Property Management Committee, the Hydrometeorology Agency, the Forestry Agency and the Committee on Women and Family Affairs.

What challenges were experienced and how were they addressed

There was a lack of sufficient time to collect the required data, and the quantitative model could not be completed. Collection of data following the proposed SDG indicators was found to be extremely challenging because of a lack of understanding and guidance on the data collection methodologies.

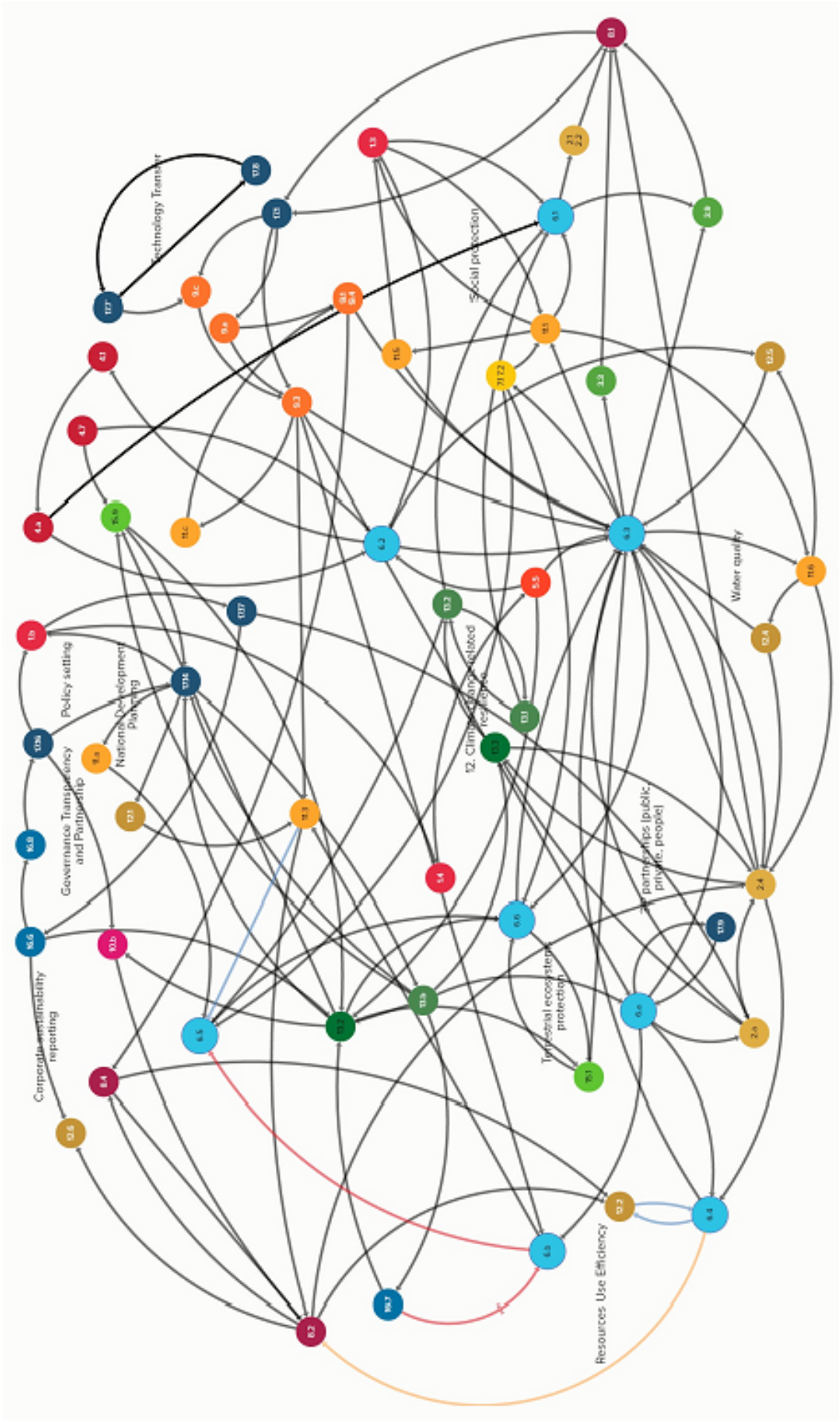
The national team informed ESCAP that the Government is developing nationally appropriate indictors for monitoring the SDGs while considering the goals and targets of the National Development Strategy, as well as midterm development strategies, sector strategies and provincial programmes. The ESCAP framework provided a useful basis for mapping and analysis of the interlinkages and causal relationships between the SDG indicators and in the targets in the national planning documents. Data for 38 selected targets were found convergent with these national planning documents. However, the team concluded that the global indicators need adjusting to the country context through a process of localization and further clarification and guidance on data collection methodology. The national team also requested more training and translation of the UN-Water's integrated guidelines for monitoring SDG 6 in the Russian language.

Outcomes of the modelling and analysis

Overview of the full aspirational model for sustainable water use in Tajikistan

A detailed analysis of the system's model for sustainable water use in Tajikistan was conducted (figure 12).

Figure 12. Full aspirational system model for Tajikistan "for sustainable water for all"



Tajikistan's sustainable development is tightly wound around its thorough management of water resources, as evidenced by its deep integration across all 17 SDGs (figure 13). The development of good governance, transparency and partnerships were considered key for a sound policy framework for pro-poor and gender-sensitive strategies for poverty eradication planning (SDG 1.b).

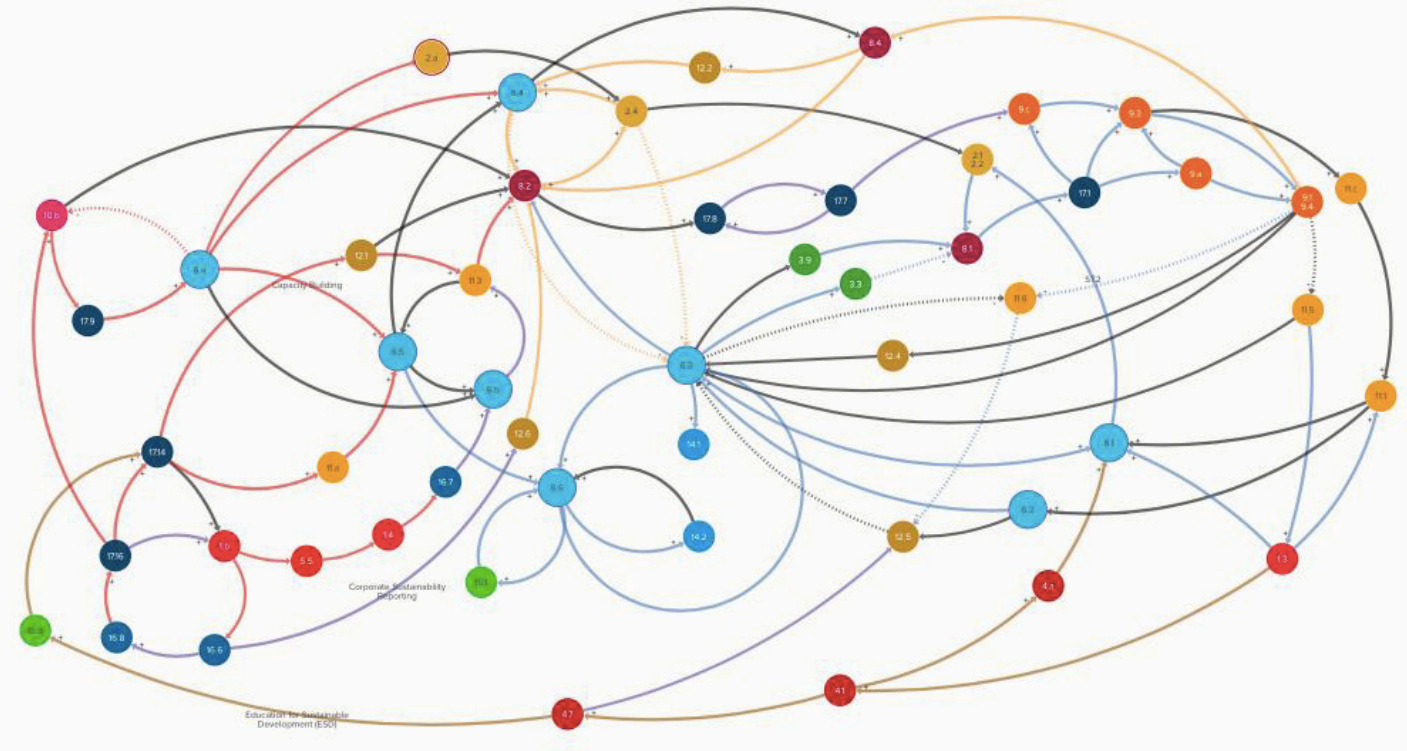
Corporate sustainability reporting (SDG 12.6) can influence and is being influenced by the prioritizing of higher levels of economic productivity (SDG 8.2) and global resource efficiency through sustainable consumption and production, which drives the decoupling of economic growth from environmental degradation (SDG 8.4). Especially in Tajikistan, where the natural resource base is declining, the 2030 Agenda emphasizes its conservation, for which conscientious reporting frameworks (SDG 12.6) can help monitor progress. Economic productivity (SDG 8.2) depends on fresh water-use efficiency (SDG 6.4), which is enhanced by capacity-building support for water harvesting, desalination, recycling and waste-water treatments (SDG 6.a). Improving water-use efficiency (SDG 6.4) also feeds back into reduced water pollution and sustainable wastewater management (SDG 6.3).

Critical interlinkages and impacts on the overall implementation of the model (key feedback loops)

Water quality (SDG 6.3) is considered a key leverage point (figure 14) because it depends on multiple factors, including waste generation (SDG 12.5) , terrestrial ecosystem conservation (SDG 15.1) and food production systems (SDG 2.4) that can lead to multi-sector changes, including reduction of waterborne diseases (SDG 3.9) and resilient basic services in urban settlements (SDG 11.1). Good water governance, especially for transboundary Central Asia water quality (SDG 6.3), can reinforce the feedback loop between integrated water resource management (SDG 6.5) and water-related ecosystems (SDG 6.6).

Water governance (SDG 6.a) through public–private partnerships (SDG 17.9) can also improve climate change resilience (SDG 13.1), mitigation efforts (SDG 13.3) and integration of climate change into Tajikistan's national planning (SDG 13.2), thereby improving social protection systems (SDG 1.3) and universal access to safe drinking water (SDG 6.1), as well as education facilities (SDG 4.a). And it can influence the situation of hunger and malnutrition (SDGs 2.1 and 2.2).

Figure 13. Important cross-sections for short- and long-term interventions (key leverage points)



3.5 *Pilot application in Fiji*

The pilot application for Fiji is still in an initial stage. The preliminary analysis of integrating the water-related goals of the 2010–2014 Roadmap for Democracy and Sustainable Socio-Economic Development[29] with the targets of the Green Growth Framework of Fiji: Restoring the Balance in Development That Is Sustainable for Our Future[30] indicates very promising results.

Based on the preliminary mapping that was conducted during a one-day training with the Fiji national team[31], an aspirational model was developed (figure 14).

The process of ensuring sustainable and safe sanitation systems for every Fijian household (SDG 6.2) can support community awareness on water conservation (SDG 6.4), especially for residential use. With greater attentiveness to the scarce water resources, it would promote aggressive leakage reduction programmes, including making rainwater harvesting compulsory for car-washing businesses (SDG 6.4). Stronger water conservation policies would allow Fiji to achieve universal and equitable access to safe and affordable drinking water (SDG 6.1), thereby establishing positive reinforcement of the implementation of Fiji's Green Growth Framework (SDGs 8.4 and 13.2).

29. Ministry of National Planning, 2010.
30. Ministry of Strategic Planning, 2014.
31. The members of the Fiji national team who were trained in December 2016: Kamal Krishnan Gounder, Principal Economic Planning Officer, Ministry of Economy, Epeli Waqavonovono, Economic Planning Officer, Economic Services, Ministry of Economy, Susana P. Valemei, Director Water and Sewerage, Janesh Sami, Lecturer, Fiji National University and Pita Tagicakirewa, Malaysia - High Commission of the Republic of Fiji.

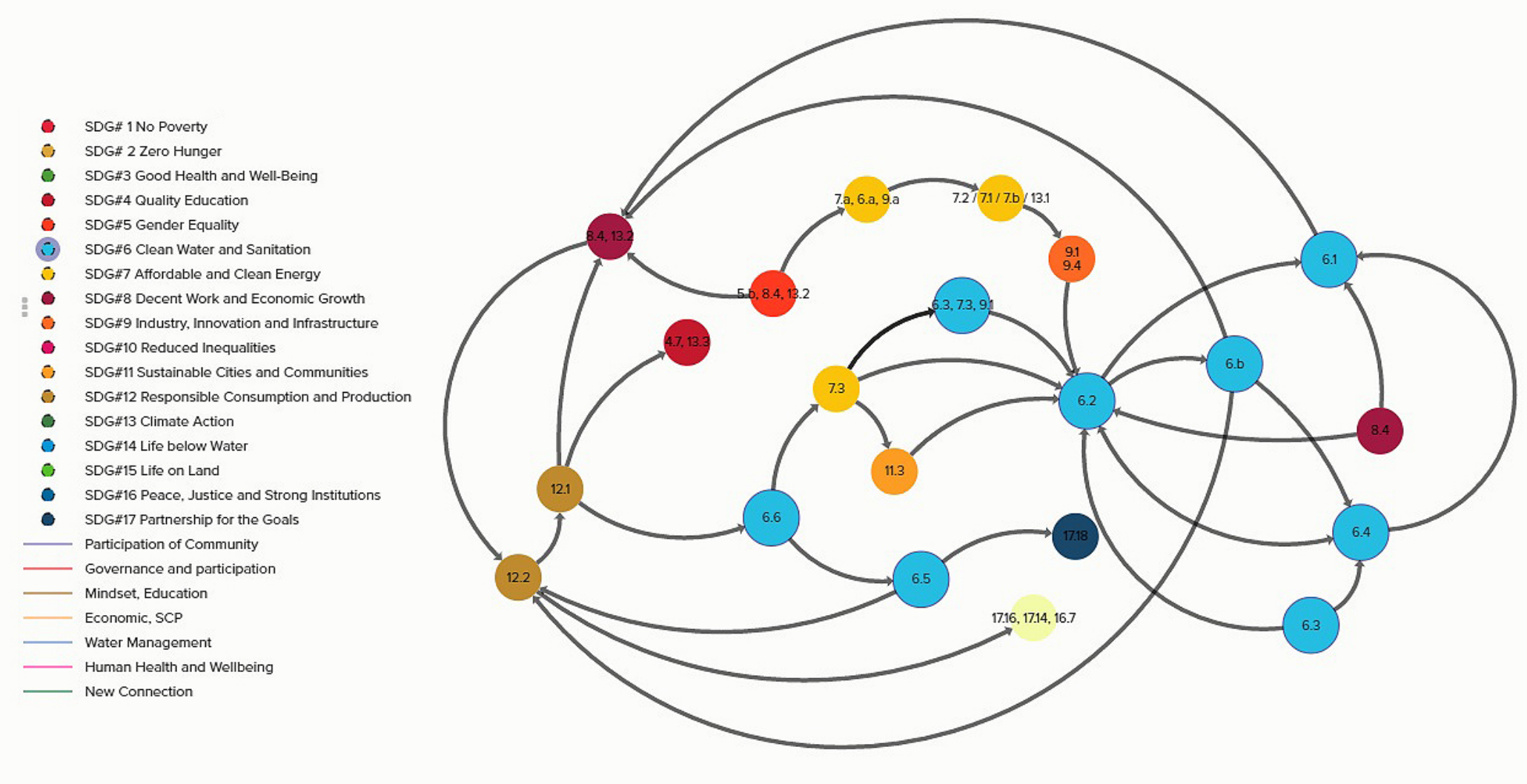
Implementation of the Green Growth Framework (SDGs 8.4 and 13.2) would increase the reviewing of policies related to the governance of water and services (SDG 12.2), which would induce the development and adoption of a legislative framework for the sustainable commercial extraction of groundwater (SDG 12.1). This would allow for the implementation of water catchment management programmes for the protection of freshwater resources, as well as the education and awareness of programmes on sustainable management and use of those resources. Simultaneously, the legislative framework (SDG 12.1) would allow for the identification of new water sources (SDG 6.6) and installation of standardized treatment systems (SDG 7.3) for water renewability.

The review of Fiji's water governance policies (SDG 12.2) would facilitate better coordination of roles and responsibilities among stakeholders (SDGs 16.7, 17.16 and 17.14). Additionally, the development of an integrated water resources monitoring and management mechanism (SDG 6.5) would have dual impact on encouraging better data sharing among stakeholders (SDG 17.18) as well as feeding back into the review of water governance policies (SDG 12.2).

Arguably, the installation of standardized treatment systems (SDG 7.3) is a high-impact leverage point based on the variables it influences. For example, installing standardized treatment system can lead to the modernizing of sewerage plants (SDGs 6.3, 7.3 and 9.4), thereby prompting a sustainable sanitation system for household use (SDG 6.2). While the connection between standardized treatment systems (SDG 7.3) and sustainable sanitation systems (SDG 6.2) is indirect, there is also a direct causal link. Investing in treating wastewater (SDG 7.3) can also enhance the capacity of the services and server providers (SDG 11.3), feeding back, once again, into a sustainable sanitation system for Fijian households (SDG 6.2).

An additional high-impact leverage point is the investing in renewable energy technology and the development of business models (SDGs 5.b, 8.4 and 13.2), according to the country's Green Growth Framework (SDGs 8.4 and 13.2). Emphasizing renewable energy technology can also encourage official development assistance and foreign direct investment support for renewable energy technology development (SDGs 6.a, 7.a and 9.a), which then can induce the development of renewable energy-based desalination technologies (SDGs 7.1, 7.2, 7.b and 13.1). To stress the importance of desalination pursued via renewable energy, a policy to install desalination plants in selected islands (SDGs 9.1 and 9.4) could be done, which would lead to sustainable sanitation systems for Fiji overall (SDG 6.2).

Figure 14. Preliminary analytical model of interlinkages between the SDG targets and the national planning documents for Fiji



4. Going beyond SDG 6: The systems thinking approach for planning and implementing the 2030 agenda

This chapter applies the analytical framework and the analytical modelling discussed in the previous chapter to various cases that move away from the SDG 6-centric focus and look at other SDGs and targets. Case studies are based on the group work during the Regional Seminar on Integrated Approaches for SDG Planning: The Case of SDG 6 on Water and Sanitation, (28–29 November 2016) and follow-up research work of the ESCAP team.

4.1 Integrating and localizing SDG 6 for inclusive, safe, resilient and sustainable cities

Integrated urban systems to support the delivery of the SDG targets

The challenge facing the city of the future is to develop robust yet flexible systems that can respond to inevitable shocks—shocks presented by climate change, population growth, resource depletion, economic instability and natural and human disasters. There is a need to develop the scientific, technological and social innovations necessary to build this new resilient city and to manage our transition to a more liveable and sustainable future.

Extensive research in energy supply, water management and transportation has begun to increase the efficiency of these individual infrastructural subsystems. Only recently, however, has research begun to develop an integrated analysis of urban services at the system level to increase the efficiency of the resource streams and improve the resiliency of the overall urban system .

Research on urban metabolism uses the analogy between cities and living systems for analysing, planning and implementing resilient and sustainable urban development.[32] Recent research has demonstrated that urban metabolism models are a powerful tool for combining and tracking different resource streams and comparing different scenarios.[33] The increased availability of data, coupled with recent developments in modelling and simulation, means that it is now feasible to conduct more detailed holistic analyses that allow us to consider the interactions and interdependencies between different flows of materials and to track the physical, spatial and temporal movement of all resource streams in cities, on a common analysis platform.

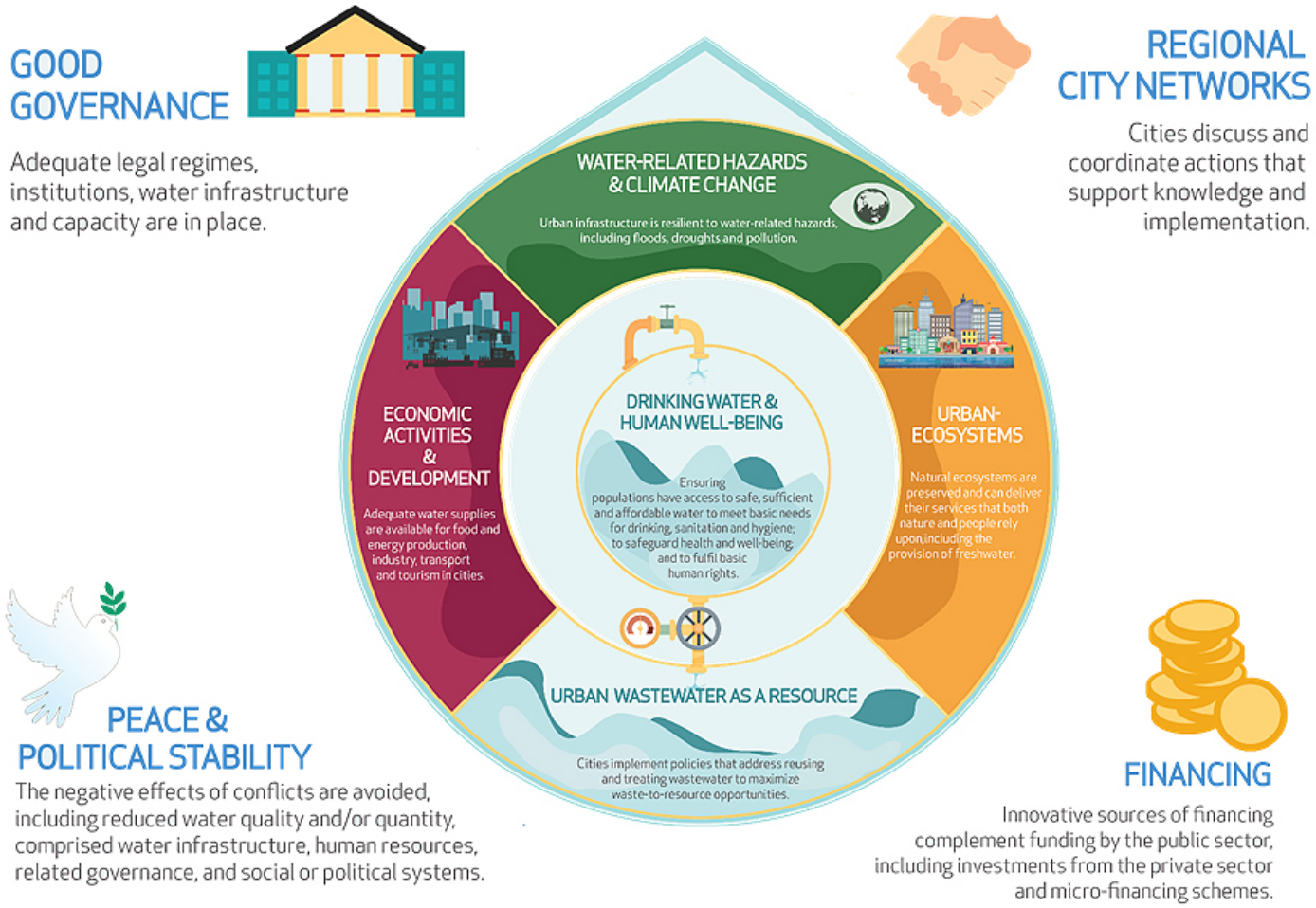
Research on collaborative virtual urban planning environments allows for the visualization of complex geospatial and demographic data sets that support strategic urban planning. There has been significant progress in the development and application of 3D-visualization tools, for

32. See Golubiewski, 2012, pp. 751–764.
33. Ramaswami, and others, 2012.

instance, and these have enabled spatial planners, architects and engineers to optimize urban design and reconcile the impact of different spatial configurations on infrastructure systems and resource flows.

The new sustainable development agenda brings great opportunities to further develop and use existing innovations on urban systems analysis and to "make cities and human settlements inclusive, safe, resilient and sustainable" (SDG 11). For example, urban systems modelling and 3D visualization (figure 15) could be extensively developed and applied as a collaborative platform that facilitates fruitful debates and discussions among stakeholders. A 3D collaborative virtual decision support platform (incorporating the urban metabolism model) allows for the visualization of the relationships between urban forms and resource use. It also enables the creation of an interactive workspace that could be used by citizens, experts, city stakeholders and policymakers to conduct foresight studies on "alternative futures" for scenario analysis. Such models would engage a broad range of stakeholders whose decisions influence the systems and resource flows and allow for planning the inclusive, safe, resilient and sustainable cities we want.

Figure 15. Thematic priorities for localizing the SDGs in an urban context

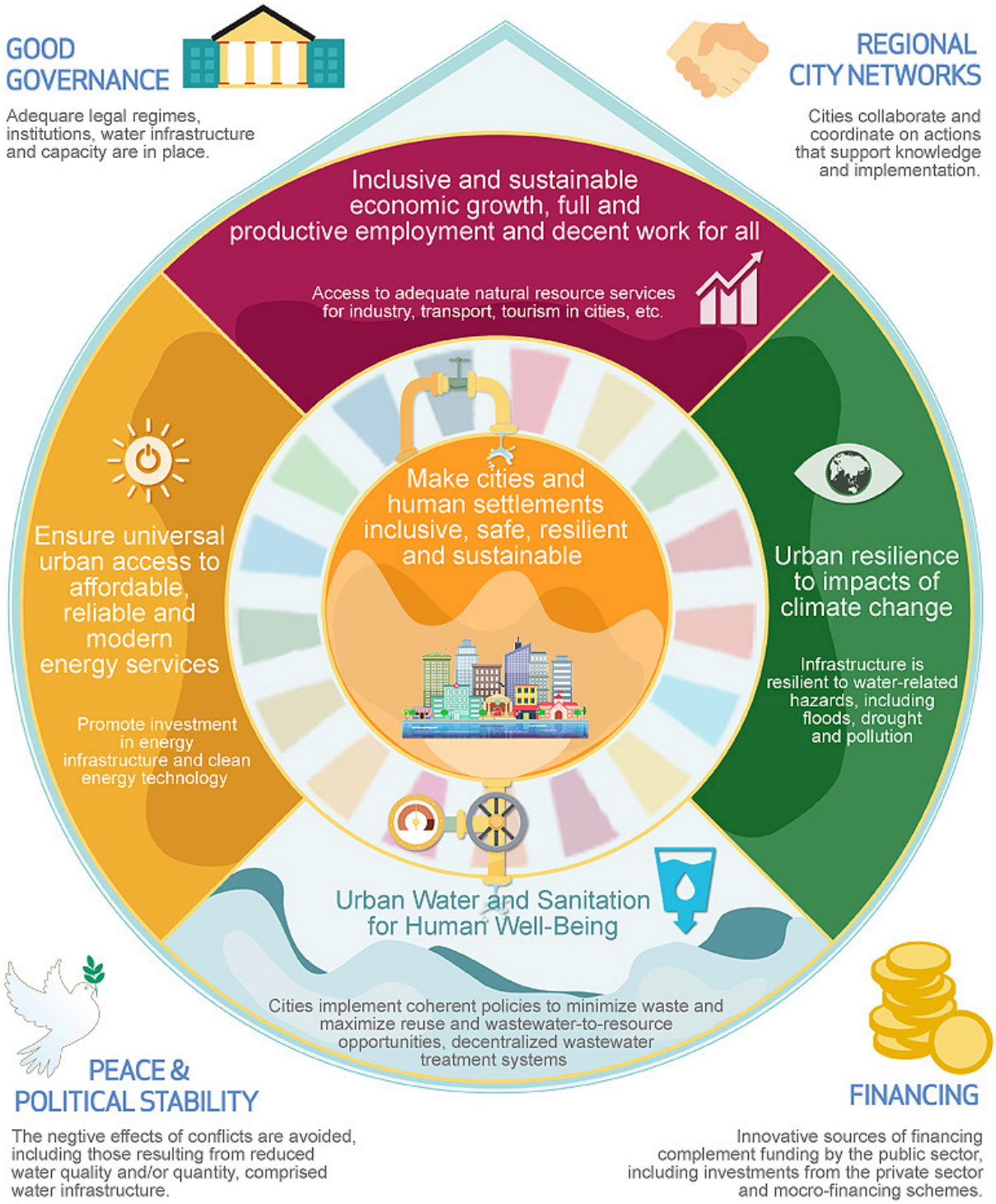


Source: ESCAP, 2015.

Harnessing key SDGs interlinkages for inclusive, safe, resilient and sustainable urban development

To facilitate this transformation, the vision of SDG 11 on making cities and human settlements inclusive, safe, resilient and sustainable should be the central viewpoint and in direct interlinkage with the cluster of related SDGs (figure 16).

Figure 16. Making cities and human settlements inclusive, safe, resilient and sustainable by localizing the SDGs



Source: ESCAP, 2017.

A few good practices on interlinkages of SDG 11 with other SDG targets are provided.

The reoccurring floods (SDG 13) led Nagoya, Japan, for example, to adopt the Integrated Water Resources Management approach (SDG 6.5) for a "water hazard-resilient city". Public participation and the promotion of multiple partnerships to carry out the plan fostered trust and better disaster prevention, built on better awareness of the renewable water cycle and its impacts on the health and well-being of the city (SDGs 3 and 8).

The Smart Water City Paju in the Republic of Korea adopted ICT techniques (SDG 7) that generate safe tap water, with a secure and good-quality water supply. This removed apprehensions among the public about drinking water from the tap, which resulted in increased tap water drinking rates, jumping from 1 per cent to 24.5 per cent, with a high rate of customer satisfaction, at 88.2 per cent (SDG 6.1).

The Public Utility Board of Singapore installed a deep-tunnel sewage treatment system to sustain the country's long-term needs. The used and treated water is further purified at NEWater plants to meet 30 per cent of the country's water needs (SDG 6.3). Thus, the innovative water and sanitation urban governance of Singapore, built on the inventive capacity of citizens, improved health outcomes (SDG 3) and the productivity of the economic workforce (SDG 8).

Bangkok's wastewater user charge is financing the process for wastewater treatment and is also being used towards addressing other serious environmental issues. Bangkok promotes the education and participation (SDGs 4, 6.a and 6.b) of local communities in wastewater treatment projects and promotes reuse of treated wastewater in agriculture and industry.

Daego and Seoul, Republic of Korea, are applying the eco-efficient infrastructure (SDG 9) and wastewater management (SDG 6.3) for water-smart and resilient cities with Integrated Water Resources Management planning (SDG 6.3) to mitigate climate-change related hazards, such as flood and drought (SDG 13).

Major challenges and how systems thinking helps address them

The drinking water and human well-being targets of SDG 6 focus on ensuring access to safe, sufficient and affordable water to meet basic needs. This requires a foundation that is based on the human rights of the urban population for safe drinking water, sanitation and hygiene. Cities would need to implement coherent policies to minimize waste and maximize reuse and wastewater-to-resource opportunities (such as through decentralized wastewater treatment systems).[34]

By targeting achievement of SDG 7, a city would ensure universal access to affordable and modern energy services, with policy coherence to be ensured by promoting investments in energy infrastructure and clean energy technology. With cities responsible for 80 percent of a nation's gross domestic

34. See https://sustdev.unescap.org/course/detail/4.

product, the achievement of SDG 8 would facilitate inclusive and sustainable economic growth, full and productive employment and decent work for all. The access to adequate natural resource services for industry, transport and tourism in cities should be maintained with related integrated policy packages. SDG 13 works to strengthen urban resilience to impacts of climate change, but it requires policies that promote infrastructure that is resilient to water-related hazards, including flood, drought and pollution.

Overview of processes, including stakeholder involvement, collaboration, cooperation and coordination between institutions

Integrated strategic approaches and enabling policy tools to facilitate a shift towards water-hazard resilient infrastructure and sustainable cities aim at achieving safe and adequate water supply and sanitation services, sound water-related ecosystems, a high level of water use efficiency as well as a greater urban resilience to water-related disasters within the framework of Integrated Urban Water Management (IUWM).

A sustainable urban metabolism is upheld intrinsically by systems thinking values, including in the urban water cycle, where alternate purposes for water resources are demonstrated by the integrative approaches applied in cities. The roles and responsibilities of the local and provincial governments to transform local needs and problems into sustainable strategies must be harmonized with the vision, goals and actions of the national level. And they require better awareness of water cycles and their services in all other sectors.

4.2 Cat Ba Island, UNESCO Biosphere Reserve and World Heritage Site

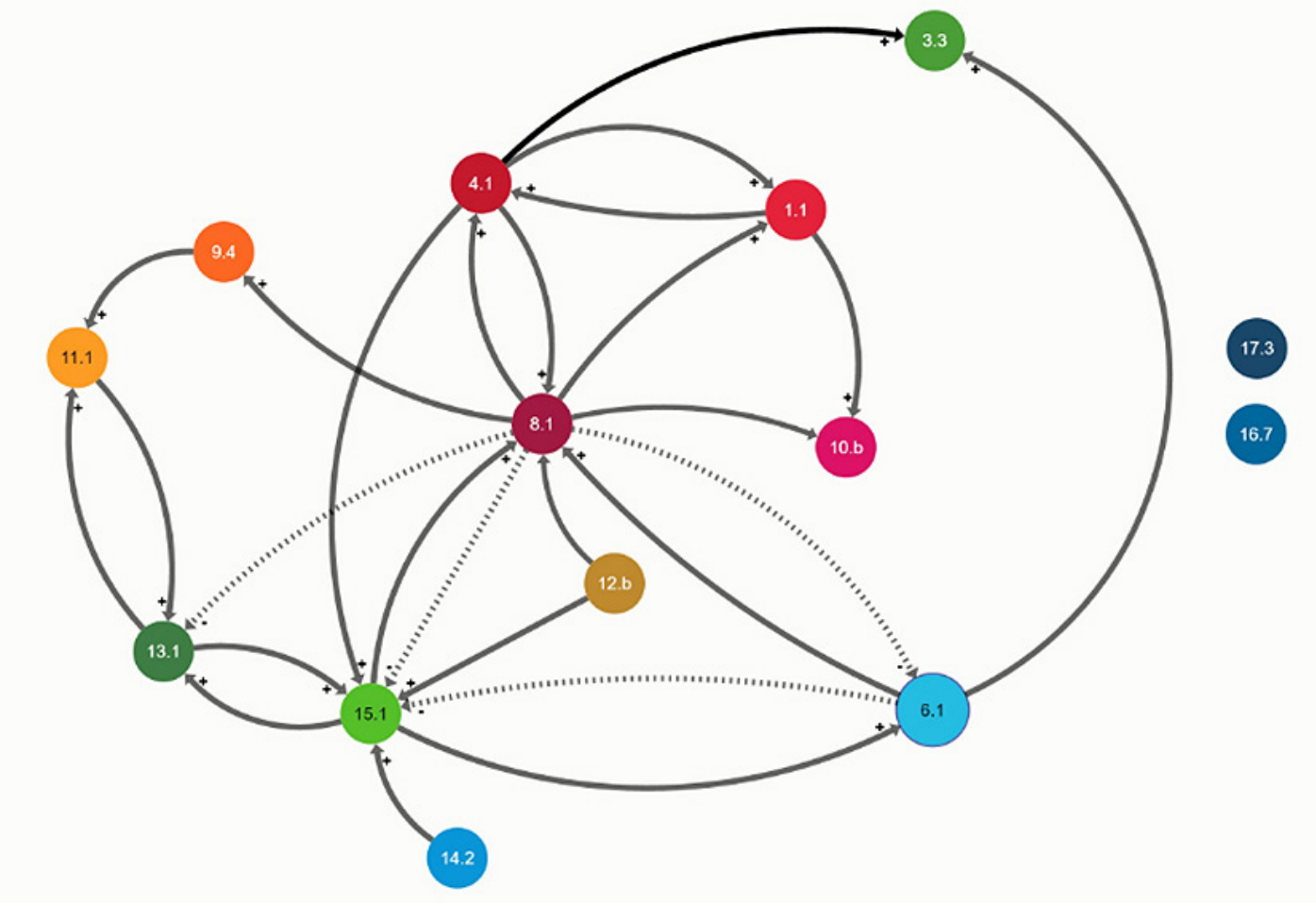
Located in northern Viet Nam, the Cat Ba Island is recognized as worthy of biodiverse global conservation by the UNESCO Biosphere Reserve Programme. It is experiencing increased tourism, which has encouraged local illegal exploitation. Natural resources, such as groundwater and land, are experiencing overuse.[35] As much as 60 per cent of Cat Ba Island's economic output is from the tourism industry, yet, its infrastructure is poor and unsustainable.[36] A systems thinking approach was used to further understand the Cat Ba Island's resource strengths and weaknesses (figure 17).[37]

Cat Ba Island's key strength lies in its continuing economic growth (SDG 8.1), which acts as the impetus to facilitate inclusive education for community members (SDG 4.1), thereby feeding back towards more resilient green growth (SDG 8.1) and reducing extreme poverty prevalence (SDG 1.1). Investing in education (SDG 4.1) encourages community health and well-being (SDG 3.3) by disseminating knowledge about sustainable living habits. The health situation (SDG 3.3) is also uplifted by ensuring equitable access to safe drinking water (SDG 6.1). Simultaneously, access to water resources (SDG 6.1) maintains the health of the local economy (SDG 8.4), but economic overdevelopment risks polluting drinking water resources, inducing a balancing feedback loop.

35. Ishwaran, and Persic, 2008.
36. Nguyen, Bosch, and Maani, 2009.
37. ESCAP, 2016.

Polluted water resources (SDG 6.1) can negatively impact the protection of natural ecosystems (SDG 15.1), which is hazardous because natural resource integrity (SDG 15.1) can protect the Cat Ba community from changing climate effects (SDG 13.1). Investing in integrated systems thinking tools to monitor sustainable tourism impacts (SDG 12.b) would both increase its economic attractiveness (SDG 8.1) and improve biophysical conservation efforts (SDG 15.1). Arguably, SDG 12.b is a high-impact leverage point due to its capability to induce green growth, which further triggers social development (health and education) by way of water. Financial assistance (SDG 17.3) and stakeholders' participation in decision-making (SDG 16.7) are two overarching influences that strengthen system connections between nodes.

Figure 17. Systems thinking modelling applied to the Cat Ba Biosphere Reserve in Viet Nam



The analytical framework developed by ESCAP was applied to three regional issues, categorized as "emerging", "persistent" and "systemic", because they had impacted their overarching biophysical and socioeconomic systems and subsystems for the time frame of the research. Within the past five years, microplastics along the Japanese coast (defined as pieces shorter than 5 mm in diameter) have emerged, threatening to disrupt marine animal life and further acidify the ocean.[38] In Singapore, water-resource scarcity has persisted in raising the cost of living in the small city-state, causing the Government to turn towards use of "new water " to fulfil access-related needs.[39]

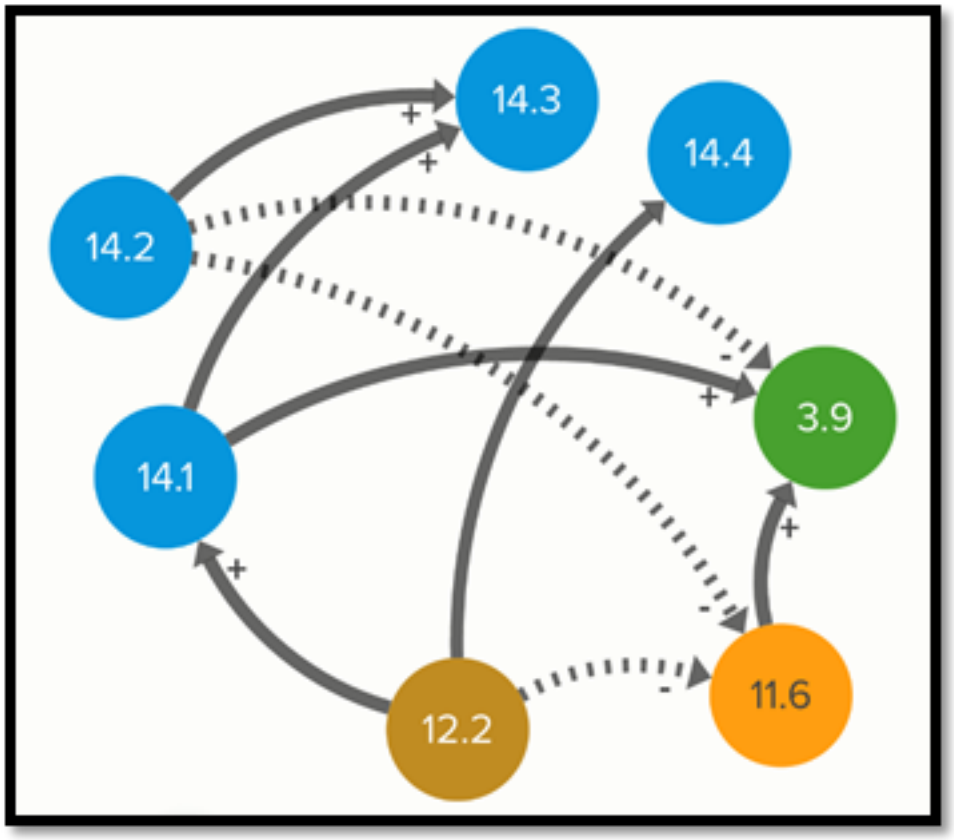
38. Kawaguchi, 2015.
39."New water" is recycled, reclaimed and reused. World Bank, 2006.

And in Nepal, while the availability of sanitation facilities are of great concern, gender issues cross-cut and magnify the systemic issue of gender-based inequalities, causing an entire host of implications that influence the female population's education, health, well-being and effective participation in society.[40]

4.3 Emerging issue: Microplastics in Japan[41]

The case study on microplastics in Japan (figure 18) directly connects to SDG 14 (on life below water) and indirectly connects to SDG 3 (on good health and well-being), SDG 11 (on sustainable cities and communities) and SDG 12 (on responsible consumption and production). Sustainably managing and protecting marine ecosystems (SDG 14.2) and reducing marine pollution (SDG 14.1) are the keys to solving the trash problem that Japan is facing. If those two issues are addressed, they will help reduce ocean acidification (SDG 14.3), environmental impacts to the country (SDG 11.6) and reduce the number of deaths due to water pollution (SDG 3.9). At the same time, Japan, as a large consumer of marine products, faces a serious problem of illegal, unreported and unregulated fishing (SDG 14.4), reflecting a need to also change production and consumption patterns (SDG 12.2).

Figure 18. Systems thinking causal diagram for the emerging issue of microplastics in Japan

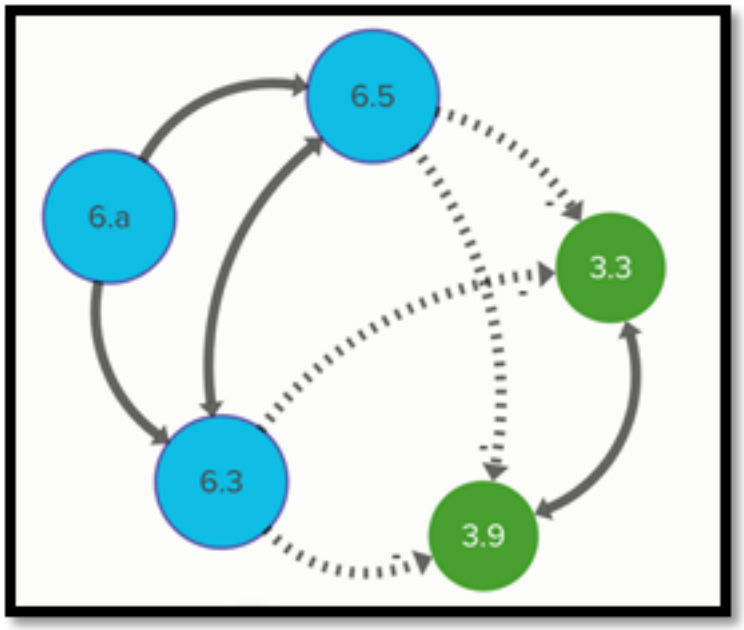


40. Mahon, and Fernandes, 2010.
41. Analysis and modelling were based on http://asia.nikkei.com/Tech-Science/Science/Trash-clogged-oceans-have-alarm-bells-ringing?page=1 and www.japantimes.co.jp/opinion/2016/07/30/editorials/plastic-waste-turning-seas-toxic/.

4.4 Persistent issue: Wastewater management in Singapore[42]

The case study on wastewater management in Singapore directly connects to SDG 6 and indirectly connects to SDG 3 (on good health and well-being). Singapore, perhaps more than any other country, has limited natural resources and a particularly critical situation with water resources. Water- and sanitation-related programmes (SDG 6.a) are extremely important to sustainably manage water in the country (figure 19). The Government is thus implementing and integrating these programmes at all management levels through transboundary cooperation (SDG 6.5) that will improve the quality of water and increase the treatment of wastewater (SDG 6.3). The overall result will reduce the contamination of waterborne diseases (SDG 3.3) and will substantially reduce the number of deaths from water pollution (SDG 3.9).

Figure 19. Systems thinking causal diagram for waste water management in Singapore

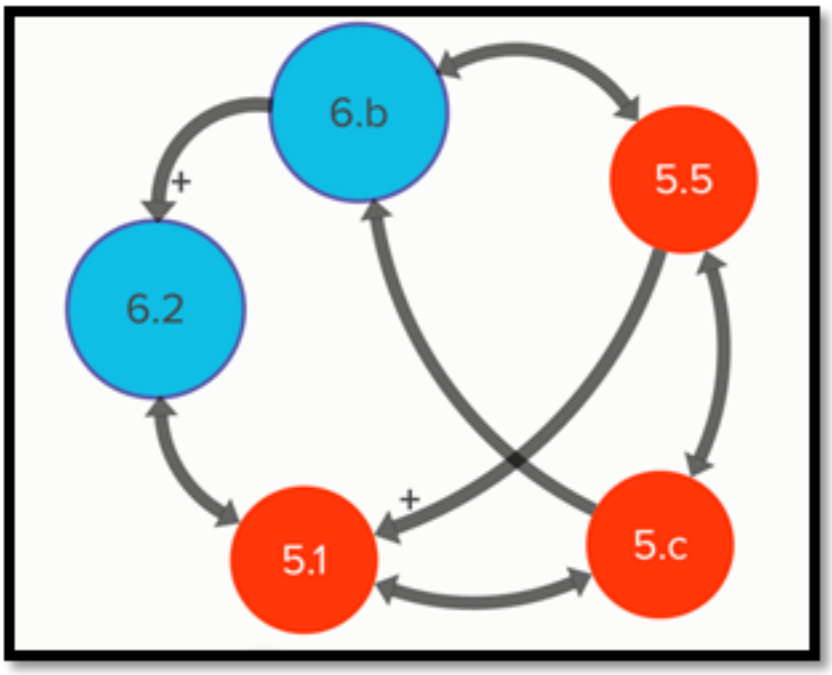


42. Analysis and modeling were based on http://siteresources.worldbank.org/INTEAPREGTOPENVIRONMENT/Resources/WRM_Singapore_experience_EN.pdf

4.5 Systemic issue: Gender and sanitation facilities in Nepal

The case study on sanitation facilities in Nepal directly connects to SDG 5 (on gender equality) and indirectly connects to SDG 6. Nepal faces a serious problem of inadequate sanitation and hygiene (SDG 6.2), especially for girls. Several survey findings have shown that girls perform poorly at school when they menstruate because they fear it will become a trigger for ridicule or discrimination (SDG 5.1) by boys. The greater the participation of women in decision-making processes (SDG 5.5), the more likely sound policies and enforcement of legislation for the empowerment of girls (SDG 5.c) will be (figure 20).

Figure 20. Systems thinking causal diagram for the gender dimensions of sanitation facilities in Nepal



5. The way forward

The value of systems-based tools in planning and implementing the SDGs is immense.

First, by understanding the complementarities and interlinkages across the SDGs, governments can link existing development plans with the goals and targets and thus eliminate trade-offs, identify co-benefits and uphold the indivisibility of the 17 goals. For example, the Fiji national team applied the approach to identify the interlinkages between its Green Growth Framework targets with the SDG targets, with a focus on water-related issues. Through the modelling, they determined that the water conservation policies in place were contributing to increased water efficiency (SDG 6.4), which was contributing towards achieving universal and equitable access to safe and affordable drinking water (SDG 6.1) and supporting more equitable, efficient and low-carbon economic growth (SDGs 8.4 and 13.2).

Second, the framework also allows governments to engage a diversity of stakeholders to jointly define problems and develop effective solutions. When stakeholders are involved, there is greater chance of stronger cross-sector cooperation and collaboration in implementation. While working on the "national sustainable water for all" model in Tajikistan, for instance, the national team there engaged a range of stakeholders, including experts from water departments, the Ministry of Women's Affairs and rural administrations who worked together in defining issues related to water and sanitation in rural areas and devising possible solutions that integrate the targets within SDGs 6, 5 and 2 and in response to the needs of the female population.

Third, the systems approach has proven particularly suitable to institutional reform and is more cost-effective when compared with the traditional linear problem analysis. In Sri Lanka, for example, the national team mapped the interlinkages between institutions and their mandates in relation to the SDGs and their targets at the national and provincial levels to advocate for strengthened interministerial collaboration in a cross-sector manner, rather than through a linear approach. That was done to avoid establishing new institutions for emerging commitments and issues related to the implementation of the 17 SDGs. Thus, valuable resources were saved and will be redirected to SDG implementation at the provincial levels.

Unlike many conventional policymaking models that assume that economic and social systems are based on hierarchies, the systems framework describes the reality in which networks and self-organization are the predominant features of a system's organization. That strength of the framework is demonstrated when institutional mandates are analysed in relation to the relevant SDGs and their targets and when measures to enhance adaptive capacities of the institutions (which was the case in Sri Lanka) and to strengthen their regulative functions (as with the case of Tajikistan) for implementation of the 2030 Agenda are developed. That impact was achieved

mainly through systems thinking analysis and modelling of the interlinkages and causal feedback between the goals and targets of the national development strategies, sustainable development road maps and the SDGs.

Finally, systems thinking allows for identifying leverage points for actions that have high impact and for drafting coherent policies that will assist governments to attract the required investments for implementing the 2030 Agenda. In the pilot applications of this framework in the three selected countries, investments in sustainable wastewater management and systems for recycling and reuse of wastewater were identified as a key leverage point requiring further analysis on investment returns.

In conclusion, the application of the analytical framework identified needs for capacity development and technical assistance and generated requests for support from ESCAP and other United Nations agencies that were voiced at the national workshops and the regional seminar, including:

- Strengthening capacities for data collection and for improving existing data sources, including statistics and indicators of production to generate data sets comparable at the regional and global levels.
- Developing capacities for data collection (quantitative and qualitative data) and analysis in an integrated manner to allow for the design of integrated policy measures and integrated responses.
- Enhancing capacity for setting up national SDG implementation monitoring and evaluation processes and in an integrated manner, which will also facilitate the selection of the national SDG indicators and improve reporting on implementation at the regional and global levels.
- Capacity development support at the provincial and city levels, with training materials translated into the local languages, which will benefit not only policy planning but also stakeholder engagement and awareness raising on the meaning and importance of the SDGs.
- Developing skills and mechanisms for the successful involvement of a wide range of stakeholders, including scientists, academics and representatives from the private sector, the public sector, NGOs, civil society organizations and donors, to ensure coordinated and concerted action at the national, regional and global levels.

The systems thinking approach applied beyond the integration of SDG 6 on water and sanitation has proven particularly conducive to strengthening and enhancing the capacity of policymakers for adaptive governance to better address the complex challenges of the 2030 Agenda and the SDGs. ESCAP will continue to provide technical and advisory services, tools and methodologies to policymakers in the region to build up their capacity for the integrated implementation of the three dimensions of sustainable development.

REFERENCES

Atkisson, A. (2011). *The Sustainability Transformation: How to Accelerate Positive Change in Challenging Times*. New York: Routledge.

Cain, J. (2001). *Planning Improvements in Natural Resources Management: Guidelines for Using Bayesian Networks to Support the Planning and Management of Development Programmes in the Water Sector and Beyond*. Wallingford, UK: Centre for Ecology and Hydrology.

Chaudhury, M. (2012). Promoting Integration and Dialogue Within the Context of Global Change. Available from http://blog.worldagroforestry.org/index.php/2012/03/30/promoting-integration-and-dialogue-within-the-context-of-global-change/.

Golubiewski, N. (2012). Is there a metabolism of an urban ecosystem? *An Ecological Critique. Ambio*. vol. 41, No. 7, pp. 751–764. Available from www.ncbi.nlm.nih.gov/pmc/articles/PMC3472014/.

Hall, N., and others (2016). *Achieving the UN Sustainable Development Goals for Water and Beyond*. Brisbane, Australia: Global Change Institute, The University of Queensland. Available from www.gci.uq.edu.au/achieving-un-sustainable-development-goals-water-and-beyond.

Hopkins , T.S., and others (2012). A systems approach framework for the transition to sustainable development: Potential value based on coastal experiments. *Ecology and Society*, vol. 17, No. 3. Available from www.ecologyandsociety.org/vol17/iss3/art39/.

International Council for Science (2016). *A Draft Framework for Understanding SDG Interactions.* Paris. Available from www.icsu.org/publications/reports-and-reviews/working-paper-framework-for-understanding-sdg-interactions-2016/.

Ishwaran, N., and A. Persic (2008). Concept and practice: The case of UNESCO biosphere reserves. *International Journal of Environment and Sustainable Development*, vol. 7(2), pp. 1–14.

Johansson, F. (2004). T*he Medici Effect: What Elephants and Epidemics Can Teach Us About Innovation*. Cambridge, MA: Harvard Business School Press.

Kawaguchi, T. (2015). Trash-clogged oceans have alarm bells ringing. *Nikkei Asian Review*. Available from http://asia.nikkei.com/Tech-Science/Science/Trash-clogged-oceans-have-alarm-bells-ringing?page=1.

Kuhnert, P., T. Martin, and S. Griffiths (2010). A guide to eliciting and using expert knowledge in Bayesian ecological models. *Ecology Letters*, vol. 13, pp. 900–914.

Mahon, T., and M. Fernandes (2010). *Menstrual Hygiene in South Asia*. Delhi: WaterAid. Available from www.wateraid.org/~/media/Publications/menstrual-hygiene-south-asia.pdf.

Nadkarni, S., and P. Shenoy (2004). A causal mapping approach to constructing Bayesian networks. *Decision Support Systems,* vol. 38, No. 2, pp. 259–281.

Meadows, D.H. (2009). *Thinking in Systems: A Primer.* London and Sterling, VA: Earthscan.

Nguyen, N.C., O.J. Bosch, and K.E.Maani (2009). The importance of systems thinking and practice for creating biosphere reserves as "learning laboratories for sustainable development". *Proceedings of the 53rd Annual Meeting of the International Society for the Systems Sciences*, pp. 1–17.

Nilsson, M., D. Griggs and M. Visbeck (2016). Map the interactions between Sustainable Development Goals. *Nature*, vol. 534, pp. 320–322.

Organisation for Economic Co-operation and Development (2007). *Higher Education for Sustainable Development: Final Report for International Research Project*. Forum for the Future, OECD. Available from https://www.oecd.org/edu/innovation-education/centreforeffectivelearningenvironmentscele/45575516.pdf.

Organisation for Economic Co-operation and Development (2015). *Policy Coherence for Sustainable Development in the SDG Framework Shaping Targets and Monitoring Progress.* Paris. Available from www.oecd.org/development/pcd/Note % 20on % 20Shaping % 20Targets.pdf.

Ramaswami, A., and others (2012). A social-ecological-infrastructural systems framework for interdisciplinary study of sustainable city systems. An integrative curriculum across seven major disciplines. *Journal of Industrial Ecology*, vol. 16, No. 6. Available from http://onlinelibrary.wiley.com/doi/10.1111/j.1530-9290.2012.00566.x/full.

Schuster-Wallace, C.J., and R. Sandford (2015). *Water in the World We Want*. New York: United Nations University Institute for Water, Environment and Health and United Nations Office for Sustainable Development.

Senge, P.M. (1997). The fifth discipline. *Measuring Business Excellence*, vol. 1, No. 3, pp. 46–51.

The Royal Swedish Academy of Sciences Stockholm (2015). Scientific Support for Policy Making in Sustainable Development, Joining Forces Conference, The Beijer Hall, Stockholm, 16–17 November. Available from https://ec.europa.eu/jrc/sites/jrcsh/files/20151116-17-gya-summary_en.pdf.

United Nations Economic and Social Commission for Asia and the Pacific (2015). *Integrating the three dimensions of sustainable development: A framework and tools*. Available from https://sustdev.unescap.org/Files/Integrating % 20the % 20three % 20dimensions % 20of % 20sustainable % 20development % 20A % 20framework.pdf.

United Nations Economic and Social Commission for Asia and the Pacific (2016a). *Analytical Framework for Integration of Water and Sanitation SDGs and Targets Using Systems Thinking Approach.* Bangkok. Available from https://sustdev.unescap.org/Files/resource/be091e7a9604024298e074d880312c16.pdf.

United Nations Economic and Social Commission for Asia and the Pacific (2016b). *Integrated Approaches for SDG 11 Inclusive, Safe, Resilient, and Sustainable Cities: Small Working Group Session*. Bangkok.

United Nations Educational, Scientific and Cultural Organization (1997). *Educating for a Sustainable Future: A Transdisciplinary Vision for Concerted Action*. Available from www.unesco.org/education/tlsf/mods/theme_a/popups/mod01t05s01.html.

United Nations General Assembly (2015). *Resolution: A/RES/70/1: Transforming our world: The 2030 Agenda for Sustainable Development.*

United Nations Industrial Development Organization (2016). Making the goals happen. *In Making It*. Vienna. Available from www.makingitmagazine.net/?p=9987.

UN-Water (2016). *Water and Sanitation Interlinkages Across the 2030 Agenda for Sustainable Development.* Geneva. Available from www.unwater.org/fileadmin/user_upload/unwater_new/docs/UN-Water_Analytical_Brief_Water % 20and % 20sanitation % 20interlinkages % 20across % 20the % 202030 % 20Agenda % 20for % 20Sustainable % 20Development.pdf.

Weitz, N., M. Nilsson, and M. Davis (2014). A nexus approach to the post-2015 agenda: Formulating integrated water, energy and food SDGs. *SAIS Review of International Affairs*, vol. 34, pp. 37–50.

Wilson, R. (2006). Policy analysis as policy advice. In *The Oxford Book of Public Policy*, M. Moran, M. Rein, and R. Goodin (eds). Oxford, UK: Oxford University Press.

World Bank (2006). *"New water" is Recycled, Reclaimed and Reused*. Washington, D.C.

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