

Achieving the UN Sustainable Development Goals for water and beyond

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Image

James Singladore - Rio De Quingua



Achieving the UN Sustainable Development Goals for water and beyond

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Overview

This discussion paper is from The University of Queensland’s Water for Equity and Wellbeing Initiative. It was developed to consider Australia’s efforts to achieve the United Nations Sustainable Development Goals in Australia and within the broader Asia-Pacific region. It focuses particularly on those SDGs that are concerned with water, and it challenges the current steps being undertaken towards attaining the SDGs in both Australia and overseas. The recommendations identify the most influential and critical SDGs that affect the attainment of the water, sanitation and hygiene goal – and, in doing so, the influence of the other goals, and identify plausible pathways for cross-government responsibility for attaining the SDGs.

The United Nations Sustainable Development Goals (SDGs) present a complex challenge for policy-makers and other stakeholders as it is difficult to know where, precisely, the most effective ‘starting point’ for implementation lies. The interlinkages between the SDGs and their respective targets are numerous and complex. The 17 goals have 169 targets, of which many explicitly refer to at least one other goal. The goal for water, sanitation and hygiene (SDG 6) focuses on water quality, quantity, sanitation and integrated management. Beyond SDG 6, water is explicitly mentioned in relation to SDG 3 (health impacts from water-borne diseases and contaminated water), SDG 11 (water-related disasters), SDG 12 (water pollution), and SDG 15 (conservation of freshwater ecosystems).

An earlier [discussion paper from The University of Queensland](#) on the SDGs (Hall et al., 2016) cautioned that a ‘list-based’ or siloed approach could overlook the complex interlinkages, trade-offs, synergies, and the positive and negative feedback loops. Without understanding these interlinked foundations, it is difficult to develop coherent and integrated policies needed to attract appropriate investment and implementation benefits.

The aims of this discussion paper are to:

- Identify the most effective and efficient starting points for governments to begin implementation of the SDGs; and
- Identify which government portfolios and supporting governance arrangements could usefully be implemented across each particular SDG, and across the suite of SDGs.

A multidisciplinary team of 13 researchers was assembled to identify the influences of the SDGs on each other, with a focus on water, sanitation and hygiene, to guide how to best achieve traction towards progressing the SDGs – and particularly, for the attainment of the goal for water, sanitation and hygiene (SDG 6). Through workshops, they identified the interlinkages and influences between the 17 SDGs and also between the targets within SDG 6 (water, sanitation and hygiene). The resulting diagrams (see Figure 1 and Figure 7) provide a guide for SDG strategic understanding, and corresponding funding and implementation of targeted actions.

The key findings for action by Australian government, industry and civil society to approach the 17 SDGs are:

- The climate action goal (SDG 13) and the partnerships goal (SDG 17) are the major general influences and enablers of all the other SDGs.
- All 17 SDGs are interlinked, and these interactions require careful analysis as they could act as either enablers or bottlenecks to achievement of other goals.
- Impediments to achieving the SDGs are both structural and procedural.

- The health and wellbeing goal (SDG 3) is the overarching goal across all the SDGs – to which all other SDGs contribute.
- Below the two overarching, all-influencing SDGs (13 and 17), the three key influential SDGs are those for education (SDG 4), poverty reduction (SDG 1), and work and economy (SDG 8).
- The goal for water, sanitation and hygiene (SDG 6) is embedded among the other SDGs, and thus is both influenced and influences other SDGs.



Figure 1: Relationships between 17 UN Sustainable Development Goals

The key findings for the targets of SDG 6 (water, sanitation and hygiene) are:

- The overarching target of SDG 6 is safe, accessible and affordable drinking water (SDG 6.1), as this delivers health and wellbeing (SDG 3), which is the main intended outcome of all 17 SDGs.
- Integrated water resources management (SDG 6.5) is the key influence for achieving all the other SDG 6 targets.
- The ‘implementing’ targets of cooperation and capacity (SDG 6a) and local participation (SDG 6b) are crucial to enabling the attainment of all the other SDG 6 targets.

To provide direction on how Australia should prioritise action to enable the SDGs, we provide the following recommendations:

- **Recommendation 1:** The overarching SDGs of climate action (SDG 13) and partnerships (SDG 17) need to be the initial focus of plans to enable all SDGs. Following this, the next three key influential SDGs are those for education (SDG 4), poverty (SDG 1) and work and economy (SDG 8).
- **Recommendation 2:** In planning SDG approaches, the SDG interlinkages need to be identified and understood to avoid unintended negative consequences and to enhance benefits.
- **Recommendation 3:** Crossover, liaison and inter-agency collaboration is required at a local, national and international level to effectively attain the SDGs and their respective targets.
- **Recommendation 4:** Create influence diagrams of the SDGs at the SDG *target* level, or at the scale of relevance to their jurisdiction (e.g. global, national, catchment or local).
- **Recommendation 5:** The health and wellbeing goal (SDG 3) needs to be considered in responses to the other SDGs, as it is the overarching goal of the SDG set.
- **Recommendation 6:** The approach of Integrated Water Resources Management (IWRM) should be seen as the main target for achieving SDG 6 (water, sanitation and hygiene), and should be a key focus in planning to attain all the elements of SDG 6.
- **Recommendation 7:** Attaining clean, accessible drinking water is the overarching target of SDG 6 (water, sanitation and hygiene), but this can only be delivered with support from the other contributing SDG 6 targets. Therefore, investment in water, sanitation and hygiene (WaSH) programs should be conducted within upstream water management, treatment, and regulations, to ensure maximum and long-term benefits.

Policy-makers should consider the above recommendations and collaborative potential to ensure Australia achieves the SDGs domestically, while also contributing internationally. Although this research task was undertaken in Australia, it is adaptable and relevant to international contexts.

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Introduction

Recent literature and analyses have identified that the 17 United Nations' Sustainable Development Goals (SDGs) are linked to each other through influences. As Le Blanc (2015) identified, the 17 goals have 169 targets, of which 60 explicitly refer to at least one other goal, and 19 targets link to three or more goals or more. Examples of these interlinkages between SDGs are numerous. For example, the educational goal (SDG 4) can improve maternal health (SDG 3), contribute to poverty alleviation (SDG 1), enhance gender quality (SDG 5) and therefore improve economic growth (SDG 8) (Nilsson, Griggs, & Visbeck, 2016). The goal on reducing hunger and improving nutrition (SDG 2) is influenced by agricultural output (SDG 15), general health and wellbeing (SDG 3), awareness of nutrition through education (SDG 4), clean water and accessible sanitation (SDG 6) (IFPRI, 2016). The goal for health and wellbeing (SDG 3) is influenced by agricultural products (SDG 15), knowledge of health behaviours (SDG 4), clean water, sanitation and hygiene (SDG 6), safe and healthy living environments (SDG 11), and efforts to reduce poverty (SDG 1) (IFPRI, 2016).

Commentators have emphasised the need to identify and understand the interlinkages between the SDGs. Nilsson *et al.* (2016) cautioned that by approaching the SDGs separately, unintended negative consequences may arise – and the potential for sustainable development will not be realised. Similarly, Watson, Thwaites *et al.* ([2014, p.5](#)), p.5) recommended actions that are each 'synergistic with achieving another goal rather than [to] undermine them'. The earlier discussion paper from The University of Queensland recommended considering the SDGs (and the goals' respective targets) as a coherent 'set', with interlinkages and feedbacks made explicit, and that a systems approach is adopted to ensure positive synergies and avoid perverse effects (Hall *et al.*, 2016). The UN acknowledged the SDGs should be considered through an integrated approach, noting that 'sustainable development interventions cannot be put in an economic, social and/or environmental box' ([UNESCAP 2014](#)).

A visual representation of the SDGs can assist to identify the interlinkages and influences. This discussion paper sought to develop diagrams from an Australian perspective that can be used to identify the 'starting point' for SDG attainment and to identify the priorities for funding – especially for those concerned with water, sanitation and hygiene. The paper also sought to identify the relevant government departments responsible for the attainment of the SDGs.

Background

The UN Sustainable Development Goals

The United Nations' (UN) current development agenda, 'Transforming Our World: The 2030 Agenda for Sustainable Development', was released in September 2015 (UN, 2015). The current agenda was developed through the leadership of the High-level Political Forum on Sustainable Development, established at the Rio+20 Conference in 2012. In establishing the forum, the UN member states resolved to develop a set of Sustainable Development Goals (SDGs). In essence, this was a merging of the uncompleted Millennium Development Goals (MDGs) with the sustainable development agenda articulated at the 2012 United Nations Conference on Sustainable Development. The merger integrates the MDGs of governance, environmental issues, social aspects and economic development into a sustainable development agenda (Hill, Buse, Brolan, & Ooms, 2014). The resulting Sustainable Development Goals were identified and refined through contributions from the UN Open Working Group on Sustainable Development Goals, in which the 'Major Groups' representing issues regarding women, indigenous people, workers, industry, science and others, were involved (UN, 2016). Each goal has established targets, and indicators are under development by a UN Inter-Agency and Expert Advisory Group to devise an indicator framework for the SDGs (Sachs, Schmidt-Traub, Kroll, Durand-Delacré, & Teksoz, 2016).

Australia is one of the 193 UN member countries that formally agreed to the SDGs. Unlike the preceding Millennium Development Goals, the SDGs apply to all countries and citizens – irrespective of the country's level of development (UNESCAP, 2014; Watson, Thwaites, Griggs, Kestin, & McGrath, 2014). For Australia, this domestic – as well as regional – focus necessitates considering the development, health and environmental status of Australian issues (see (Hall et al., 2016).



Figure 2: The 17 Sustainable Development Goals of the United Nations (UN, 2015)

There is an established need for the UN SDGs to improve the health and wellbeing of the world and its population. The concept of 'health' is applied here, using the broad definition established by the World Health Organisation: 'a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity' (WHO, 1948). The 17 UN SDGs reflect this health and wellbeing need by identifying the social, economic and environmental systems that support this ultimate health status (UN, 2015). An independent 'SDG Index' was released by the Sustainable Development Solutions Network to

propose a 2015 baseline level for individual countries against the SDG targets – intended to assist in identifying priorities for action (Sachs et al., 2016).

Of the countries for which data was available, four Scandinavian countries were ranked highest in the SDG Indices (Sweden, Denmark, Norway and Finland, respectively). Australia was ranked 20th in the index, with the following SDGs identified as requiring greater prioritisation: SDG 2 (zero hunger), SDG 7 (affordable and clean energy), SDG 13 (climate action), SDG 14 (life below water), SDG 15 (life on land) and SDG 17 (partnerships for the Goals), as displayed in Figure 3 (Sachs et al., 2016).



Figure 3: Australia's performance as assessed by the independent SDG Index (n.b. red indicates goals for which Australia exhibited poor performance, and green for strong performance) (Sachs et al., 2016)

Overall, the SDG Index identified that many low-income countries will require significant external assistance to supplement the efforts of their own national leadership in attaining the SDGs, such as foreign investment, technology sharing, capacity development and increased Official Development Assistance – including from Australia (Sachs et al., 2016). It was recommended that Asia seeks to balance its economic performance in alignment with environmental sustainability (Sachs et al., 2016). For Asia, the main SDG challenges identified were SDG 3 (health and wellbeing, particularly relating to health systems and some infectious diseases), SDG 4 (education), SDG 2 (zero hunger – notably improved nutrition and sustainable agriculture) and access to basic infrastructure services for water, energy and other needs (SDGs 6, 7, 9). Of note, Pacific countries were not included in the SDG Index due to insufficient data (Sachs et al., 2016). This is despite the documented environmental and health challenges in the Pacific region (Schrecongost & Wong, 2015; World Bank, 2015). Given Australia's geographic proximity and economic centrality within the Asia Pacific region, the status of these countries is of importance for Australian policy objectives.

The Sustainable Development Goal for water, sanitation and hygiene

One of the 17 UN SDGs, SDG 6, focuses on water, sanitation and hygiene, and the 'upstream' aspects that support this resource, namely healthy river catchments and communities. 'Upstream' protection, preservation and management of waterways is covered by treaties, such as the UN Watercourses Convention (United Nations, 1997). However, SDG 6 was proposed in acknowledgement that access to clean, safely managed water, sanitation and hygiene are key interventions for primary health prevention and could reduce the global disease burden by almost ten per cent (Cameron, Hunter, Jagals, & Pond, 2011; Prüss-Üstün, Bos, Gore, & Bartram, 2008).

The need for a specific SDG focused on water and associated sanitation and hygiene is relevant for Australia, given its position next to south-east Asia, where 55 percent of the population lack access to

drinking water that is free of contamination (known as an ‘improved’ drinking water source) and one billion people lack sanitation facilities that separate humans from contact with their excreta (‘improved’ sanitation) (WHO & UNICEF, 2014, 2016a). Only half of the population in the Pacific Island countries have access to such facilities (WHO ROWP, 2008). A limitation of the SDG Index was its reliance on global datasets, resulting in details being lost through aggregation. Hence, despite the SDG Index indicating that Australia has attained SDG 6 (water, sanitation and hygiene) (Sachs et al., 2016), this does not reflect the situation that poor hygiene and unsanitary living conditions have contributed to children in remote Australian Aboriginal communities experiencing a higher rate of common infectious diseases than in large urban communities (Hall et al., 2016; McDonald, Bailie, Brewster, & Morris, 2008).

While the earlier Millennium Development Goal targeting drinking water was achieved at a global level, the sanitation target was not (Jenkins, 2016). The first two targets of SDG 6 encompass the core focus on water, sanitation and hygiene (WaSH). Targets are also included on water provision beyond human use and interaction and towards structural, ecosystem and governance needs regarding water management (UN, 2015). These targets are outlined in Table 1. These diverse targets within SDG 6 recognise the wider environmental quality required to deliver long-term drinking water (target 6.6), and also that an holistic approach to water management is required; the approach of Integrated Water Resources Management is strongly recommended (WHO, 2016).

Table 1: Targets of Sustainable Development Goal 6 (UN, 2015)

<p>Sustainable Development Goal 6. Ensure availability and sustainable management of water, sanitation and hygiene for all</p> <p><i>Action targets:</i></p> <p>6.1 By 2030, achieve universal and equitable access to safe and affordable drinking water for all</p> <p>6.2 By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations</p> <p>6.3 By 2030, improve water quality by reducing pollution, eliminating dumping and minimising release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally</p> <p>6.4 By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity</p> <p>6.5 By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate</p> <p>6.6 By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes</p> <p><i>Means of Implementation:</i></p> <p>6.a By 2030, expand international cooperation and capacity-building support to developing countries in water – and sanitation-related activities and programs, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies</p> <p>6.b Support and strengthen the participation of local communities in improving water, sanitation and hygiene.</p>	
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After technical consultation with more than 100 experts from 60 organisations, indicators to monitor progress against the eight SDG 6 (water, sanitation and hygiene) targets have been released by the UN. (WHO & UNICEF, 2016b). The targets seek to achieve a higher standard of drinking water, sanitation and hygiene than the preceding MDGs. For SDG 6.1 (drinking water), the UN's proposed core indicator is 'percentage of population using safely managed drinking water services' that provides a 'basic' (previously referred to as 'improved') drinking water source located on the premise that is available when needed and compliant with faecal and priority chemical standards (WHO & UNICEF, 2016b). For SDG 6.2 (sanitation), the proposed core indicator is 'percentage of population using safely managed sanitation services' that is at least a basic (previously referred to as 'improved') sanitation facility that is not shared, and where excreta are safely disposed *in situ* or transported and treated off-site (WHO & UNICEF, 2016b). The independent SDG Index proposes that an additional indicator be included, which monitors freshwater withdrawal as a proportion of total renewable water resources (Sachs et al., 2016).

Water impacts among the SDGs

Water is influential within many of the SDGs. The goal for water, sanitation and hygiene (SDG 6) focuses on water quality, quantity, sanitation and integrated management. Beyond SDG 6, water is explicitly mentioned in relation to SDG 3 (health impacts from water-borne diseases and contaminated water), SDG 11 (water-related disasters), SDG 12 (water pollution), and SDG 15 (conservation of freshwater ecosystems) (Jenkins, 2016; UN, 2015). This regular mention of water within the other SDGs beyond SDG 6 reflects the interdependence of SDG 6 – and that successful attainment of SDG 6 relies on progress also within other SDGs.

Water also implicitly influences the above and other SDGs, in ways that also reflect interlinkages between the goals. Health and wellbeing (SDG 3) is affected by water in many ways, and water, sanitation and hygiene investments have been roughly calculated as providing 7-to-1 benefits to costs for health outcomes (OECD, 2011). These benefits are gained from reducing health impacts from waterborne pathogens that cause cholera, typhoid and diseases (WHO, 2016), and hygiene-affected infections, including trachoma (Cumming, Watson, & Dangour, 2016). In addition, improved water, sanitation and hygiene services help reduce malnutrition (Cumming et al., 2016; IFPRI, 2016). Related to this, improved health and reduced sickness can result in more time for educational (SDG 4) and workforce participation (SDG 8) (OECD, 2011) (WHO, 2014b).

Effective water management can affect and be affected by the goal for agriculture (SDG 15), in terms of water supply and security, ecosystem services that support agriculture, and contamination of water supplies through algal blooms (Cain, 2001; Reflection Group, 2016; WHO, 2016). This can, in turn, influence additional sectors beyond agriculture, including fishing, tourism and real estate (SDGs 8 and 14) (OECD, 2011).

Sustainable development and integrated thinking

The 17 Sustainable Development Goals present a conundrum for policy-makers and other stakeholders as it is difficult to know where, precisely, the most effective 'starting point' for implementation lies: the interlinkages between the SDGs and their respective targets are numerous. An earlier [discussion paper by The University of Queensland](#) stated that approaching the SDGs with a 'list-based' or siloed approach could overlook the complex interlinkages, trade-offs, synergies, positive and negative feedback loops, and not adequately prepare foundational conditions prior to interventions (Griggs et al., 2013; Hall et al., 2016; Juech & Michelson, 2011; Le Blanc, 2015; Nilsson et al., 2016). Without understanding these interlinked foundations, it is difficult to develop coherent and integrated policies, direct appropriate investment and ensure benefits (Le Blanc, 2015). Indeed, sustainable development responses require a move from this

siloed thinking to integrated thinking using a systems approach to problem-solving (Juech & Michelson, 2011; Le Blanc, 2015). With this systems perspective, SDG targets can be identified that contribute to multiple goals, and prioritising these critical targets can increase the impact and feasibility of achieving the SDGs (Le Blanc, 2015). The University of Queensland previously recommended that the SDGs are considered as a coherent 'set' with interlinkages and feedbacks, using an integrated 'systems approach' to ensure positive synergies and avoid unintended negative consequences (Hall et al., 2016).

Integrated Water Resources Management (IWRM) is a systems approach that considers the relationships between activities within a whole catchment system, including the stakeholders within it, rather than focusing on discrete components of the system (Hadwen et al., 2015). The IWRM approach can consider and address environmental, economic, social and political issues – including the features that may enhance or prevent attainment of the water management goals (Cain, 2001). IWRM was recognised in the final recommendation of The University of Queensland publication – stating that SDG 6 should ideally be supported through an IWRM framework (Hall et al., 2016).

Governance processes for the SDGs

Once the interlinkages of the SDGs have been established, this raises questions of the best governance approaches to ensure that the 'siloed' thinking does not persist. Recent publications regarding the SDGs have noted the critical need for governance reforms to establish policies to progress and attain the SDGs; on critique emphasise integration across disciplines and sectors to achieve this effective governance (IRF, 2015).

At an international level, there are agreements such as the UN Watercourses Convention (United Nations, 1997) that are increasingly driving domestic policy agendas on development and resources (Dovers & Hussey, 2013). However, at a national implementation level, many government agencies are not integrated in terms of strategies, policies and implementation – especially on sustainability issues. Some new organisational structures, such as 'mega-departments' and whole-of-government mechanisms have been initiated, but even these new institutional structures have not seen sustainability issues become an equal priority with other policy issues (Dovers & Hussey, 2013). This lack of integration prevents full understanding, monitoring and planning of consequences from diverse applications of sustainable development (Le Blanc, 2015). Indeed, the framing and understanding of the sustainability agenda goals can affect which administrative portfolio has carriage of the issues – and thus how the SDG is operationalised (Dovers & Hussey, 2013). Instead, the environmental, social and economic aspects of the SDGs would be best considered through collaborative and transdisciplinary agencies (Dovers & Hussey, 2013).

The earlier discussion paper from The University of Queensland recommended that appropriate government policy coordination arrangements and oversight were adopted to ensure that the SDGs are approached as an integrated set by government and other implementing organisations (Hall et al., 2016). Other researchers have taken this further, stating that a 'system knowledge' is important, but not sufficient for sustainable development initiatives involving large numbers of stakeholders (Düspohl, Frank, & Döll, 2012). In addition to this system knowledge, they recommend that 'target knowledge' of the different stakeholder perspectives of the 'problem' is required, as well as 'transformation knowledge' that identifies how common goals can be achieved (Düspohl et al., 2012). Together, these strands of knowledge can be considered as transdisciplinary research (Düspohl et al., 2012).

More specifically regarding SDG 6, the responsibility and delivery of water, sanitation and hygiene services (SDG 6) is often spread across multiple government agencies, including agriculture, planning, water, public works, health and education (Cumming et al., 2016). An example of the unbalanced development outcomes that do not follow strong and interdisciplinary governance is in many of the Pacific Island Countries, which have some of the lowest rates globally of drinking water, sanitation and hygiene access (WHO & UNICEF, 2015). This is due to a range of structural, economic and cultural issues, including fragmented policies and governance structures, competing funding priorities, and historic cultural practices regarding water ownership and stewardship (WHO & UNICEF, 2015). In response, SDGs could ideally be achieved by their agencies working collaboratively, and potentially employing 'cross-cutting indicators' to ensure intersectoral coordination and engagement (Cumming et al., 2016). A proposed transdisciplinary approach – that incorporates the three types of knowledge – is critical. This would allay the concerns of critiques that international organisations, such as the World Bank, may emphasise agricultural and industrial water use over water management planned following human rights objectives (Karunanathan & Tellatin, 2016).

Approach to SDG analysis

To display the influences and connections between the SDGs in a systems approach, a simplified Bayesian network approach was selected (Cain, 2001; Nadkarni & Shenoy, 2004). This approach produces a graphical diagram that displays the links between 'nodes', also known as directed acyclic graphs (Cain, 2001). The research team sought to construct a diagram that reflected the determinants and descendents of all 17 SDGs, and also all of the targets of SDG 6. This corresponded to previous scholars using approaches to present these complex and dynamic systems (Le Blanc, 2015).

The research team met twice to review the SDGs and the SDG 6 targets and, through discussion, created diagrams that clarified the cause-and-effect relationships related to water, sanitation and hygiene, among the goals and targets (Cain, 2001; Nadkarni & Shenoy, 2004). Eleven researchers involved in water issues and in the Water for Equity and Wellbeing initiative met for the first round of diagram creation, representing a range of disciplines, including public health, communication, politics and sociology. The team was divided into two multidisciplinary groups. Each group was provided with 17 cards that featured the 17 SDGs, and created a physical diagram in the order in which one might directly influence the next. This process is displayed in Figure 4. The activity was then repeated for the eight targets of SDG 6, again using cards to physically create the diagram. The second round of diagram creation occurred one week later. It involved five researchers, self-selected from the initial group. Their aim was to resolve differences to the two network diagrams through discussion, in order to complete one final diagram for the 17 SDGs and one for the eight SDG 6 targets.



Figure 4: Participants identifying the relationships of the SDGs in Round 1

The next stage of the method was to ascribe the strength of influence between the goals and targets, using a form of expert judgment to develop estimates known as expert elicitation (Kuhnert, Martin, & Griffiths, 2010). The researchers reviewed the diagrams, and indicated the strength between each goal and target in terms of minor, medium or major. The diagrams were amended to display connecting lines in different widths, where wider lines reflected a stronger influence.

The final stage of this research approach was to consider the relevant Australian government portfolios that could progress the SDGs – both within Australia and overseas. A complete list of the current Australian government departments was placed in a table against the 17 SDGs. In a simplified form of policy analysis (Wilson, 2006), the research team independently reviewed the SDGs against their understanding of the departmental portfolios, and identified which SDGs were most relevant for each portfolio.

Results and discussion

To display the influence of the SDGs on one another, the final diagrams are provided in Figure 5 and Figure 7. These include the weightings that reflect the strength of influence of each SDG.

Influences among the 17 SDGs

The diagram of the 17 SDGs is provided in Figure 5. It reflects the findings that all the SDGs are interrelated. Each goal could be considered at several scales, such as global (e.g. climate change issues), national (e.g. policy), catchment (e.g. IWRM) and local (e.g. community participation). The health and wellbeing goal (SDG 3) was found to be the ultimate desired outcome of all the SDGs. This placement of SDG 3 provides a prominence to the health agenda – similar to that held in the preceding Millennium Development Goals (Hill et al., 2014) – although the MDGs had a poverty-reduction focus in comparison to the current sustainable development focus of the SDGs.

The goal for global partnerships (SDG 17) was placed as a major influence – and was considered as an ‘enabling goal’. The goals regarding poverty (SDG 1), work and economy (SDG 8) and climate action (SDG 13) were all placed as major influences on the other goals. The goal for water, sanitation and hygiene (SDG 6) was embedded amongst other goals – as both the recipient and instigator of influences. Poverty (SDG 1) and work and economy (SDG 8) were both found to have strong influences on peace and justice (SDG 16). Education (SDG 4) was identified as a major influence on improving the capacity for equality (SDG 5), and a medium influence on increased clean energy (SDG 7) through research, training and uptake.

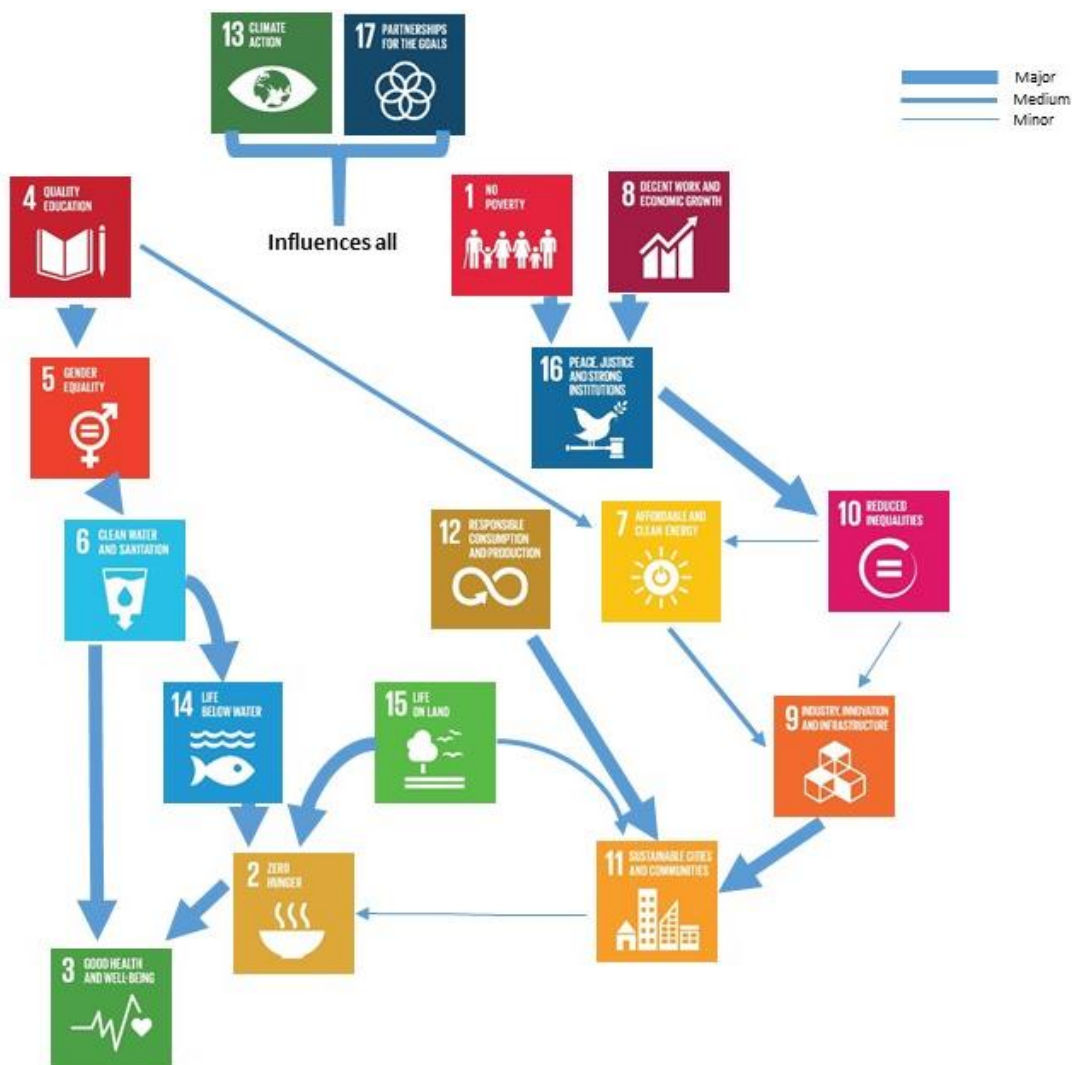


Figure 5: Relationships between 17 UN Sustainable Development Goals (also presented as Figure 1)

These findings contrast with a water-centric SDG diagram produced by the UN Economic and Social Commission for the Asia Pacific (UN ESCAP) and displayed in Figure 6 (Karazhanova, 2015). The integrated approach to SDGs was acknowledged in a UN ESCAP that proposed a systems approach to prioritise all SDGs that contribute to achieving a single goal. The figure was created by UN ESCAP to display a ‘multi-faceted and multi-dimensional concept’ to address the need for integrated policy approaches (Karazhanova, 2015). The research team considered that the UN ESCAP figure did not adequately explain the relationships between the SDGs, and that the representation as a closed circle did not explain the strengths of the relationships. In addition, they concluded that representing SDG 6 as an end goal was not accurate – given the influence of water, sanitation and hygiene (SDG 6) on ‘downstream’ goals, namely food production (SDG 14 and SDG 2), and on health and wellbeing (SDG 3).



Figure 6: SDG 6 (water, sanitation and hygiene) influenced by all SDGs (from Karazhanova, 2015)

Influences among the targets for SDG 6 (water, sanitation and hygiene)

The targets within the goal for water and sanitation (SDG 6; see Table 1) were arranged into a diagram. The research team concluded the targets describing capacity-building and cooperation (SDG 6a) and local community participation (SDG 6b) were more influential from ‘outside’ – similar to the finding of Bartram et al. (2015). The final diagram is displayed as Figure 7. The target of integrated water resource management (SDG 6.5; IWRM) is the key influence of the other targets. The effective implementation of IWRM is a major influence on water efficiency (SDG 6.4) and the health of water-related ecosystems (SDG 6.6). These targets in turn strongly influence water quality (SDG 6.3) and sanitation and hygiene (SDG 6.2). The team noted that consideration of sanitation and hygiene may be greater if presented in separate targets. Water quality (SDG 6.3) was found to be a major influence on drinking water (SDG 6.1), with some

influence also from sanitation and hygiene (SDG 6.2). The main resulting goal of SDG 6 was safe, accessible and affordable drinking water (SDG 6.1). This enables health and wellbeing (SDG 3), which is the main intended outcome of all 17 SDGs, according to the group’s creation of the SDG diagram (see Figure 5). This diagram creation exercise with the targets enabled a more nuanced conversation, suggesting that the systems approach was better suited to representing the influences of the SDG targets than the goal level of SDGs.

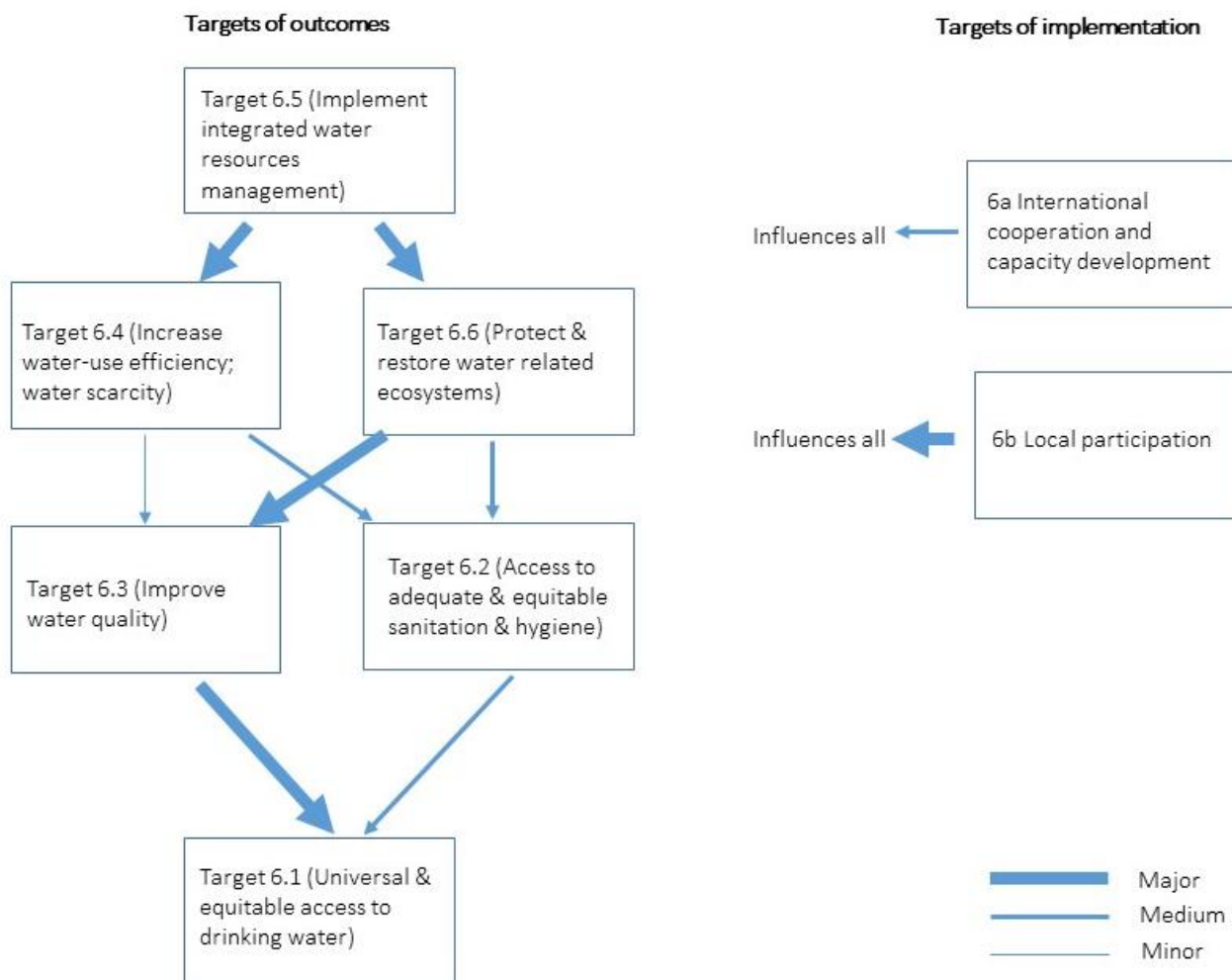


Figure 7: Relationships between targets of SDG 6 (water, sanitation and hygiene)

Possible governmental responsibilities for progressing the SDGs

A final stage was to align the 17 SDGs with the Australian government portfolio most likely to be assigned responsibility for implementation of each of the respective goals. Table 2 displays the results of this assignment, based on the understanding of the research team and the results of the diagram creation exercise. The diversity of the SDGs and their respective targets created difficulties in undertaking this task. The resulting table displays the multiple SDGs for which each portfolio could take responsibility. A key result is that no single portfolio can take responsibility for the entire set of 17 SDGs. The current assignment of the SDGs mainly to the Department of Foreign Affairs (DFAT) and the Department of Energy and Environment (United Nations, 2016) is likely to be too narrow, and Australia’s ability to progress the SDGs in Australia and overseas is likely to be more attainable with the involvement and cross-collaboration of the portfolios proposed here. An additional result is that several SDGs were difficult to assign clearly to a

department, such as SDG 10 (reduced inequalities), SDG 12 (responsible consumption and production), and SDG 13 (climate action).

Table 2: Proposed alignment of SDGs with Australian Federal Government portfolios

Portfolio/ SDG	SDG 1- No poverty	SDG 2- Zero hunger	SDG 3- Health & wellbeing	SDG 4- Education	SDG 5- Gender equality	SDG 6- Water, sanitation and hygiene	SDG 7- Clean energy	SDG 8- Economic growth	SDG 9- Industry & innovation	SDG 10- Reduced inequalities	SDG 11- Sustainable cities	SDG 12- Responsible consumption	SDG 13- Climate action	SDG 14- Life below water	SDG 15- Life on land	SDG 16- Peace & justice	SDG 17- Partnerships
Attorney-General																X	X
Dept Agriculture & Water		X				X									X		
Dept Communications & Arts				X												X	X
Dept Defence					X											X	
Dept Education & Training				X				X	X	X							
Dept Employment				X				X	X	X							
Dept Finance					X			X									
Dept Foreign Affairs & Trade	X				X	X							X			X	X
Dept Health	X	X	X												X	X	
Dept Human Services	X		X		X					X							
Dept Immigration & Border Protection								X			X						
Dept Industry, Innovation & Science				X					X	X		X					
Dept Infrastructure & Regional Development								X	X		X				X		
Dept Parliamentary Services																X	X

Portfolio/ SDG	SDG 1- No poverty	SDG 2- Zero hunger	SDG 3- Health & wellbeing	SDG 4- Education	SDG 5- Gender equality	SDG 6- Water, sanitation and hygiene	SDG 7- Clean energy	SDG 8- Economic growth	SDG 9- Industry & innovation	SDG 10- Reduced inequalities	SDG 11- Sustainable cities	SDG 12- Responsible consumption	SDG 13- Climate action	SDG 14- Life below water	SDG 15- Life on land	SDG 16- Peace & justice	SDG 17- Partnerships
Dept Social Services	X	X	X														
Dept Environment & Energy						X	X				X	X	X	X	X		
Dept House of Representatives																X	X
Dept Prime Minister & Cabinet																X	X
Dept Senate																X	X
Dept Veterans Affairs			X													X	
Treasury	X											X					X

Conclusions and recommendations

This discussion paper sought to identify a 'starting point' to understand enabling conditions and the interlinkages for traction towards the UN Sustainable Development Goals, particularly for the attainment of the goal for water, sanitation and hygiene (SDG 6). Although water was the starting point for considerations, the results illustrated the crucial interlinkages and influences between all of the SDGs.

The findings were identified through collaboratively constructing diagrams (directed acyclic graphs) that could display the influence of determinants and descendents of the 17 SDGs, and also the targets within SDG 6 (water, sanitation and hygiene).

The key findings for all 17 SDGs are:

- All 17 SDGs are interlinked, and these interactions could act as either enablers or 'bottle necks'—depending on the approach.
- The health and wellbeing goal (SDG 3) is the overarching goal from all the SDGs – to which all other SDGs contribute.
- The climate action goal (SDG 13) and the partnerships goal (SDG 17) are the major influences and enablers of all the other SDGs. This finding was resolved as the climatic changes and actions affected the conditions that would affect all other SDGs, and that partnerships can influence the priorities of aid spending and organisational activities – thus facilitating the attainment of the other SDGs.
- Below the two overarching, all-influencing SDGs (13 and 17), the three key influential SDGs are those for education (SDG 4), poverty (SDG 1) and work and economy (SDG 8).
- The goal for water, sanitation and hygiene (SDG 6) is embedded among the other SDGs, rather than as a final resulting goal, due to the influence of water, sanitation and hygiene on 'downstream' goals, namely food production (SDG 14) and hunger (SDG 2), and on health and wellbeing (SDG 3).

The key findings for the targets of SDG 6 (water, sanitation and hygiene) are:

- The overarching target of SDG 6 is safe, accessible and affordable drinking water (SDG 6.1), as this enables health and wellbeing (SDG 3), which is the main intended outcome of all 17 SDGs. All other SDG 6 targets support this target.
- The target of integrated water resources management (SDG 6.5) is the key influence of the other SDG 6 targets, as the effectiveness of this management affects the environmental and social conditions of the water resource.
- The 'implementing' targets of cooperation and capacity (SDG 6a) and local participation (SDG 6b) are crucial to enabling the attainment of the other SDG 6 targets.

It is clear that the progression of the 17 SDGs within and beyond Australia require cross-collaboration by the responsible organisations. At a governmental level, the findings indicated that all government portfolios are relevant to aspects of the SDGs, and no single department can deliver on the goals, nor can one SDG be attained through the actions of a single department. Therefore, new and existing cross-departmental collaboration is essential.

These conclusions need to be considered within the limitations of this research task and approach:

- The SDGs are very broad, and each goal should be considered in tandem with its associated targets when identifying interlinkages to prioritise action.
- The diagram creation approach selected and applied by The University of Queensland researchers can be critiqued in many ways as being too short, with too small a group, and with potential biases to the country (Australia) in which this was undertaken, the disciplines represented by the research team members, and the water focus of the research initiative. Other diagram attempts have been introduced in this discussion paper, and display different results. However, the usefulness of this approach is to provide a commentary on the linkages, and to propose the direct relationships and strength of influence of these relationships. This can then assist decision-makers to plan their own approach towards enabling and attaining the SDGs.
- Identifying the relationships between the SDGs (at a goal level) is more difficult than at a target level, due to the broad concept rather than specific targets. Decision-makers could best apply this method at a target level.

To respond to the research question posed in this discussion paper of ‘where to begin to enable maximum positive impact’ of the SDGs, the following recommendations provide the following direction:

- **Recommendation 1:** The overarching SDGs of climate action (SDG 13) and partnerships (SDG 17) are the major influences and enablers of all the other SDGs. SDG 13 and SDG 17 need to be the initial focus of plans to enable all SDGs. Following this, the next three key influential SDGs are those for education (SDG 4), poverty (SDG 1) and work and economy (SDG 8).
- **Recommendation 2:** In planning SDG approaches, the SDG interlinkages need to be identified and understood to avoid unintended negative consequences and to enhance benefits.
- **Recommendation 3:** Crossover, liaison and inter-agency collaboration is required at a local, national and international level to effectively attaining the SDGs and their respective targets.
- **Recommendation 4:** Visually presenting the SDG relationships in a diagram is a helpful way to plan a response, and this is best approached at a target level, and at the scale of relevance to their jurisdiction (e.g. global, national, catchment or local).
- **Recommendation 5:** The health and wellbeing goal (SDG 3) needs to be considered in responses to the other SDGs, as it is the overarching goal of the SDG set.
- **Recommendation 6:** The approach of Integrated Water Resources Management (IWRM) should be seen as the main target for achieving SDG 6 (water, sanitation and hygiene), and should be a key focus in planning to attain all the elements of SDG 6. Ratifying the UN Watercourses Convention could be an initial step towards IWRM and holistic water management. At an implementation level, IWRM may also generate diverse benefits that contribute to attaining targets within other SDGs.
- **Recommendation 7:** Attaining clean, accessible drinking water is the overarching target of SDG 6 (water, sanitation and hygiene), but this can only be delivered with support from the other contributing SDG 6 targets. Therefore, investment in water, sanitation and hygiene (WaSH) programs should be conducted within upstream water management, treatment, and regulations, to ensure maximum and long-term benefits.

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