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Productivity Commission

# Knowledge, capacity and capability building

Supporting Paper K

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## **GUIDE TO THE SUPPORTING PAPERS (AND DESCRIPTOR)**

- SP A Water entitlements and planning (*Entitlements and planning*)
- SP B Water trading and markets (*Trading*)
- SP C Environmental management (*Environment*)
- SP D Securing Aboriginal and Torres Strait Islander people's interests in water (*Cultural access*)
- SP E Ensuring the integrity of water resource management (*Integrity*)
- SP F Urban water services (*Urban*)
- SP G Urban water services: regional and remote communities (*Regional*)
- SP H Water reform in rural Australia (*Rural*)
- SP I Government investment in major water infrastructure (*Infrastructure*)
- SP J Community engagement (*Engagement*)
- SP K Knowledge, capacity and capability building (*Knowledge*)**

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### **Publications enquiries:**

Media, Publications and Web, phone: (03) 9653 2244 or email: [mpw@pc.gov.au](mailto:mpw@pc.gov.au)

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## Key points

- Knowledge generation has been integral to water reform achievements under the National Water Initiative.
- Governments have a role in funding knowledge generation that is in the public interest. Further investments in knowledge generation will be key to filling existing knowledge gaps, supporting the ongoing reform process and responding to emerging challenges.
  - Investment in knowledge will provide a foundation for evidence-based decision making, innovation, continuous improvement and the development of community water literacy. It will support water planning, inform decisions about the use of environmental water and help utilities meet growing water and service demands.
- Efficient investment should be supported by a formal process of research priority setting and improved coordination between jurisdictions.
- Inclusion of an expectation in governing documents that regulated utilities invest in research and development activities to improve service delivery would empower utilities and ensure that economic regulators include associated expenditure when making price determinations.
- Provision of good information is not enough to realise evidence-based policy.
  - Decision makers need to know that information exists. Success requires sound relationships between knowledge generators and users. Institutional mechanisms like communities of practice and Cooperative Research Centres can support the development and maintenance of these relationships.
  - Those working in the water sector also need the capacity and capability to use information. Governments need to ensure that water planners, managers, regulators and policy makers have both the resources and the knowledge, skills and experience required to effectively implement the National Water Initiative. The staff of water utilities also need support, training, skills and qualifications to be able to effectively discharge their functions.

Success in sustainably managing Australia’s water resources and delivering efficient and affordable water services in the coming decades will, in part, rest on the generation and application of knowledge. New knowledge will be critical in helping the water sector to respond to current and future challenges, such as climate change and increasingly frequent droughts. It will support improved decision making based on the best available information, innovation and continuous improvement, and development of community water literacy — three of the overarching policy objectives that the Commission suggests should be applied in all reform areas (NWI renewal advice 4.1).

The need for knowledge and capacity building was recognised in the National Water Initiative (NWI).<sup>1</sup> Specific areas meriting investment were listed, and knowledge and capacity building were recognised as underpinning elements for implementation of the Agreement. Parties agreed to:

- identify the key knowledge and capacity building priorities needed to support ongoing implementation of the Agreement

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<sup>1</sup> NWI paragraphs 98-101.

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- identify and implement proposals to more effectively coordinate the national water knowledge effort.

## 1 Knowledge generation

Information, knowledge and their application are key for all elements of the NWI. Since the NWI was implemented in 2004, all States and Territories, as well as the Australian Government, have made investments in knowledge generation. Box 1 describes some key government knowledge generation programs currently underway and the Commission's assessment summarises activities undertaken in each of the jurisdictions over the past three years (*Assessment*).

New information (scientific and socioeconomic) has supported evidence-based decisions: water planning is becoming more sophisticated based on scientific input; environmental objectives have been identified; water modelling tools and datasets have been developed; information on water-dependent cultural values has been gathered and incorporated into water plans and management approaches; and mapping and water forecasting has improved (NWC 2014, pp. 5, 9, 11, 13, 17). Overall, the country is now better informed about our water resources, of the impact of water and land-use decisions and the likely effect of climate change. In addition to public-good directed research, the Australian Government has also contributed to agriculture-focused research and development with implications for water use. For example, 23 of 219 project clusters assessed under the Rural Research and Development Corporation program reported improved water use efficiency or water quality impacts (Agtrans Research 2019). Improvements in water use efficiency can help agricultural industries adapt to reduced water availability (SP H *Rural*).

Despite the past investments, continued effort is required to prepare for coming challenges.

We suggest that further reform of the NWI should be supported and underpinned by independent, nimble and well funded research, that can provide additional decision support to allow for sound responses to either sudden system shocks (such as climate emergencies or pandemics) or more gradual changes over time that warrant more systematic addressing. (WaterRA, sub. 98, p. 2)

The commitment to knowledge generation should be retained in a renewed NWI. The following sections discuss: the contribution of knowledge to decision making and management in the water sector; the role of governments in creating knowledge; principles for efficient and effective knowledge generation; the need for coordination and priority setting; and strategies to improve the use of information by decision makers.

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## Box 1 Selected water knowledge building activities

The following are selected examples of some knowledge building activities being undertaken by Australian Government agencies. This is not an exhaustive list, but rather illustrates the nature and breadth of activities.

The Murray–Darling Basin Authority is managing a \$20 million program over 2020–2024 to strengthen scientific knowledge — the Murray–Darling Water and Environment Research Program. The program will provide strategic research and practical information, and include tactical investment in high need projects. Priority themes for the program are climate adaptation, hydrology, environmental outcomes and social, economic and cultural outcomes. These priorities were identified in collaboration with the Commonwealth Environmental Water Office and the Department of Agriculture, Water and the Environment. The strategic research component will be delivered by consortia led by CSIRO and La Trobe University, who, combined, will contribute a further \$7 million to the program (MDBA 2020).

The National Water Grid Authority Science Program supports the delivery of the National Water Grid through three themes: water resource analysis, assessing alternative and emerging options for addressing water security, and communicating science (NWGA nd). Some of the work under the program is being undertaken by CSIRO and the Bureau of Meteorology.

The CSIRO maintains a water research stream to help Australia better manage its river basins and groundwater resources. Their research covers a wide range of applications including developments to support climate and hydrological modelling, water resource assessments, ecosystem research and monitoring, drought and efficiency research for agricultural production, and social research into the impacts of water reforms. CSIRO frequently conduct research and analysis for Australian, State and Territory Governments. Recent water projects have included:

- water resource assessments across northern Australia to investigate the potential for regions to support increased regional development (CSIRO nd)
- an assessment of water resources in Norfolk Island to support improved water security (CSIRO nd)
- a risk assessment for the Australian Government regarding the release of a Carp virus to manage Carp numbers in the Murray–Darling Basin (CSIRO 2020, p. 3)
- contributing to enhanced national climate change projections, and a framework to integrate climate and hydrological science modelling with the aim of informing water resource planning activities through the Earth Systems and Climate Change Hub (2020)
- monitoring and evaluating the benefits of environmental water releases, in conjunction with the Commonwealth Environmental Water Holder (CSIRO 2020, p. 9).

The Bureau of Meteorology maintains and updates a range of water information products. These include data on available water volumes, historical rainfall and stream flow data, hydrological geospatial information, water markets information, water assessments, soil moisture, runoff and evapotranspiration data and national performance reporting for urban water service providers. They also produce a range of short- and long-term forecast products (BOM 2021).

Other examples of knowledge generating activities, including those by State and Territory Governments, are listed in *Assessment*.

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## 1.1 Knowledge enables informed decision making and management

Decisions based on systematic evidence produce better outcomes (Evidence-Based Policymaking Collaborative 2016, p. 2; Sutcliffe and Court 2005, p. iii). And high quality information can lead to improved policy settings (PC 2010, p. 19). Governments being seen to take knowledge-based decisions can also be crucial to community acceptance of policy decisions (PC 2010, p. 2).

Ideally, all decisions should be based on the best available evidence.<sup>2</sup> Where decisions need to be made quickly, this will be the highest quality evidence to hand. Where more lead time is available, the evidence base can be built through strategic investments that consider the costs, risks, timing and knowledge that could be made available to support the decision-making process.

Sources of evidence used to inform decision making can be varied (Evidence-Based Policymaking Collaborative 2016, p. 3; Sutcliffe and Court 2005, p. 4). Academic research is one. Others include, for example, policy or operational reviews, monitoring data, climate or hydrological modelling exercises, expert judgment, Aboriginal and Torres Strait Islander knowledges, outcomes of experimentation and information collected by the private sector (for example investigations completed for environmental approvals).

Knowledge is used by decision makers in resource management and service provision (policy makers, water planners and water utilities) as well as by entitlement holders and the general public. The importance of trusted and credible water resource management information for water users, managers and the wider public is described in SP E *Integrity*.

Many of the supporting papers accompanying this one have flagged the need for decisions to be based on the best available evidence. For example, SP C *Environment* states best-practice principles to establish environmental objectives and agreed outcomes include a decision-making framework that is based on good scientific, objective and on the ground knowledge. And SP F *Urban* notes that acquiring information and conducting analysis on supply augmentation and demand management options will support best-practice planning.

## 1.2 Knowledge generation requires support and management

Knowledge related to management of Australia's water resources covers a wide range of disciplines, including engineering, hydraulics, hydrology, hydrogeology, climatology, ecology, chemistry, agriculture, Aboriginal and Torres Strait Islander knowledges, psychology, sociology, geography, economics, law and history (box 2). Building and maintaining expertise across these areas is important for informing water management. As the Murray–Darling Basin Authority (MDBA) (sub. 23, p. 14) noted:

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<sup>2</sup> Evidence includes data, other sources of information and knowledge, where the latter is a product of processes that draw meaning from data and other information.

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Investments in science and monitoring are critical to the development of water policy and the ongoing adaptive management of water policy.

Water-related knowledge generation is funded from a variety of sources, including the Australian, State and Territory Governments, research corporations and the private sector (including water utilities). Knowledge generation is also undertaken by a variety of bodies — government research institutions, universities and the private sector including consultants and water utilities.

### **Box 2      Applications of knowledge across a range of disciplines**

Knowledge relevant to water resource management and water service provision spans a wide range of disciplines.

For example, water planning decisions require:

- an understanding of the hydrology and hydrogeology of a system and how it behaves under different climate scenarios, generally captured in water system models
- regional climate change modelling to provide credible future climate scenarios
- an understanding of key ecological assets and their water requirements at different life history stages and their ecological tolerances
- an understanding of cultural values and their dependence on flow regimes
- an understanding of the demands of alternative consumptive water users (such as irrigation or town water supplies) across a connected system, including how these change
- socioeconomic tools to assist in trade-off decisions and scenario planning.

Advances in global satellite data accessibility and availability are being used to assist with compliance of water take and other controlled activities (*Assessment*).

The provision of safe drinking water requires human health and toxicology studies to determine appropriate standards for key parameters in drinking water guidelines and ongoing monitoring is required for emerging pollutants, such as Per- and polyfluoroalkyl substances (PFAS). Research is also required across chemistry and engineering to develop efficient treatment technologies, for example desalination membrane technology.

In recent pricing submissions, utilities have used innovative community engagement such as citizen juries (YVW 2017, p. 26). Utilities have also used choice modelling techniques, drawing on economics and psychology, to provide insights into customer willingness to pay for service improvements.

**Governments have a role to play in ensuring the funding of knowledge generation**

Governments have a role in funding knowledge generation that is in the public interest. This includes where research is a public good, or is supporting government delivery of public goods (PC 2007, p. 74). The management of water resource systems, environmental water management and the development of water quality standards are all examples of public goods. Without government support, knowledge creation would be under-provided, risking inefficient or poor provision of government services, and failure to achieve objectives.

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Governments, in the past, have recognised and invested in long-term research and training to support water-related knowledge generation. For example, in 2008 the Australian Government recognised a gap in knowledge about groundwater and a shortage of skilled groundwater scientists and managers. In response, the National Water Commission (NWC) and the Australian Research Council co-funded the National Centre for Groundwater Research and Training. Between 2009 and 2014, the Centre received approximately \$6.9 million in funding for the training of Honours, PhD and post-doctoral researchers (UNSW 2015, p. 13). The Centre continues to serve as a training and research institution; for example, it partnered with the MDBA to deliver a strategic groundwater research program between 2015 and 2018 to support enhanced groundwater management in the Murray–Darling Basin (MDB) (Simmons et al. 2019, p. 6).

In addition, other ongoing government-funded monitoring, data collection, technology development, modelling and analysis activities feed into knowledge-based decisions and further research. Examples include water trade data collection by the Bureau of Meteorology; water accounts maintained by the Bureau of Meteorology, the ABS and the MDBA; development of hydrological models within and across jurisdictions; and regular market analysis conducted by the Australian Bureau of Agricultural and Resource Economics and Sciences and the Australian Competition and Consumer Commission. Ongoing monitoring of water quantity and quality is undertaken in each State and Territory, and ecological monitoring is undertaken to support environmental management (SP C *Environment*).

In the coming decades: knowledge about the expected impacts of climate change on regional water resources will have important implications for water planning; understanding of ecological and environmental water needs will underpin decisions about the use of environmental water, including during periods of water scarcity; and projections of climate change and population growth will help water utilities manage water supply options to meet demand. Ongoing government-funded research effort will be needed.

**Economic regulation should allow for investment in knowledge generation by water utilities**

Other aspects of water knowledge generation are best funded by businesses. A clear example is knowledge that supports the operation of water service utilities. Improved understanding of urban water use, values and systems has the potential to lead to efficiency improvements, better outcomes and possibly lower service provision costs.

However, research, knowledge building or innovation do not feature strongly in documents specifying operational expectations of water utilities. For example, in New South Wales, obligations of water utilities are specified in operating licences. The operating licence for Sydney Water (2019–23) does not include reference to investment in innovation, research or knowledge building activities (Sydney Water 2019). An exception is in Victoria, where the *Ministerial Statement of Obligations* for water utilities states that water corporations must ‘undertake continuous review, innovation and improvement’ (Neville 2015, p. 5).

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These documents are used by economic regulators to identify acceptable expenditure in pricing determinations.

Inclusion of an expectation that regulated utilities invest in research and development activities relevant to their business in statements of obligations, or similar governing documents, would empower utilities and ensure that economic regulators include associated expenditure when making price determinations.

A clear requirement of the NWI for research in this space would alleviate the need for justifying investment in research to price regulators on an individual basis, especially in situations where benefits are long-term or intangible. (WaterRA, sub. 98, p. 2)

In NSW, the Independent Pricing and Regulatory Tribunal is currently undertaking a review which will consider how to encourage innovation in regulated water businesses to deliver greater value to customers (IPART 2020).

### Funding is needed for water-related knowledge generation to fill information gaps and support evidence-based decision making

The variety of funding sources and breadth of relevant topics make it difficult to identify how much research funding has been directed toward water-related issues and how it has changed over time. Some have suggested that funding has fallen. The Australian Academy of Technology and Engineering and the Australian Academy of Science (sub. 90, p. 6), for example, stated that current funding levels are near historic lows after the peak levels seen in the mid-2000s.

The academies also noted that most of the Australian Government research and development funding programs in the past three decades have lasted less than five years. Examples of programs that have ended, and it is not clear they have been replaced with similar programs, include Land and Water Australia, six different Cooperative Research Centre (CRC) programs, the National Program for Sustainable Irrigation, Raising National Water Standards, the Australian Water Recycling Centre of Excellence, and the National Centre for Excellence for Desalination. The NWC was also abolished in 2015. It had a number of functions related to the national water reform agenda, one of which was to ‘identify and address significant knowledge gaps critical to implementing the NWI’ (Rosalky 2011, p. 11). Knowledge generation activities initiated by the NWC included the *National Groundwater Action Plan*, projects to improve knowledge of northern Australian resources and initiatives to enhance Aboriginal and Torres Strait Islander engagement in water planning (Rosalky 2011, pp. 11–12).

Inquiry participants have called for the NWI to be supported by well-funded and managed research:

We ... recommend a national water research funding agency to professionally and strategically direct, administer and evaluate the investment of research funding, on a stable ongoing basis that nurtures long-term dividends for the nation. Such an agency would ensure the water research and

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development community is supported to provide contemporary evidence-based advice on approaches to water policy. (ATSE and AAS, sub. 90, p. 6)

... a strategic knowledge generation function similar to that performed by the former Land and Water Australia, [is] needed. (Wentworth Group of Concerned Scientists, sub. 68, p. 5)

Engineers Australia recommends continued investment in basic hydrological and ecohydrological research, and the long-term and targeted data monitoring networks that underpin them, to provide a strengthened knowledge base for future water resources development, management and reform. (Engineers Australia, sub. 63, p. 4)

... national research needs to be continued and adapted to regional Australia ... (NSW Water Directorate, sub. 37, p. 6)

The MDBA supports ... calls for policy makers to prioritise ... investment in research and development. (MDBA, sub. 23, p. 10)

And for investment in research capacity.

Australia should ensure sufficient support for research training and early career development in water-relevant disciplines, and in particular multidisciplinary doctoral programs. It is important to retain and develop capacity in research at a generational level, to ensure long-term continuity of expertise. (AAS, sub. 95, p. 1)

While the Commission has not assessed the current level of funding across all jurisdictions (due to challenges with identifying all funding sources), nor sought to determine the optimal level of funding, inquiry participants and others have identified knowledge gaps that are affecting various aspects of water management.

- Inland Rivers Network (sub. 86, p. 18) stated that ‘significant knowledge gaps have been recognised’ in the Great Artesian Basin and that water plans for the region require accurate calculation of planned environmental water and improved knowledge of annual recharge and flux due to its fragility. It suggested that the new NSW water plan for the Basin will not deliver on the environmental outcomes sought through the NWI because of these gaps.
- WWF Australia (sub. 50, p. 5) observed the then Queensland Department of Natural Resources, Mines and Energy’s ability to assess environmental outcomes in some water plan areas is undermined by poor data and knowledge gaps.
- Water Services Association of Australia (sub. 88, p. 16) noted that recent drought conditions and declining water supplies exposed gaps in understanding of water security.

Investments in knowledge generation have contributed to success in water reform and management over the 17 years since the NWI was agreed. For example, outputs of the *National Hydrological Modelling Strategy*, first initiated in 2008, are still being applied to water planning, operations and governance processes through the use of eWater Source, a national hydrological modelling platform (eWater 2019, p. 1). However, many other programs of research and development have come to an end yet water reform is still a work in progress. Further investments in knowledge generation will be key to filling existing knowledge gaps, supporting the ongoing reform process and responding to emerging challenges.

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## Coordination between jurisdictions will lead to more efficient investment

While some water knowledge needs are specific to a particular location or region, many are shared across jurisdictions. Coordination between jurisdictions on knowledge generation efforts and sharing of findings may have a number of benefits, such as avoiding duplication of effort, pooling of resources to realise more activities, greater knowledge dissemination and greater consensus on common issues. Smaller states can be more reliant on collaborative efforts and information sharing, as they can lack the capacity to undertake larger research tasks independently.

In 2017, the Commission noted that two national institutions for coordinating knowledge generation efforts — the NWC and the National Water Knowledge and Research Platform (NWKRP) — had ceased. The NWKRP was an outcome of the 2008 COAG *National Water Knowledge and Research Strategy*. It brought together representatives of each jurisdiction to discuss research plans, allow for collaboration and share findings. The NWKRP ceased in 2016 as it was not delivering on its objectives (PC 2017, p. 472).

There is currently no national platform to coordinate knowledge generation and sharing. The only cross-jurisdictional program identified by the Commission is within the MDB — the Basin Science Platform was established by MDB jurisdictions in 2019 to better understand and prioritise knowledge and science investment across the MDB (Joint Basin Governments 2019). However, a lack of coordination remains an issue:

Due to the lack of coordinated investment, and monitoring investment directly to the MDBA, the Basin Plan water reform remains under pressure. The lack of relevant information means that government cannot effectively describe the conditions of the Basin and the contributions the water management framework has made to the environment and Basin communities and economies. Additionally, the lack of relevant and accessible information has left a vacuum in the public domain, which is consequently filled with misinformation, misperceptions or misappropriation of available information, that only further erodes trust and support. (MDBA, sub. 23, p. 14)

In renewing the NWI, jurisdictions should recommit to a principle of effective coordination of knowledge building activities. The National Water Reform Committee appears well placed to coordinate research efforts by bringing jurisdictions together. Other options for how coordination is implemented may include re-establishing a standalone platform, standing up an additional committee of officials from each jurisdiction, or including the task as a function of an existing water policy agency.

## Identifying the priorities for knowledge generation efforts is important

Funding to support knowledge generation in water resource management and service provision will always compete with other areas of public expenditure, and the amount available should be reflective of expected research payoffs. Research priorities can therefore help to secure and maximise the value of research funding. Setting research priorities helps to direct research efforts into areas of strategic importance and policy relevance and, through

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this, maximise the benefits of research investment. Research priorities can inform the funding decisions of governments, research institutions and other research funding bodies. They should reflect current and emerging issues and should be regularly reassessed and updated as required.

A number of areas of significant knowledge and capacity building needs were identified in the NWI to support the implementation of the Agreement. And in 2012 the NWKRP identified priority research themes for a five year period, but this national effort ceased when the platform was defunded.

Some jurisdictions formally identify their science or research needs. In Victoria, the Applied Aquatic Ecology Research Hub, established in 2017, adopted key themes to guide research and monitoring needs, and these themes will be updated as priorities change (Victorian Government 2017, p. 6). Queensland's *Water Planning Science Plan* sets out the state-wide science needs for water plans, and is updated every five years (DRDMW (Qld) and DES (Qld) 2020, p. 7). The MDBA has also identified knowledge priorities to guide the Murray–Darling Water and Environment Research Program and other investments (*Assessment*: section 7).

Knowledge and capacity needs continuously evolve. Some of the priority areas identified under the NWI are of less relevance now as understanding has improved. Contemporary issues such as climate change and population growth, mean new knowledge gaps emerge. Knowledge gaps are also identified through experience. For example:

Observations from the Basin Plan implementation experience are that:

- Real-time information is limited, with significant time-lags in being able to report on water use and outcomes, particularly in terms of environmental water use.
- There remain significant gaps in being able to monitor and report an integrated view of the Basin's social, cultural, economic and environmental conditions over time. (MDBA sub. 23, p. 14)

A number of candidates for research effort have been identified through this inquiry and previous Commission research (box 3).

Only some parties to the NWI have a clear process for identifying and updating research priorities for the water sector. In the absence of State and Territory processes, a system for identifying water research priorities could be formalised at the national level. The National Water Reform Committee appears well placed to oversee a process to identify and report the highest research priorities. To remain current, priorities identified through the process would need to be updated regularly — for example, on a three-yearly basis. And an effective process would involve all jurisdictions and draw on input from the research community and research users. Research priorities should be provided to the Australian Research Council and other relevant funding bodies to help inform decisions on the provision of Australian government funding for research related to water.

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### Box 3      **Possible water-related research priority areas**

On the basis of issues canvassed in other supporting papers and previous Commission research, potential priorities for water-related research include knowledge that would underpin:

- adjusting water resource management to respond to climate change
- adaptive approaches to managing environmental water
- understanding the cultural value of water systems
- managing uncertainty in water supply planning processes
- costs and benefits of integrated water cycle management
- designing and testing regulation, policy and technologies for novel water supply sources in fully allocated catchments with a view to improve water security.

Submissions to the inquiry also noted the need for research related to groundwater, including development of groundwater models and improving linkages with surface water models, the impacts of other activities (such as the growing energy sector) on groundwater and use of groundwater for water supply for inland towns (International Association of Hydrogeologists, sub. 15, p. 2; NSW Water Directorate, sub. 37, p. 4; Holley et al., sub. 46, pp. 6–7).

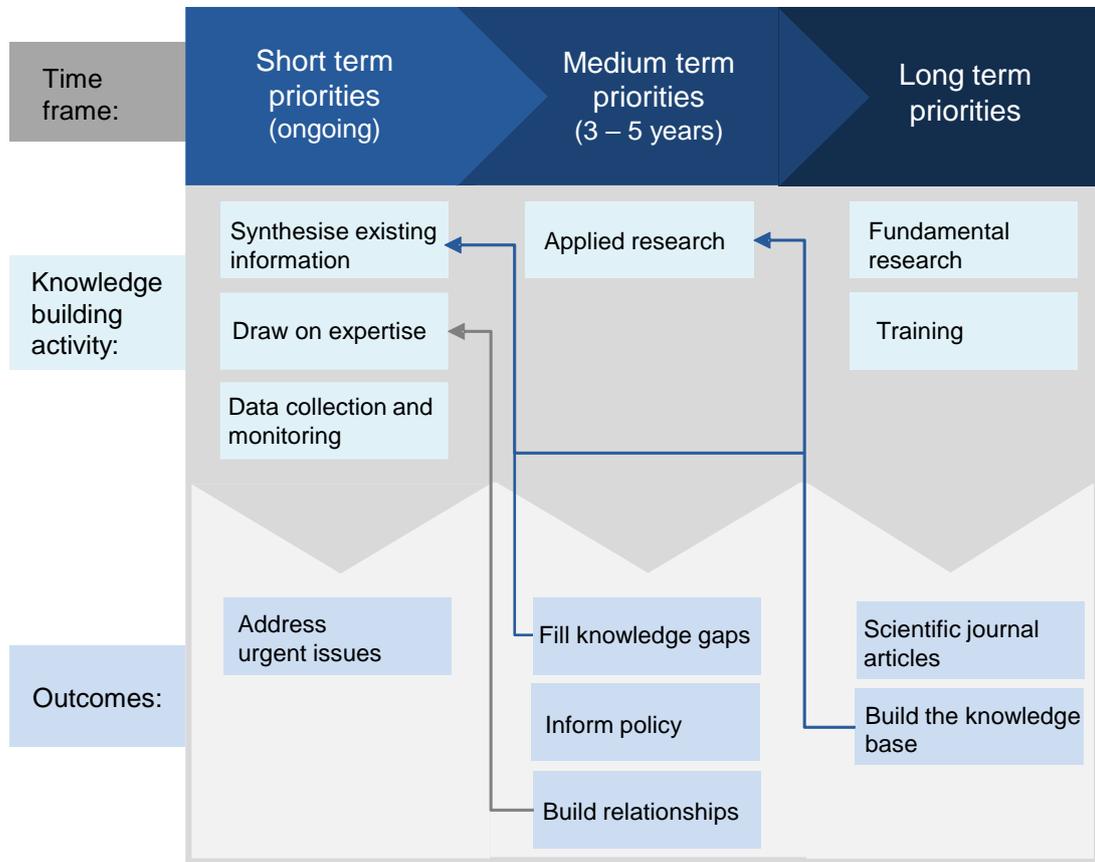
## **1.3 Governments also need to act to optimise the use of knowledge**

Provision of good information is not sufficient to realise knowledge-based policy. Decision makers need to know information exists. They are also more likely to use information if they trust its source and have confidence in the quality of the work. Channels for the flow of information between producers and users need to be fostered (PC 2010, p. 19).

### **Strong partnerships are needed**

Approaches to knowledge production and use can be described across three timeframes — short, medium and long term (figure 1) — and range from fundamental research to highly applied questions. The needs of decision makers (timely and relevant information) and knowledge generators (opportunities to produce work for publication and funding for research) can be met across these timeframes through ongoing partnerships that foster trust and communication.

Figure 1 Knowledge building activities



A short-term need characterises many policy situations. Decisions frequently need to be made in relatively short timeframes, without the opportunity to conduct new research. Decision makers will look for information that is currently available to help understand an urgent issue and respond. In this situation, data from regular monitoring activities are likely to be useful as well as the results of systematic reviews. Additionally, if these decisions are to be informed by the latest knowledge, decision makers may look to the research community for recent findings and expert opinion with integration through the creation of expert panels. To best support decision makers when these situations arise, investments should be made in data gathering and monitoring activities (SP E *Integrity*), in fundamental and applied research (on which they draw) and also in establishing durable links and building trust between decision makers and the research community.

The importance of sustaining links with the science community and maintaining data on river conditions is highlighted in the response to the 2018-19 fish deaths in the Lower Darling. In early 2019, meetings were convened of water holders, river operators and water policy officers from the MDB jurisdictions, along with fish scientists. Together, they shared and considered the available information on fish deaths, water quality and drought risks and proposed responses to the fish deaths (MDBA 2019b, p. 6). The independent assessment of

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the event found that the community and government actions in response to the deaths helped protect remaining fish (Vertessy et al. 2019, p. 12).

For the medium-term, decision makers will have an understanding of issues that are expected to arise and where there are knowledge gaps. Filling these knowledge gaps provides opportunities to establish and build on collaborative relationships. Over this timeframe, decision makers can work closely with researchers to undertake targeted applied research or synthesise existing information to fill identified knowledge gaps. Many of the research projects initiated by jurisdictions outlined in *Assessment*: section 7 fit this category.

Over the longer term, researchers have the opportunity to investigate ongoing, new and emerging issues likely to be of interest to policy makers and managers. Long-term research activities help generate and maintain the skills and knowledge base of water researchers. It should be strategic and directed at developing the knowledge, models and data likely to be helpful in meeting policy needs as well as identify the issues and opportunities for the future. WaterRA (sub. 98, p. 2) acknowledged the importance of longer-term, fundamental research to support relationships and provide the best available information required for shorter-term work when it arises:

More than ever, recent climate and health emergencies have emphasised the need for a high degree of collaboration between governments, research organisations and the community, to develop solutions in a timely manner. WaterRA has been involved in some of these efforts and can confirm that success was born from longstanding trusted relationships and foundation research conducted over previous decades, which provided the springboard for conducting research in a shorter time frame.

### *Several approaches to establishing constructive relationships can be identified*

Expert panels or communities of practice are frequently used to advise water policy makers and managers.

Expert panels established to address a particular problem in the short term, frequently draw on experts across a range of disciplines — helping to integrate the best available information for water managers or policy makers. For example, Icon Water drew together an expert panel over the period of May–June 2020 to provide perspectives on long-term water security (Icon Water 2020). And in 2019, the Australian Government established an independent expert panel in response to the 2018-19 fish deaths in the Lower Darling (Vertessy et al. 2019, p. 15).

Communities of practice are groups of experts that come together on a regular basis to discuss issues and best-practice responses, building relationships and trust. For example, until 2013 the Commonwealth Environmental Water Holder was advised by the Environmental Water Scientific Advisory Panel, the Stakeholder Reference Panel and the Commonwealth Environmental Water Advisory Council (PC 2017, p. 159). The MDBA established three communities of practice in 2018 that continue to improve the application of scientific knowledge to environmental water management (MDBA 2019a, p. 110). Communities of practice in particular, allow for two-way information flows so that the

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expert scientific community understands the needs of decision makers; and decision makers gain knowledge and support for the implementation of policy decisions.

Cooperative Research Centres (CRCs) have been another good model for creating partnerships and relationships between industry and researchers. The model also addresses the different timeframes for research and fosters discussion across different disciplines. To be eligible for funding under the program, CRCs must be medium to long term, include an education and training component and work to encourage application or take up of research. There is currently a CRC for Water Sensitive Cities, set up in 2012 and due to end in June 2021, and there have been a number of water-related CRCs in the past. Previous CRCs include the CRC for Catchment Hydrology (1992–2005), the CRC for Freshwater Ecology (1993–2005), the CRC for Water Quality and Treatment (1995–2008), the CRC for Irrigation Futures (2003–2010) and the eWater CRC (2005–2012).

However, with the decline in water-related centres through the mid-2000s and cessation of other mechanisms for policy–researcher collaboration such as Land and Water Australia (in 2009), there are few institutional mechanisms to regularly bring decision makers and researchers together beyond the MDBA communities of practice. There is a risk that, without such a mechanism, a disconnect between science and policy will grow.

Over time the Australian Government has progressively shifted the CRC program toward a commercial focus, away from areas of public goods. This is likely to mean fewer successful CRC bids from the water sector, where most of the benefits from research are public goods. The Commission has previously stated it does not support the move away from a public good focus in the CRC program (PC 2007, p. xxix):

The original objectives of the program should be reinstated — namely, the translation of research outputs into economic, social and environmental benefits, rather than focusing public support on the commercialisation of industrial research alone.

The CRC model is well-suited to the research needs of the water sector, operating across disciplines, timeframes and encouraging collaboration. If water sector programs with a strong public good focus are not eligible under the CRC program, consideration could be given to alternative research investment models that share these features.

For water service delivery issues, Water Research Australia brings together researchers, regulators and industry to help develop links between decision makers and the science community. Water Research Australia helps to define and conduct targeted research for the water industry (WaterRA 2020b). Its members include water utilities, consultants, government departments and universities; and research is mostly focused on issues for water utilities such as customer engagement, management of source water and contamination, water recovery and reuse, and economic regulation (WaterRA 2020a, 2021).

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## 2 Capacity and capability building

To effectively implement a renewed NWI, water planners, managers, regulators and policy makers will need both capacity and capability — that is, resources to identify and access the best available information and the requisite knowledge, experience and skills to evaluate and use them. Without adequate capacity and capability, new knowledge that is generated will be of little value. This requirement applies equally to the water resource management and service provision areas.

### 2.1 In water resource management

The Commission has limited evidence to suggest that the current capacity and capability of policy makers and water planners are inadequate to manage Australia’s water resources.

On a principles basis however, the recognition of capacity in the current NWI should be retained, and a commitment also made to capability development, in a renewed agreement. Efforts to build the capability of people involved in water resource management through education, training and collaboration would support their ability to put new knowledge to its best use and help optimise the return on investment in any knowledge building.

### 2.2 In water service provision

There appear to be greater challenges in ensuring adequate capacity and capability in service provision, particularly in small-scale utilities and in regional and remote areas of the country (SP G *Regional*). Participants have raised concerns about the capacity in local governments to implement best practice urban water planning and to provide water services. In particular, issues raised include that:

- local governments are under-resourced to implement priority reforms (HLW, sub. 65, p. 5)
- there are challenges recruiting and retaining skilled operational staff, particularly for regional and remote locations (Unity Water, sub. 44, p. 3, qldwater, sub. DR142, p. 4, LGNSW, sub. DR147, p. 11)
- there is a shortage of Registered Training Organisations and trainers to deliver training programs required by utilities, particularly in regional areas (LGNSW, sub. DR147, p. 11)
- there is no nationally consistent or minimum mandatory standard for water treatment operators, and competency mapping is required to ensure recognition of water professionals’ capabilities (WIOA, sub. 53, p. 4, AWA, sub. 89, p. 12, qldwater, sub. DR142, p. 5, LGNSW, sub. DR147, p. 11).

Hall et al. (2017) also discusses the lack of capability in Aboriginal and Torres Strait Islander communities to maintain water treatment facilities.

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Building the capacity and capability of water utilities' staff is primarily within the remit of the utilities. However, given the importance of the sector to the community and its wellbeing, governments have a responsibility to monitor and ensure appropriate systems are in place to maintain capability. In New South Wales, for example, the need for capability, training and certification of water utility staff was recognised in its infrastructure strategy (INSW 2018, p. 163).

As noted in *SP G Regional*, collaboration between service providers can help to overcome some scale challenges and could be facilitated by State and Territory Governments. Peak utility bodies also aid in collaboration and help to monitor developments, share information and support utilities in maintaining the skills of their staff. The Queensland Water Regional Alliance Program is an example of industry-led collaboration, including on issues associated with skills and training, supported with funding from the Queensland Government.

There are existing frameworks, outside the NWI, appropriately tasked to deal with training and qualification concerns. The Water Industry Reference Committee is responsible for the qualifications under the National Water Training Package, and is tasked with consulting widely with industry and other interested parties in developing the package (AISC 2020). And the national vocational education and training regulatory framework (DESE 2020) is the forum for concerns about delivery of training. Governments have a role in supporting these formal qualification and skills recognition frameworks, accrediting qualifications and training providers to ensure they meet quality requirements and the needs of the industry. The Productivity Commission has recently conducted a review of the National Agreement for Skills and Workforce Development which looks at Australia's vocational education and training system in detail (PC 2020).

The 2019 Water Industry Reference Committee skills forecast found that the primary reasons for skills shortages in the water industry were low wages, competition from other organisations and geographic location of work (AIS 2019, p. 22). These factors are likely to be more acute in the case of small utilities in regional and remote areas with limited resources. Consideration of the provision of community service obligation payments, where utilities are not able to adequately recover costs (*SP G Regional*), should take account of these challenges to ensure utilities maintain the capability to provide a basic level of service.

### **3 NWI renewal advice**

Knowledge, along with the capacity and capability to use it to best effect, has underpinned implementation of all elements of the NWI. This critical role will continue. An ongoing commitment to relevant knowledge generation and its effective use will be fundamental in enabling the Australian water sector to meet the challenges of climate change and population growth, innovate and continue to improve management approaches.

As an overarching principle, decisions across all facets of water resource management and service provision should be based on the best available information. Achieving this will

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require investments, both in knowledge creation and the relationships that enable policy makers and water managers to tap into expertise when it is needed.

#### NWI RENEWAL ADVICE 16.1: EFFECTIVE KNOWLEDGE GENERATION

Commitment to a culture of evidence-based decision making, innovation and continuous improvement will underpin successful implementation of a renewed National Water Initiative. Inclusion of the following principles in a renewed National Water Initiative would bring that to effect.

- Knowledge building priorities are identified through processes that involve all jurisdictions and draw on input from the research community and research users.
- Governments invest in knowledge generation activities that align with identified priorities and serve the public good.
- Investments are streamlined through effective coordination between jurisdictions.
- Utilities are empowered to invest efficiently in knowledge generation.
- Strong, durable partnerships between decision makers and knowledge generators are developed and actively managed.
- Decision makers have the capability and capacity to use knowledge effectively in making evidence-based decisions.
- Water utility staff have the capacity and capability to discharge their functions.

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