Year 1 evaluation of Queensland Water Modelling Network

Final Evaluation Report

A final evaluation report prepared for Department of Environment and Science

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AITHER

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Abbreviations

3CP	Capability, Collaboration and Capacity Program
DES	Department of Environment and Science
DRDMW	Department of Regional Development, Manufacturing and Water
EOI	Expression of Interest
QWMN	Queensland Water Modelling Network
RD&I	Research, Development and Innovation Program
RfP	Request for Proposal

Executive Summary

Climate change and variability, drought, groundwater over-extraction, run-off and erosion, and other pressures all pose risks to the quality and quantity of Queensland's water resources. These risks need to be managed effectively, to protect the state's water resources, and the social, cultural, economic and environmental outcomes they underpin. The Queensland Water Modelling Network (QWMN) was initiated to provide the tools, information and collaborative platforms to support best practice water modelling, and influence improved decision-making. Effective delivery of the QWMN will support water planning and management decisions that allow Queensland to continue to enjoy the social, cultural, economic and environmental outcomes from its water resources. Evaluation of Year 1 of the second phase of the QWMN will help ensure that the network makes best use of its limited resources, and achieves its desired outcomes and associated economic, social and cultural benefits.

Review findings

Through extensive stakeholder engagement and documentation review, this evaluation found that QWMN effectively addresses a clear and ongoing need and is achieving short-run outcomes. QWMN is also well-placed to achieve its long-run outcomes and vision. To ensure the continued success of the QWMN some opportunities have been identified to improve program delivery.

In summary, this evaluation found that:

QWMN is addressing a clear and ongoing need

The challenges facing Queensland's water resources will increase over time. QWMN addresses a clear and ongoing need to provide decision-makers with the best-available scientific evidence, modelling and tools to support effective policy and program design and decisions.

In particular, QWMN needs to continue to invest in actions to build capability in students and early career professionals to address organisational risk. Future investment to build capability should be focused on specific current and predicted future needs and requirements of the Queensland government.

Broad challenge statements have encouraged innovation in the research, development and innovation (RD&I) program. However, they also contributed to some confusion among stakeholders about the specific issues that the RD&I program is seeking to address. There is an opportunity for QWMN to target specific high value strategic needs more deliberately, while also continuing to encourage innovation.

Program delivery is effective and collaborative

Year 1 of the QWMN's program was delivered effectively, supported by efficient program management from the QWMN Secretariat. The QWMN Secretariat has facilitated effective collaboration across the Department of Environment and Science (DES) and other departments, universities, the private sector and with young professionals. The collaborative approach is considered by many stakeholders to be innovative, and nation-leading.

While the administration of QWMN was efficient and effective, stakeholders did suggest that longer and more flexible project timelines may support more collaborative projects and more comprehensive modelling research.

The RD&I tender process could also be streamlined to reduce the burden on applicants and the QWMN Secretariat. Stakeholders stated that the proposal requirements and timelines can present barriers to developing collaborative and innovative proposals. Some internal stakeholders and technical advisors were also unclear on the evaluation decision-making process of RD&I tenders. While the evaluation process appears sound, greater internal clarity will increase trust in the process.

QWMN is delivering intended outcomes

QWMN is achieving its short-run outcomes. QWMN has invested in strategic modelling requirements that will help the water sector model and address key risks and issues. Knowledge generated by these investments is being actively shared across Queensland. There are even examples of interest interstate and internationally in the work that QWMN is funding.

The early progress is building important foundations that will help the QWMN to realise its long-run outcomes. However, realising long-run outcomes will require decision-makers to understand water modelling information and use it to inform policy and management decisions. QWMN has experienced some challenges getting attendance at capability and networking events and sharing knowledge with policy and decision-makers. If this issue is not resolved, it could limit QWMN's ability to influence water planning and policy decisions.

Recommendations

The findings outlined above demonstrate that QWMN is in a strong position to continue to achieve its intended outcomes, and its vision of being a *"state-wide network with national influence that delivers transformative change"*. QWMN has limited resources and it is important that these resources are directed as efficiently and effectively as possible. To ensure the continued success of the QWMN, opportunities have been identified to target specific strategic needs, streamline and refine processes and raise the profile of QWMN:

Targeting specific strategic needs

- **Recommendation 1** - QWMN should consider a separate and complementary approach to market that identifies specific strategic needs for Queensland. An approach to market that encourages innovative projects should also continue.
- **Recommendation 2** - QWMN should identify the specific modelling capability needs and develop fit for purpose approaches to meet long-term requirements.

Streamlining and refining processes

- **Recommendation 3** - QWMN should consider options to accommodate longer project timelines, where this would support project outputs and outcomes. This should be considered within the context of the limited funding available.
- **Recommendation 4** - QWMN should streamline the RD&I tender process, including a two-stage application process and extended timelines. The two-stage application process should be applied to both the specific strategic needs and innovation approach to markets.

- **Recommendation 5** - QWMN should consider options to communicate with internal technical advisors at the conclusion of the tender evaluation process.

Raising the profile of QWMN with decision-makers

- **Recommendation 6** – QWMN should consider options to increase senior leadership advocacy for QWMN within government departments and councils.

1. The Queensland Water Modelling Network and the Year 1 evaluation

Queensland's water resources underpin social, cultural, economic and environmental outcomes across the state. Climate change and variability, drought, groundwater over-extraction, run-off and erosion, among other pressures are adversely affecting water outcomes for Queensland's communities, economies and environment.

Effective management of these risks requires proactive water planning and decision-making, informed by robust scientific evidence and water modelling. The Queensland Water Modelling Network (QWMN) was created to provide the tools, information and collaborative platforms to support best practice water modelling, and the uptake of their results by decision-makers.

Evaluation and adaptation are fundamental to the long-term success of the QWMN and help ensure best use of limited resources. Evaluation promotes improved planning and delivery to achieve outcomes, not just outputs, by measuring progress towards outcomes, identifying successes and areas for improvement, and informing adaptive management. Overall, evaluation can support greater efficiency and effectiveness in delivering the QWMN and achieving desired outcomes and associated economic, social and cultural benefits. Evaluation findings will also help demonstrate and communicate progress and achievement, giving ministers, industry partners, universities, the community and other stakeholders confidence in the value of the QWMN and supporting the case for future funding.

1.1. About the QWMN program

The QWMN was established in 2017 to improve the state's capacity to model its surface water and groundwater resources and improve the quality of models. The QWMN was initially resourced for four years (FY 2016-17 to 2019-20), and subsequently received approval for a further four years (FY 2020-21 to 2023-24).

Investment is led by five key goals, as described in the *QWMN Research, Development and Innovation Strategy 2018-2020* (Queensland Government 2018):

1. Build a state-wide network with national influence to deliver transformative change
2. Foster integrated and scalable modelling to address water risks and opportunities
3. Champion a community of practice to leverage expertise
4. Encourage strategic co-investment and co-production in water modelling research, development and innovation
5. Increase application of water modelling to inform decision-making.

These goals are delivered through three program areas:

- a Research, Development and Innovation (RD&I) investment program, including: i) strategic evaluations; ii) individual projects; and iii) reviews and responses

- capacity and capability building in government, research and private sectors (currently referred to as the Capability, Collaboration and Capacity Program (3CP))
- an underpinning effective governance process/structure.

Overall, QWMN's vision is to develop a state-wide network with national influence that delivers transformative change.

1.2. Purpose and approach to the evaluation

The purpose of this evaluation was to measure program effectiveness and the achievement of objectives and outcomes of Year 1 of the second funding tranche from 2020-2024.

The Year 1 evaluation focused on assessing process. The evaluation also considered progress towards outcomes where possible, acknowledging the early stage of the program, and identified potential opportunities to improve the efficiency and effectiveness of QWMN. As the first of the annual evaluations, this report also serves as a baseline for ongoing annual reporting.

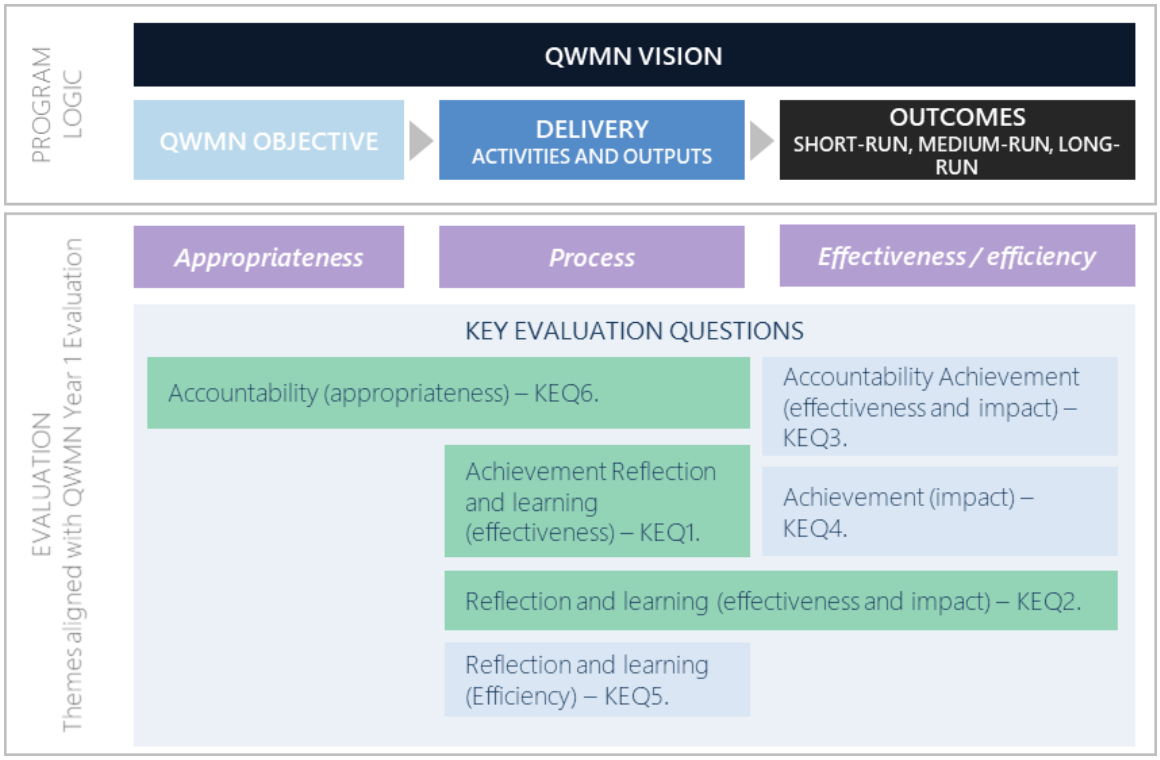
The evaluation was guided by the *Year 1 Monitoring and Evaluation Report: Final evaluation plan* (Aither 2021), which was adapted from the *M&E Framework (2020 - 2024): Queensland Water Modelling Network* (Alluvium 2020) to provide a detailed plan for the Year 1 evaluation. The *Year 1 Monitoring and Evaluation Report* (Aither 2021) provided a strong conceptual framework based on program logic to guide the evaluation. The program logic aligns with *Queensland Government Program Evaluation Guidelines* (Queensland Government 2020) and the existing *M&E Framework (2020 - 2024)* (Alluvium 2020).

The evaluation process took an iterative, multiple lines of inquiry approach drawing on stakeholder engagement and desktop analysis. Key evaluation questions (KEQs) were used to develop an accurate picture and evidence-base, and assess the:

- appropriateness of the program (considers the needs and objectives of the program)
- process (considers delivery inputs, activities and outputs)
- effectiveness and efficiency of the program (considers the progress and achievement of outcomes)[1].

Figure 1 shows the relationship between the program logic, three themes and the KEQs.

[1] Note: The evaluation focused on Year 1 but also considered activities that built upon activities and outcomes from the previous tranche of funding.



Note The annual evaluation is focused on collecting data to answer KEQs in the green boxes indicated. Some sub-questions from KEQ3, 4 and 5 also require annual data to be collected as part of the annual evaluation.

Figure 1 The relationship between program logic, evaluation themes and key evaluation questions

1.2.1. Approach to stakeholder engagement

Data on outcomes and some outputs is naturally limited in the early stages of program delivery. Stakeholder engagement was used as a critical information source for this Year 1 evaluation. Engagement was undertaken through two approaches:

- targeted individual or small group interviews
- an online survey distributed to the broader QWMN contact database.

Interviews followed a semi-structured approach, with high-level guiding questions. In total, 12 interviews were undertaken with 25 stakeholders across the following groups:

- 3CP Delivery Partners
- University Delivery Partners
- Private Delivery Partners
- Government Delivery Partners
- Former Steering Panel members
- DES policy / program
- 3CP Innovation Associates.

The online survey focused on capturing respondents' perceptions, agreement and satisfaction, using a Likert scale to quantify responses as well as open-ended questions to elicit further feedback. A total of 20 responses were received from a range of delivery partners, panel members and the broader water modelling community. Appendix B provides a summary of questions and responses to the survey.

Participation was voluntary for both engagement approaches. Figure 2 shows the representation across stakeholder groups from both engagement processes.

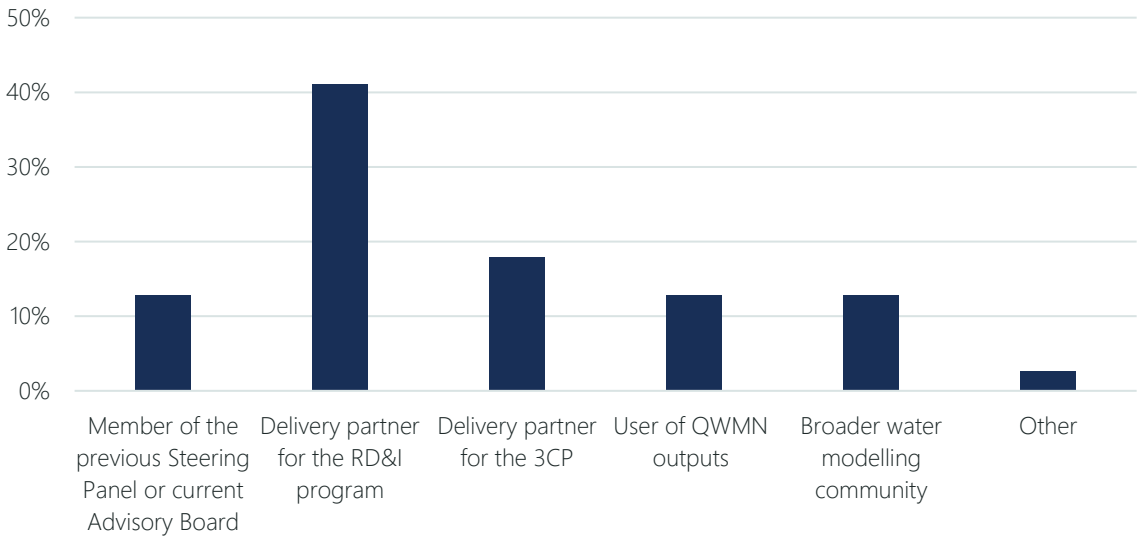


Figure 2 Proportion of the stakeholders engaged and their involvement with the QWMN

1.3. Structure of the report

The main body of this report presents findings and recommendations for the first year of the QMWN under the second tranche of funding. Findings and recommendations are grouped into the core themes of the evaluation:

- Section 2: Appropriateness - QWMN is addressing a clear and ongoing need
- Section 3: Process – Program delivery is effective and collaborative
- Section 4: Effectiveness – QWMN is delivering intended outcomes.

The evaluation approach and results are provided in the appendices:

- Appendix A - Program logic
- Appendix B - Survey questions and results.

2. QWMN is addressing a clear and ongoing need

Pressures such as climate change and variability, drought, groundwater over-extraction, run-off and erosion requires proactive, coordinated and robust water planning and decision-making to support water outcomes for Queensland's environment, communities and economy. The intensity of these challenges will increase over time.

QWMN addresses a clear and ongoing need to provide decision-makers with the best-available scientific evidence, modelling and tools to support effective policy and decisions. QWMN has made good progress and laid strong foundations and remains an appropriate means to address ongoing risks.

The future capability and capacity of Queensland water modelling needs to be developed to ensure the sector is resilient. Stakeholders consistently noted that the modelling capability in Queensland is limited to a small group of people. There is a continued need to develop and build the capability of the next generation of water modellers.

QWMN needs to continue to invest in actions to build capability in students and early career professionals to address organisational risk. This should be done by identifying the specific current and predicted future needs and requirements of the Queensland government.

Challenge statements used to prompt proposals for the RD&I program have been deliberately broad to encourage innovation and identification of emerging issues. There is evidence that this approach has enabled innovative projects and solutions. However, it has also contributed to some confusion among stakeholders about specific issues and intended end-users.

QWMN should continue to encourage innovation across the sector through this approach. Innovation should be complemented by a separate approach to market that identifies specific strategic needs for Queensland. Increased clarity and focus on the specific needs or problems the RD&I program is seeking to address will help to prioritise investment and identify and target intended beneficiaries. This clarity will also improve understanding of the RD&I purpose among applicants.

Recommendation 1

QWMN should consider a separate and complementary approach to market that identifies specific strategic needs for Queensland.

There is opportunity for QWMN to target specific high value strategic needs. QWMN should engage with government and private sector to identify a limited set of specific priority needs to be addressed that year to progress water planning and management.

This should be a separate approach to market. The current broad challenge statements should remain in order to encourage innovation across the sector.

Recommendation 2

QWMN should identify the specific modelling capability needs and develop fit for purpose approaches to meet long-term requirements.

QWMN should build the talent pool and long-term modelling capability by continuing to engage and develop university students and graduates. This should be done by identifying the specific current and predicted future needs and requirements of the Queensland government. Options for addressing capability needs can then be targeted appropriately.

2.1. QWMN addresses clear needs and risks in Queensland's strategic water modelling capacity and capability

QWMN addresses clear needs and risks identified by the 2014 Queensland Chief Scientist's *Science Capability Audit - Water* (the Water Audit). There remains strong demand for QWMN to address these ongoing gaps in the sector.

The Water Audit identified gaps and risks to effective water management, including:

- reduced capability in water-related science and research and development across Queensland, both within government and more broadly within the private and academic sector
- silos and no coordinated effort to understand emerging strategic water issues and risks
- challenges translating science to policy and decision-making.

The first four years of QWMN operations and activities (first phase) have laid the groundwork to address these gaps. Many stakeholders reflected that the activities undertaken under during the first phase of QWMN had addressed the initial gaps and challenges. It has provided a collaborative platform across the Queensland modelling sector and started to encourage a more strategic approach to addressing gaps and risks.

This collaborative and strategic approach across the sector has not yet been cemented, and QWMN remains appropriate to address ongoing risks in the sector. If funding was to be discontinued the sector would likely go back to being siloed and encounter the same problems, gaps and risks.

QWMN takes a multifaceted approach to addressing the gaps and risks identified by the Water Audit. This includes:

- direct funding for research, development and innovation to address priority modelling needs to inform decision-making (RD&I program)
- a separate Capability, Collaboration and Capacity Program that delivers events and services to build capacity and capability across the sector (3CP).

This is appropriate given the breadth of issues, and enables QWMN to address the distinct gaps facing the sector.

2.2. QWMN success is inspiring visions of an expanded future role, and providing guidance for future investment

QWMN success to date is encouraging stakeholders to look to the future. The strong support for QWMN provides a robust foundation for the network to build off and provides guidance for areas QWMN can focus on over the next few years.

Many of the issues facing the Queensland water modelling sector are also being faced by other states. There may be opportunity to collaborate with and leverage investment from other jurisdictions. There is a perception among stakeholders that the water modelling sector is lacking a coordinated response across Australia. Reflecting the value of QWMN, many stakeholders suggested that Queensland was well situated to be a leader in water modelling nationally, or even internationally. A national agenda may help to leverage skills and insights across Australia, and ultimately support better water planning and management decisions. Many pointed to QWMN as a leading example of a coordinated and strategic approach to modelling and suggested a future role for QWMN in facilitating a national agenda and approach to water modelling.

Stakeholders also identified areas for future investment based on emerging challenges and risks. The array of different challenges and risks are captured in Box A. These suggestions provide a useful starting point for the planned revision of the RD&I Strategy. The identified ideas also reflect the significant and varying challenges facing the sector. Limited budgets and resources will require the prioritisation of challenges – based on those that pose the most risk, or are likely to deliver the most benefit to the state. Priorities should be identified according to a clear policy problem or need in order to maximise outcomes from investment.

Box A: Potential future RD&I focus areas

Stakeholders suggested many future areas that the RD&I program could focus on. They ranged from specific model improvements to community engagement and education. Examples include:

- integration of climate change models with water models, in particular shallow water groundwater systems
- continued focus on groundwater modelling and integration with other catchment and surface water models
- increased modelling of wetlands
- increased modelling of estuaries at a water cycle level (for example, integration with groundwater)
- increased modelling of water holes
- consideration of water quality, including bio nutrients
- integration of water, terrestrial, air and groundwater models
- methods to improve model management, and calibration of models with on-ground data
- building trust and understanding of modelling with decision-makers, and community.

2.3. QWMN must continue to support innovation at the same time as addressing specific strategic needs

Challenge statements for the RD&I program have been deliberately broad to encourage innovation and independent development of projects and solutions. There may be opportunities to be more prescriptive about problems and intended beneficiaries to address specific and high value strategic needs, while also continuing to support innovation.

The challenge statements used to prompt proposals for research and develop funding address the high-level gaps or risks facing the sector. There is also evidence that the statements have enabled innovative projects and solutions. For example, one of the successful projects from the 2020-21 funding round; "*Between a hot place and hypoxia: Modelling to support climate adaptation of Queensland's inland river waterholes*" (Franklin and Cramp 2021), responded to three of the challenge statements. It also identified an issue and proposed solution not anticipated by the QWMN team.

The broad nature of the challenge statements, however, has contributed to some confusion among stakeholders. Multiple stakeholders suggested that the broad statements contributed to a lack of clarity on the exact issues that QWMN was seeking to address through the RD&I program. This includes:

- confusion about the intended end-users or beneficiaries of projects
- challenges for proponents in understanding the characteristics of a successful project
- potential lack of a regional focus.

There may be an opportunity for QWMN to provide more strategic direction on the specific issues and targeted end-users projects should be seeking to address. Clarity on specific needs or problems would help to identify and target intended beneficiaries of projects, and improve stakeholder understanding of the RD&I program and its focus. It would also help identify whether there was a specific regional need that was not being addressed, or had greater need or benefit, than other state-wide issues.

QWMN should still continue to support innovation. QWMN should consider having a particular challenge statement specifically for innovative projects, while having other, more specific challenge statements that identify a clear problem or need. This would continue to support innovative proposals while also ensuring that the critical modelling needs are being addressed.

2.4. Ensuring long-term modelling capability requires investment in the next generation

The long-term capability of Queensland modelling requires development of the next generation of water modellers. QWMN needs to continue to invest in actions to build capability in students and early career professionals to address organisational risk.

The vulnerabilities related to modelling capability across Queensland government departments engaged in water related science, policy and management was identified in the Water Audit. The Chief Scientist stated:

> *"the loss of a few key individuals either by retirement or resignation will have a marked negative effect on Queensland Government's capacity in the overall water sector" (Queensland Government 2014, p. 25).*

There is a continued need to develop and build the capability of the next generation of water modellers. QWMN has targeted this need through various approaches including supporting funding of PhDs, opportunistic internships, a hack-a-thon, a Source catchment student challenge and other events. There has been progress over the first phase of QWMN. Case Study 1 provides an example of how the practical capability of the next generation of water modellers has been built, while also identifying a talent pool for the Queensland government.

Capability building is a long-term and ongoing investment that requires continued and targeted investment. Stakeholders continued to raise concern about the limited number of modellers in government and associated organisational risk. There may be opportunities for more strategic investments to develop the capability of the next generation of water modellers. Clarity on the exact gaps that need to be filled within the Queensland government including anticipation of future needs and requirements will help to identify the most effective means of addressing future needs.

Case Study 1: Source catchment student challenge developing student capability

As part of the QWMN Mentoring Program provided in the first phase of the network, students developed practical experience using Australia's National Hydrological Modelling Platform and were exposed to Queensland government staff. Queensland government staff involved in the project reflected that this practical experience:

- enabled students to acquire relevant water modelling skills and capabilities and have an appreciation of the implications of water modelling on policy, planning and industry decision making
- highlighted some innovation solutions to practical questions and challenges
- provided a talent pool of interested students for the Queensland government to draw upon.

3. Program delivery is effective and collaborative

Year 1 of the QWMN's program was delivered effectively, supported by efficient program management from the QWMN Secretariat. The QWMN Secretariat has facilitated effective collaboration across DES and other government departments, universities, the private sector and with young professionals. Collaboration supported the identification of key policy problems, and more effective project outcomes. The collaborative approach is considered by many stakeholders to be innovative and nation leading.

While the administration of QWMN was efficient and effective, stakeholders did suggest that longer project timelines may support more collaborative projects and more comprehensive modelling research.

There are opportunities to refine the tender process for the RD&I program, to reduce resource requirements on evaluators and on project proponents. Stakeholders reflected that the tender process required significant input under tight timeframes to complete. It is also a significant task to review and evaluate responses. Introducing a two-stage application process, with an initial expression of interest (EOI) followed by detailed request for proposal (RfP) for shortlisted project proponents, would reduce resource requirements and address concerns about tight timeframes.

There are also opportunities to enhance the transparency of the RD&I tender evaluation process. Some technical advisors on evaluation panels were unclear on how their input had fed into final decision-making. While there was no evidence of poor practice, there are opportunities to provide feedback to technical advisors and others to clarify how the final decision was reached. This would help to provide additional transparency and enhance confidence in the evaluation process.

Recommendation 3

QWMN should consider options to accommodate longer project timelines.

QWMN should consider options to accommodate longer or more flexible project timelines where this would support project outputs and outcomes. This should be considered within the context of the limited funding available.

Recommendation 4

QWMN should streamline the tender process, including a two-stage application process and extended timelines.

The tender process should be divided into a two-stage application process. This will reduce initial resource requirements for project applicants, and support more collaborative applications. It will also manage the resource requirements for evaluation, which will be important as interest in QWMN increases.

The two-stage process should be split into:

- an initial EOI, such as an abstract or short project description
- a detailed RfP for shortlisted EOIs.

The process should ensure that there is sufficient time for project applicants to develop their RfP.

Recommendation 5

QWMN should consider options to communicate with internal technical advisors at the conclusion of the tender evaluation process

QWMN should ensure feedback is provided to technical advisors about how their advice has informed decisions. This could include formal internal written or verbal reports back to technical advisors on the final decision. Improved communication of evaluation processes and decisions would increase transparency internally and support long-term confidence in QWMN.

3.1. QWMN's collaborative approach provides benefits to projects and the sector

QWMN's focus on collaboration has provided benefits to research projects and the sector. The 3CP program has developed a strong Community of Practice within the Queensland water modelling sector. The QWMN Secretariat has also proactively built networks and relationships to understand government and decision-maker questions and needs across the sector.

The QWMN Secretariat have proactively established connections and relationships across DES and other departments to improve collective understanding of issues and identify key policy gaps. For example, the RD&I program has been able to address specific gaps in wetland modelling raised by the wetlands team in DES. The QWMN Secretariat is also now beginning to build relationships outside of DES, in relevant departments such as the Department of Regional Development, Manufacturing and Water (DRDMW). DRDMW reflected positively on being consulted during the development of

challenge statements for the RD&I program as this has provided the opportunity to shape the RD&I investment process to meet their policy requirements. DRDMW expressed an interest in being further engaged and involved in the QWMN.

The requirement for collaboration has improved the efficiency of RD&I projects. Stakeholders reflected that collaboration between different organisations and disciplines made them better placed to answer complex questions and provide pragmatic and achievable solutions. Although collaboration was highly valued, stakeholders commented that it was not without challenges. Some stakeholders suggested that the expectations for collaboration for RD&I projects were too high and were not commensurate with the amount of funding and limited time available to undertake projects.

Outputs from the QWMN Secretariat have helped develop capability across the sector. Workshops run by the QWMN Secretariat have provided useful information on writing successful tenders, with one stakeholder reflecting that it had helped develop approaches for successful funding applications in the future. Stakeholders also reflected positively on feedback provided on tender applications.

3.2. Administration is generally clear and effective, with some opportunities for greater flexibility

Year 1 of the QWMN has been delivered on time and broadly on budget. This success has been facilitated by effective program management and administration. Some additional flexibility in project timelines may support improved outputs and outcomes

The QWMN governance and administrative approach, executed by the QWMN Secretariat, is effective and appropriate. There is clear program and risk reporting by the QWMN Secretariat. RD&I program delivery partners were generally comfortable with the reporting requirements, and approach to management and communication from the QWMN Secretariat. Figure 3 shows that over 90 percent of survey respondents found project administration to be simple and clear. During Year 1 of the second tranche of funding, the QWMN transitioned from an overarching Steering Panel which was predominately made up of Queensland government representatives, to a broader Advisory Board with members from the private, academic and government sectors. This has enabled greater input and advice from across the sector and demonstrates a maturing of the QWMN governance.

Figure 3 Survey results: How effective was the QWMN Secretariat project administration?

The QWMN program was delivered on budget. Twenty-seven submissions were received from the RD&I tender process, with three successful projects funded and delivered in Year 1. Table 1 summarises the projects. The QWMN External Engagement Program, which ran for 2 years and 9 months, was completed in February 2021. The program facilitated a community of practice, university mentoring program, innovation program (including five industrial PhD students), a biennial forum, a strategic partnerships group (to broker new partnerships/investment) and communications (external website, visual design and monthly e-newsletter). An evaluation of the External Engagement Program has been completed (separately and independently from the Year 1 evaluation). Over its lifespan, engagement (measured by newsletter recipients) with the External Engagement Program grew by 861 per cent. A successful tender process for the next phase of the engagement program (the 3CP) was run in 2021 to maintain and build momentum established under the original engagement program.

Table 1 RD&I projects funded through Year 1

Project title	Project description	Project lead	Partners
Modelling Surface Water Availability to Inform Water Security for Freashwater Biodiversity and Human Society in a Changing Climate	This project will develop fine-grained, spatially explicit predictive models of surface water availability under future scenarios of climate change throughout south-eastern Queensland river networks to inform water planning and biodiversity management. It will provide hydro-ecological model outputs in user-friendly forms to support water management and community adaptation to climate change.	Griffith University	• Healthy Land and Water • SeqWater • Bureau of Meteorology
Between a hot place and hypoxia: Modelling to support climate adaptation of Queensland's inland river waterholes	This project will develop a new modelling capability for assessing the responses of dissolved oxygen regimes in refuge waterholes during periods without flow; the influences of varied hydrologic and weather conditions; and the threats this might pose to the fish which rely upon these waterholes for their survival. The project will develop a flexible and adaptable river waterhole ecohydrology model which will support future adaptation strategies.	University of Western Australia	• University of Queensland • Water Planning Ecology, Department of Environment and Science
Reefonomics: delivering social dimensions to the Reefonomics platform	This project will add modelling capacity to the existing Reefonomics platform to allow social dimensions to be modelled alongside the water quality and economic implications of land management actions. Specifically, two major components will be added: 1. adoption –likelihood of land management actions to be adopted 2. social benefit –if adopted what are the farm-level, district, industry and region level social benefits of the investment portfolio?	Truii	• Eberhard Consulting • Office of the Great Barrier Reef

Flexibility in project delivery timelines may enhance RD&I project outputs and outcomes. There were some suggestions that short and strict timelines may have limited project outputs. For instance, some suggested that data sharing opportunities with partners and colleagues across different projects was limited due to set timelines. It was also suggested that the nine-month approach to projects (accounting for tender assessment periods and contract negotiations) may have limited project outcomes, with longer projects potentially able to consider more complex problems.

More flexible approaches to project timelines in the future may assist delivery partners to coordinate and collaborate across projects. Options to accommodate longer or more flexible project timelines where this would support project outputs and outcomes should be considered.

3.3. Streamlined tender processes could reduce the burden on applicants and the QWMN Secretariat

RD&I tender processes are resource intensive for project applicants and for the QWMN Secretariat. A streamlined approach could reduce resource burdens for both applicants and the QWMN Secretariat.

The resources required to administer the tender process are increasing. QWMN is receiving a greater number of applications as recognition of and interest in the network grows. This means that there is greater competition, and more diversity of proposals. However, it also increases the resources required for the administration and evaluation process for the QWMN Secretariat.

The proposal requirements and timelines can present barriers to developing collaborative and innovative proposals. There was a six-week timeline for 2020-2021 applications, occurring between 30 March to mid-May. Stakeholders indicated this timeline made it challenging to develop a collaborative and innovative approach. Overlaps with other grant and funding processes added further challenges to the process. There was even some evidence of potential proponents not submitting proposals given the short timelines and effort required to complete the proposal.

A streamlined, two-stage tender process would reduce the resource burden on applicants and the QWMN Secretariat. The administration and evaluation resource requirements will increase as interest in QWMN continues to grow. An improved tender process will also help support future growth of QWMN. A simpler tender process would also encourage greater competition, with a larger number of organisations likely to submit proposals if less investment (and therefore risk) was required to submit an initial application.

The following gateway approach to the tender process is recommended for both the strategic needs and innovation approaches to market:

1. Initial Expression of Interest (EOI) - that invites abstracts or short project descriptions in response to challenge statements. Applications should be assessed against agreed criteria, with a selected shortlist invited to provide detailed response to a request for proposal (RfP).
2. a detailed RfP for shortlisted EOIs – this should be similar to the current request for proposal with a detailed methodology and budget.

Opportunities to extend application timelines should also be considered, noting the two-stage tender approach would likely help achieve.

3.4. Greater clarity on evaluation decision-making will increase trust in process

The evaluation process for the RD&I program is sound, but there may be some opportunities to improve its transparency.

QWMN follows standard procedures for tender evaluation and the process appears sound. Evaluation questions and weighted criteria is used to assess proposals, and there is an evaluation panel with clear and delineated responsibilities. The QWMN Secretariat provide feedback to both successful and unsuccessful proponents, supporting transparency of decision-making. This feedback was reflected positively by project proponents.

Some stakeholders are not completely clear on how RD&I projects are selected. Some technical advisors on the evaluation panel were unclear on how their inputs had fed into final decision-making. QWMN should ensure feedback is provided to technical advisors on how their advice was used to inform the final selection of projects. This could include formal internal written or verbal reports back to technical advisors.

A minority of external stakeholders suggested the RD&I evaluation process was not transparent. This perception reportedly discouraged a small minority of stakeholders from participating in the tender process. However, Aither's review found that the process was robust and transparent and there are limited avenues to improve external processes.

4. QWMN is delivering intended outcomes

QWMN is achieving its short-run outcomes. QWMN has invested in strategic modelling requirements that will help the water sector model and address key risks and issues. Knowledge generated by these investments is being actively shared across Queensland. There are even examples of interest interstate and internationally in the work that QWMN is funding.

The early progress is building important foundations that will help the QWMN to realise its long-run outcomes. However, realising long-run outcomes will require decision-makers to understand water modelling information and use it to inform policy and management decisions. QWMN has experienced some challenges getting attendance at events and sharing knowledge with policy and decision-makers. This may limit QWMN's ability to influence water planning and policy decisions.

Greater awareness among government (both state departments and local government) would encourage more involvement from decision-makers with QWMN. QWMN should actively engage with state and local government leaders to raise the profile of QWMN among decision-makers.

Recommendation 6

QWMN should consider options to increase senior leadership advocacy for QWMN within government departments and councils.

Improving senior leadership engagement would raise the profile of QWMN among decision-makers. The quarterly Science Operational Committee meetings provide an opportunity to raise the profile of QWMN among key government decision-makers. QWMN should also target a similar leadership meeting within the Local Government Association of Queensland.

4.1. Most short-run outcomes are being realised

QWMN is demonstrating success, with short-run outcomes being realised. QWMN has invested in strategic modelling needs to address key risks and issues facing the sector. It has also built a Community of Practice that supports knowledge generation and sharing, and capacity building. The outcome "models consider traditional knowledge and cultural values" has not yet been achieved as investment was not focused in this area in the first year.

Since its establishment, the QWMN has encouraged investment to address strategic needs and risks. This has been supported by both major program areas of QWMN, and is demonstrated by the achievement of short-run outcomes. Stakeholders stated that QWMN investments had enabled the sector to move beyond investments that were focused on operational modelling to broader strategic risks and issues facing the sector. For example, Griffith University drew on insights from several projects to revise their curriculums to meet current gaps in modeller capability and provide students with skills aligned with sector need (see Case Study 2 below). Stakeholders also indicated that networking events built connections which supported efficiency in the sector by removing silos, particularly between other commercial and government stakeholders.

Case study 2: QWMN is influencing university curriculum

Insights from two QWMN documents (*Skills and Knowledge Audit* and *Critical review of climate change in Queensland water modelling)* helped to inform curriculum development at Griffith University (Queensland Government 2019; Alluvium 2019). Revisions to the curriculum will shape the development of students and help to address gaps in modeller capability. This demonstrates the influence of QWMN, and provides a clear case study on how QWMN is helping to encourage a more strategic approach to addressing capability and capacity gaps within the sector.

The civil and environmental engineering curriculum has been revised in response to findings from the *Skills and Knowledge Audit* (Queensland Government 2019). The audit, completed as part of the External Engagement Program (the precursor to the 3CP program), highlighted a strong demand for water modellers with programming skills to support effective communication of the modelling outcomes. Programming and data manipulation to support effective communication (i.e. big data handling and visualisation) have become foundation elements in the curriculum to help address this need.

An undergraduate hydrology course has also been updated in response to the *Critical review of climate change in Queensland water modelling* (Alluvium 2019). This review was funded under the RD&I project stream in 2019. The report provided background information on the different sources of future climate information and the methods to incorporate this information into hydrologic models. The information formed the basis of the new teaching and learning material for the course and led to the specific inclusion of future climate modelling assessment tasks. This will provide students with practical experience and knowledge that can be used in their careers.

There is evidence that the majority of short-run outcomes are being realised. The program logic in Appendix A summarises the anticipated outcomes and theory of change behind the QWMN. Table 2 below summarises how short-run outcomes have been realised. Where this is no evidence of outcomes being realised, this is because investment has not been made in these areas. Planned investment for Year 2 suggests that these outcomes will be addressed.

Table 2 Achievement of short-run outcomes

Short-run outcome	Summary of achievement
Models refined and aligned with user needs	Models have been refined and are better aligned with user needs. QWMN has engaged across the sector to understand user needs and requirements. The majority of survey respondents stated QWMN has developed and improved models that are better suited to users' needs, and produce outputs that are better integrated with program design and investment
Models integrate with and support monitoring activities	QWMN has developed tools that integrate with existing monitoring activities. For instance, the Reefonomics tool is a web-based tool that supports prioritisation of investment in on-ground actions across the Great Barrier Reef catchments. The tool brings together multiple different data sources from different models as well as monitoring activities undertaken for the Queensland Office of the Great Barrier Reef to generate scenarios that can help decision-makers make investment decisions.

Short-run outcome	Summary of achievement
Improved sector capacity and capability to use and apply models	QWMN has encouraged a more strategic approach to addressing capability and capacity gaps. Forty-one percent of survey respondents felt that 3CP events had helped them learn new skills or knowledge that could be applied to their job and supported a "moderate change" in their capacity and capability to use and apply models. There is evidence of university curriculums being revised to address gaps in modeller capability (see Case Study 2).
Improved government capacity and capability to use and apply models	Government stakeholders have been engaged in the design of RD&I challenge statements. Multiple stakeholders stated that they had been able to get specific questions answered through targeted QWMN investment. There have been some challenges engaging policy decision-makers in 3CP events. This is discussed further in Section 4.3.
Knowledge generated is shared across targeted groups	Knowledge has been shared across the Queensland water modelling community, and nationally and internationally. Forty-one percent of survey respondents felt that 3CP events had helped them learn new skills or knowledge that could be applied to their job. QWMN Secretariat actively sought opportunities to share knowledge from RD&I projects, including organising a webinar on the outcomes of one RD&I project that received national and international attendance (see Case Study 3).
Knowledge created from reviews	Knowledge has been generated through reviews. For example, the *Critical review of climate change and water modelling* in Queensland was referenced by multiple stakeholders as a key document that identifies key areas for further research. Content and insights from the critical review have also been used to revise a university curriculum to incorporate climate modelling with hydrology modelling.
Models consider traditional knowledge and cultural values	There is no evidence yet of models better considering traditional knowledge and cultural values due to QWMN investment. This is because this was not a focus area until 2021. Aither notes that the 2021-2022 RD&I challenge statements included requests for incorporation of traditional knowledge and cultural values in some of the statements, and understands that this will be a greater focus for the QMWN in the future.

4.2. Knowledge has been shared across and beyond the QLD modelling sector

Knowledge generated through QWMN is being shared through workshops and presentations which have received national and, at times, international interest. The transition to online forums has enabled knowledge to be shared efficiently across Queensland, including regional areas.

QWMN has a wide audience and actively shares knowledge across the state. During Year 1, engagement activities were largely conducted online due to the COVID-19 pandemic. Although unintended, the transition to online platforms supported greater knowledge sharing across regional

areas. Online platforms open up networking events and conferences to those in regional areas who otherwise may not have been able to justify the travel and time costs to attend events in Brisbane. There were even examples of webinars being attended by people from across the country, and internationally (see Case Study 3). There was a strong view among stakeholders that the online component of QWMN events should continue to support knowledge sharing across the whole state.

Aither understands that the next iteration of 3CP will have a combination of online and in-person events. This approach will support regional engagement and access to knowledge and networks, while also supporting more informal networking activities enabled through face-to-face events. There may also be opportunities to liaise with the Local Government Association of Queensland and coordinate face-to-face events with other conferences so that travel can be more easily justified for regional council officers.

Case study 3: Between a Hot Place and Hypoxia seminar

Knowledge from Year 1 RD&I project *Between a hot place and hypoxia: Modelling to support climate adaptation of QLD inland river waterholes* (Franklin and Cramp 2021), that modelled fish adaptation to climate change, has been shared across Queensland, and more broadly nationally and internationally. This is a clear example of knowledge being actively shared by QWMN across the modelling sector. It also highlights that QWMN is undertaking work of national and international interest and demonstrates that online platforms are an effective means of sharing knowledge across a wider cohort.

The webinar was run virtually over Microsoft Teams in June 2021 and received wide attendance. Seventy-one participants attended at the time. Forty-eight percent of attendees were from Queensland, from across government, universities and the private sector. The webinar also received attendance from New South Wales Government, and the Commonwealth Government, and from professionals in the United Kingdom and Cyprus. A recording of the webinar has since been shared on YouTube and has received 100 views.

4.3. QWMN has built strong foundations to achieve long-run outcomes and benefits

This Year 1 evaluation did not require an evaluation of long-run outcomes. However, early successes and achievement of short-run outcomes is providing a clear pathway toward long-run outcomes. The QWMN is set up to realise its long-run outcomes.

Strong foundations have been built for QWMN to achieve long-run outcomes and benefits. Stakeholders can see a clear link between the achievement of short-run outcomes toward medium and long-run outcomes and benefits. Figure 4 shows this linkage between QWMN outcomes and benefits. There are already examples of QWMN realising some of its medium-run outcomes. As discussed in Section 4.2, QWMN is sharing knowledge across the Queensland water modelling community, and at times more broadly.

Realising the potential benefits of QWMN is complex. There are external factors that will ultimately influence the realisation of long-run benefits, including large government water planning and management programs and private decision-making. However, QWMN can play an enabling role and

provide robust information to improve water planning, decision-making and management decisions and achieve social, cultural, economic and environmental benefits. Tracking particular case studies will help to demonstrate the causal links between information from QWMN investments and achievement of benefits over time. Potential case studies to track over time are identified in Box B below.

Box B: Potential case studies to inform future evaluations

The Year 1 evaluation was required to identify and document possible projects that could be insightful case studies on the achievement of outcomes and benefits in the mid-term and final evaluations.

The following projects are likely to improve water planning decision-making and investments over time, and should be reviewed as part of the QWMN mid-term and final evaluations:

- **Reefonomics** – potential to improve reef decision-making to maximise environmental, economic and social outcomes from investments.
- **Modelling from between a hot place and hypoxia study** – potential to support better drought management to protect fish species, and associated environment values and services and avoided extreme event costs.
- **Critical review of climate change and water modelling in Queensland** – potential to inform future investments to improve modelling and understanding of climate change effects on water, and avoided extreme event costs.

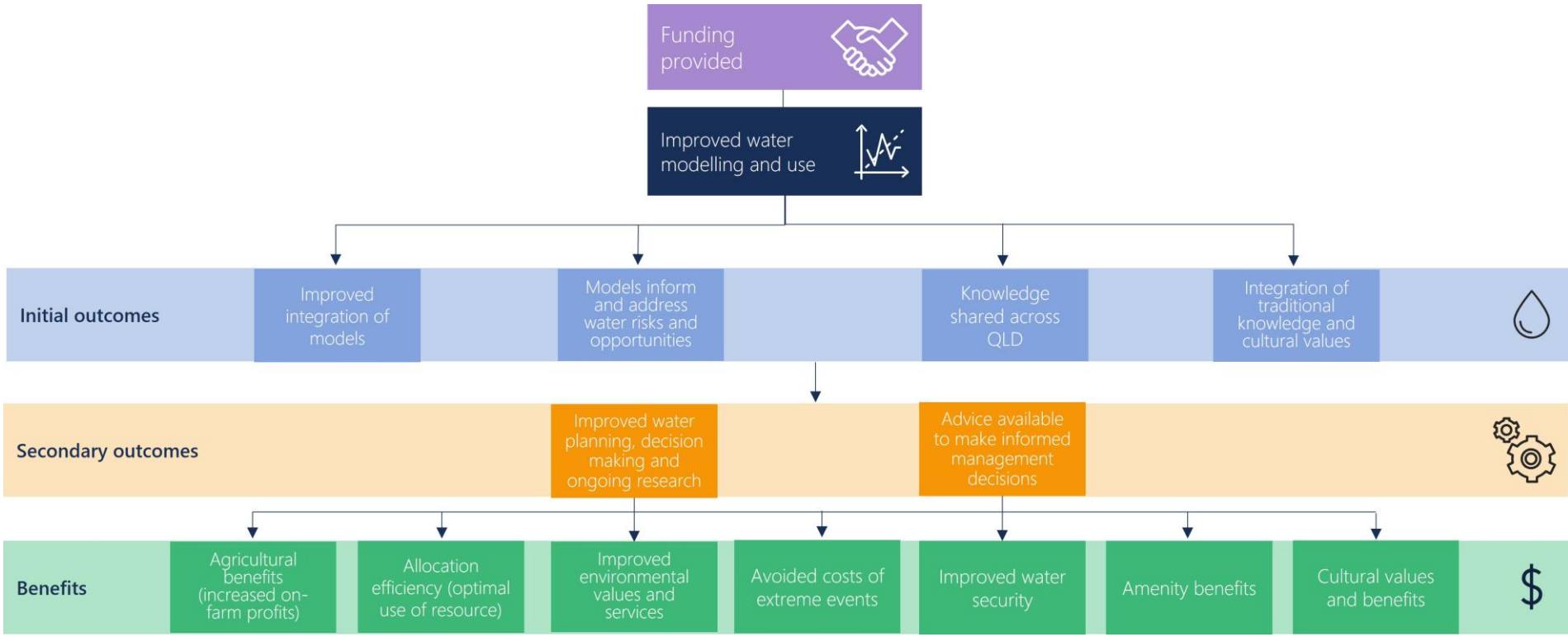


Figure 4 Map of conceptual benefits in Queensland

4.4. The profile of QWMN among leaders should be raised

Decision-makers need to understand and use water modelling information for the benefits of the QWMN to be achieved. QWMN has actively involved decision-makers from across government but there have been challenges getting the desired level of engagement with the network. The profile of QWMN among government and local council leaders could be improved.

There is growing recognition of QWMN across departments. The QWMN Secretariat actively seeks to involve stakeholders from DES and DRDMW in QWMN planning processes, such as the development of annual Challenge Statements for the RD&I program and inclusion of DRDMW and Department of Resources representatives on the Advisory Board. This supports investment into real-world challenges and questions facing decision-makers.

Awareness of QWMN and its achievements among leaders and key decision-makers could be improved. Stakeholders noted that there was often limited attendance from policy and decision-makers at events which limit QWMN's ability to influence water planning and policy decisions. QWMN could have a higher profile with government and local council leaders.

QWMN should actively seek to engage with government and local council leaders to raise awareness of the network. Aither understands that there are quarterly Science Operational Committee meetings that involve senior leadership across multiple Queensland government departments. This provides an opportunity to raise the profile of QWMN with key government decision-makers. QWMN should also seek to engage with the Local Government Association of Queensland in a similar forum to build awareness among council leaders.

5. Recommendations

Year 1 of the QWMN has been built from strong foundations established in the first phase of the network. QWMN is addressing a clear need, has identified actions and mechanisms to address this need and is delivering those actions. Short-run outcomes have been achieved, and are setting up QWMN to achieve its long-run outcomes and vision.

QWMN has limited resources and it is important that these resources are directed as efficiently and effectively as possible. To ensure the continued success of the QWMN, opportunities have been identified to target specific strategic needs, streamline and refine processes and raise the profile of QWMN, including:

Targeting specific strategic needs

- **Recommendation 1** - QWMN should consider a separate and complementary approach to market that identifies specific strategic needs for Queensland. An approach to market that encourages innovative projects should also continue.
- **Recommendation 2** - QWMN should identify the specific modelling capability needs and develop fit for purpose approaches to meet long-term requirements.

Extending timelines and streamlining processes

- **Recommendation 3** - QWMN should consider options to accommodate longer project timelines, where this would support project outputs and outcomes. This should be considered within the context of the limited funding available.
- **Recommendation 4** - QWMN should streamline the RD&I tender process, including a two-stage application process and extended timelines. The two-stage application process should be applied to both the specific strategic needs and innovation approach to markets.
- **Recommendation 5** - QWMN should consider options to communicate with internal technical advisors at the conclusion of the tender evaluation process.

Raising the profile of QWMN with decision-makers

- **Recommendation 6** – QWMN should consider options to increase senior leadership advocacy for QWMN within government departments and councils.

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Appendix A - Program logic

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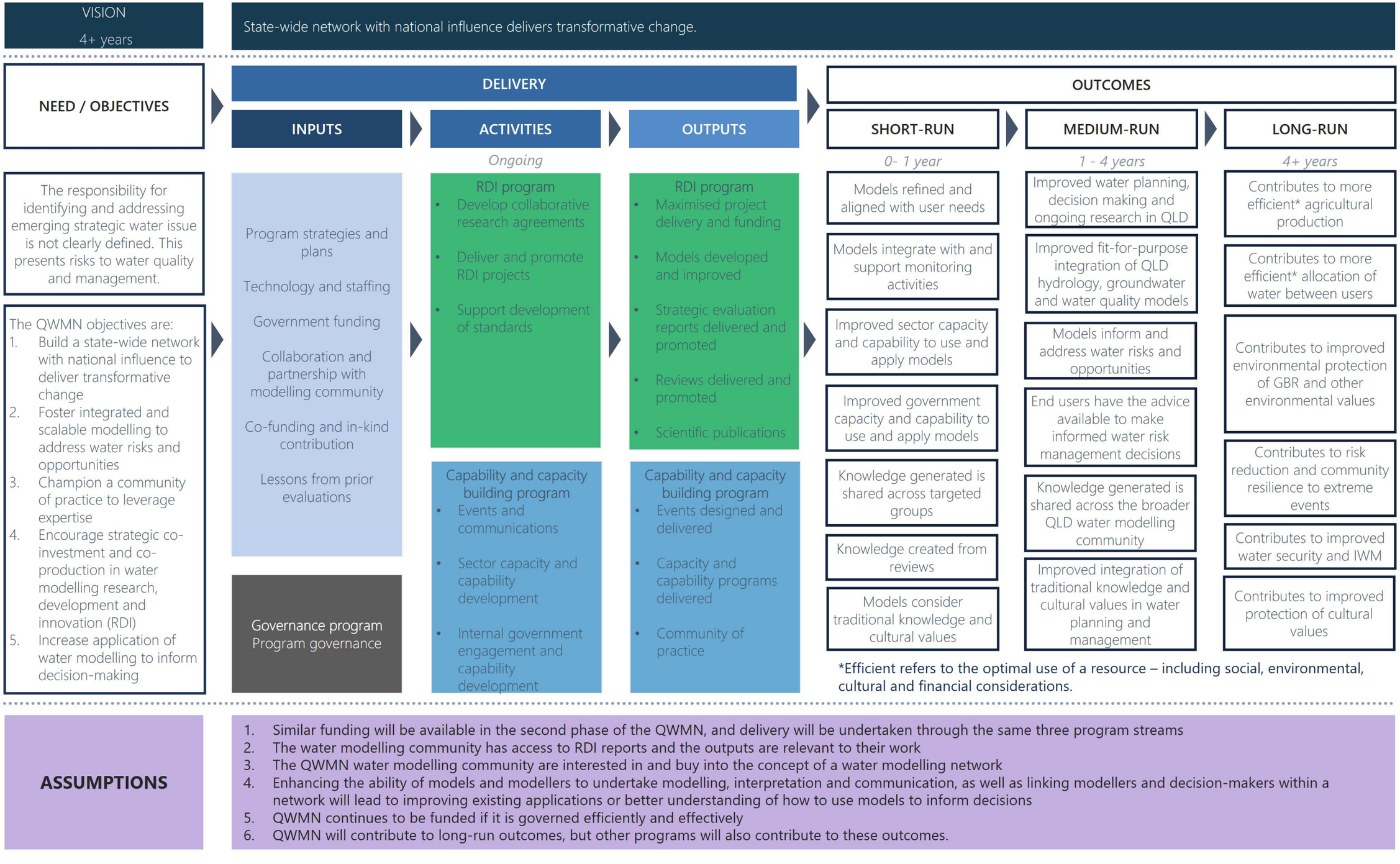


ASSUMPTIONS

1. Similar funding will be available in the second phase of the QWMN, and delivery will be undertaken through the same three program streams
2. The water modelling community has access to RDI reports and the outputs are relevant to their work
3. The QWMN water modelling community are interested in and buy into the concept of a water modelling network
4. Enhancing the ability of models and modellers to undertake modelling, interpretation and communication, as well as linking modellers and decision-makers within a network will lead to improving existing applications or better understanding of how to use models to inform decisions
5. QWMN continues to be funded if it is governed efficiently and effectively
6. QWMN will contribute to long-run outcomes, but other programs will also contribute to these outcomes.

Source Adapted from *M&E Framework (2020 - 2024): Queensland Water Modelling Network*

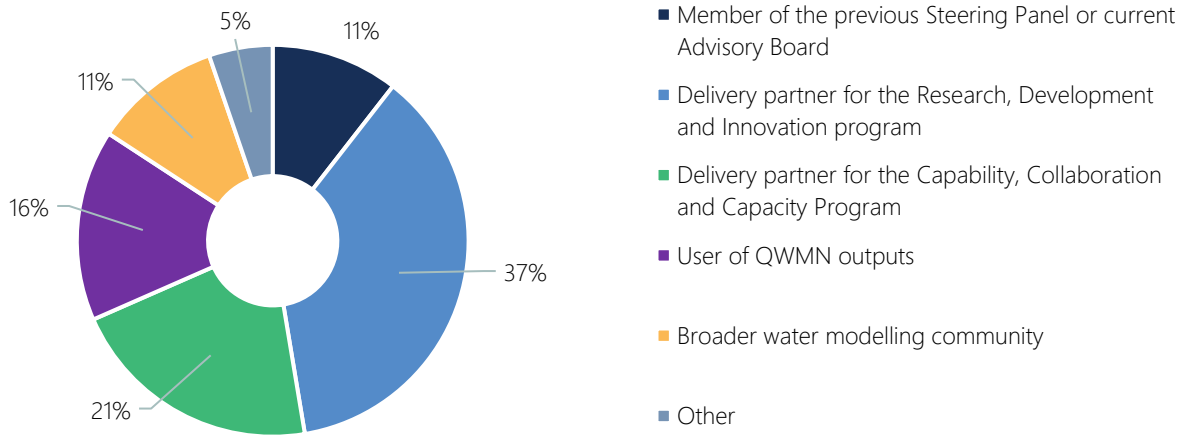
Figure 5 Program logic

Appendix B - Survey questions and results

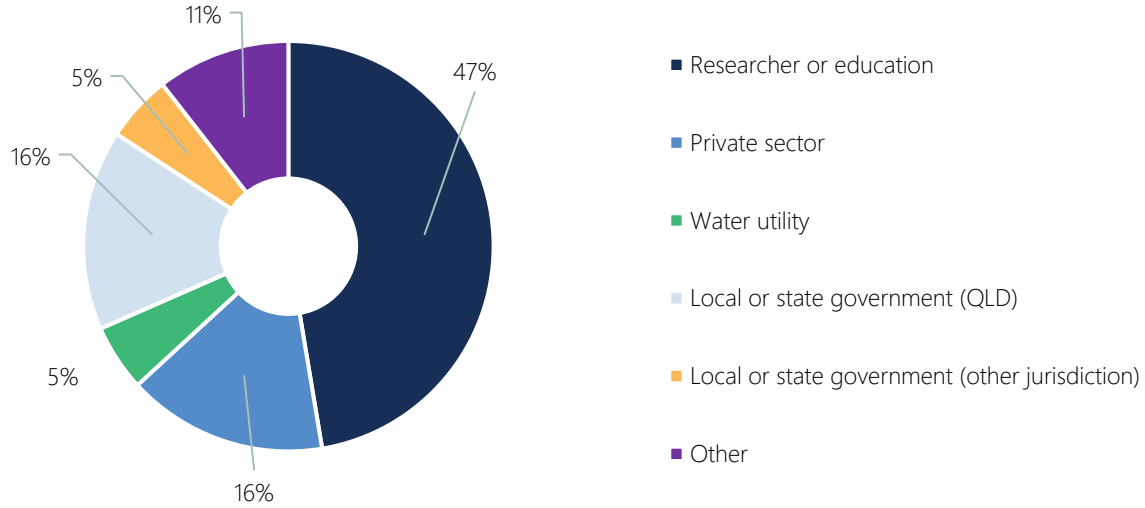
Stakeholder engagement - Survey

The evaluation drew on insights from stakeholders who were involved in Year 1 of the QWMN, across DES and other government departments, university partners and students and the private sector. The survey was operated using SurveyMonkey, and results have been deidentified. Some questions allowed multiple responses to be selected, and the majority of questions were able to be skipped. Answers to some questions have not been presented as they were relayed as comments.

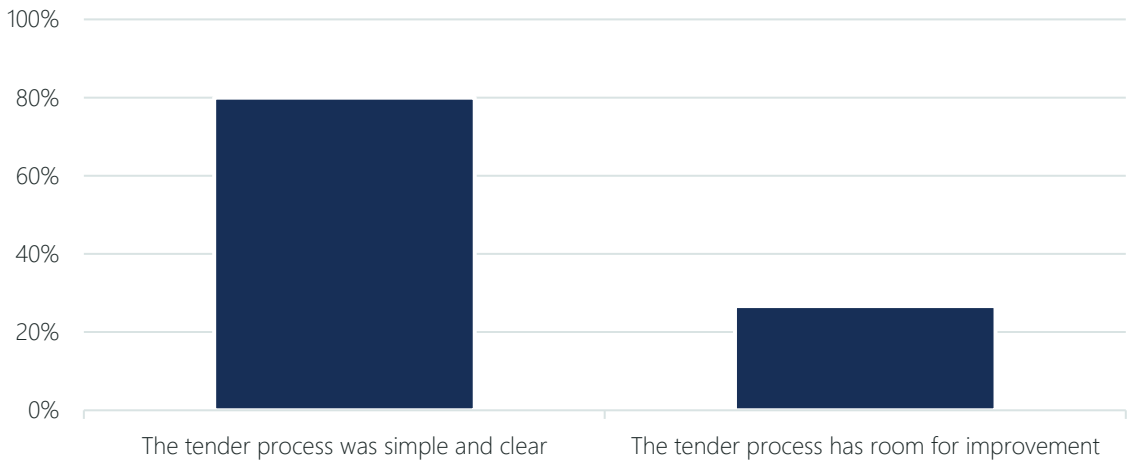
Question 1: How would you describe your involvement in the QWMN?



Question 2: What is your role in the Queensland modelling community?

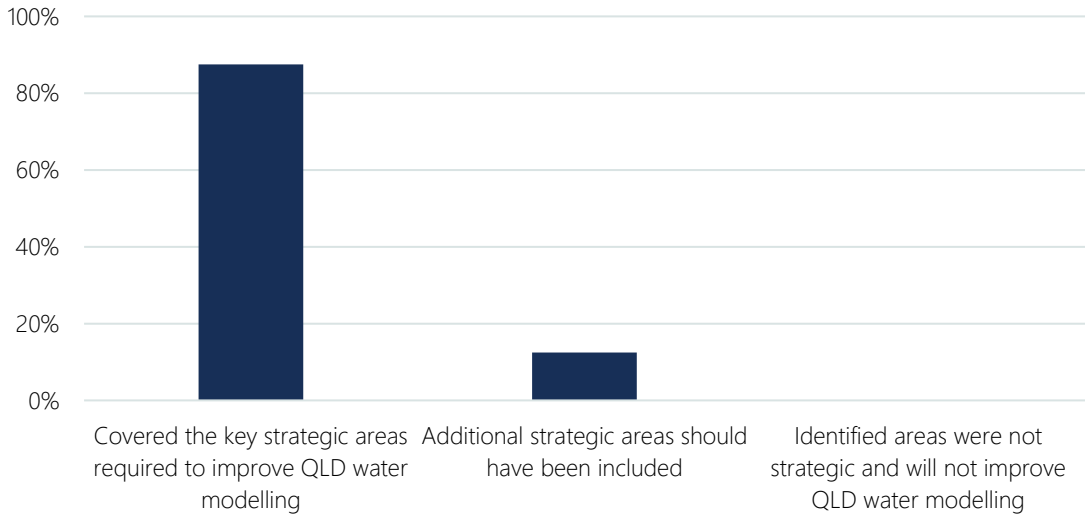


Question 4: How effective was the QWMN Secretariat tender process?



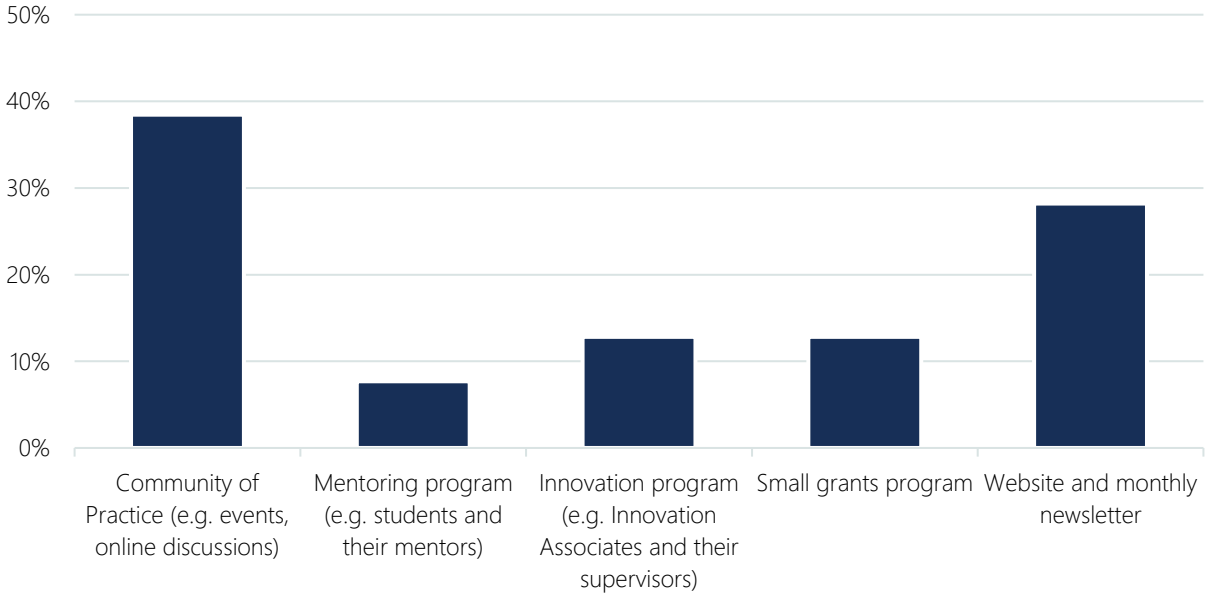
Note Respondents were able select more than one answer for this question.

Question 5: Were the strategic priorities and challenge statements identified in the QWMN tender process in 2020 appropriate?



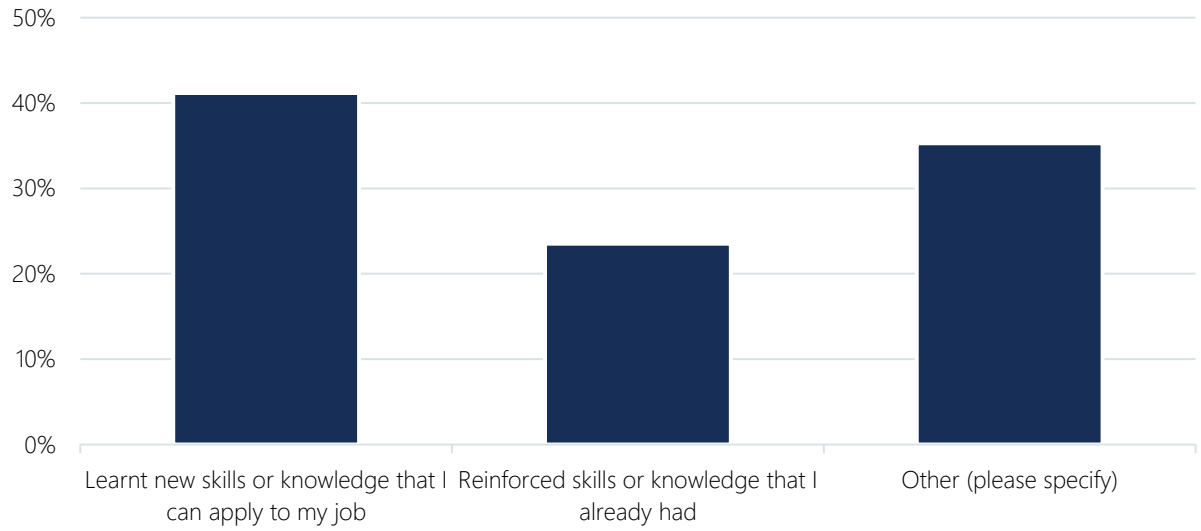
Question 7: If you were successful in the tender process, how effective was the QWMN Secretariat project administration?

Question 9: Have you taken part in any capacity and capability events or services in 2020/21?

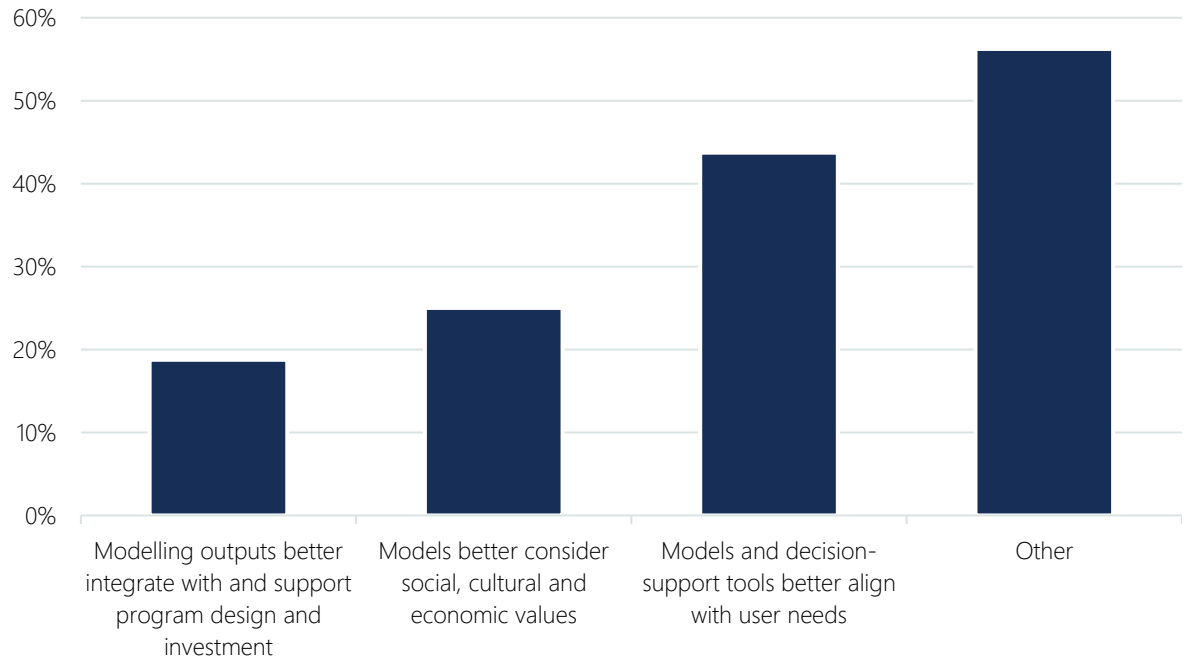


Note Respondents were able select more than one answer for this question.

Question 10 What did you get out of the events or services?

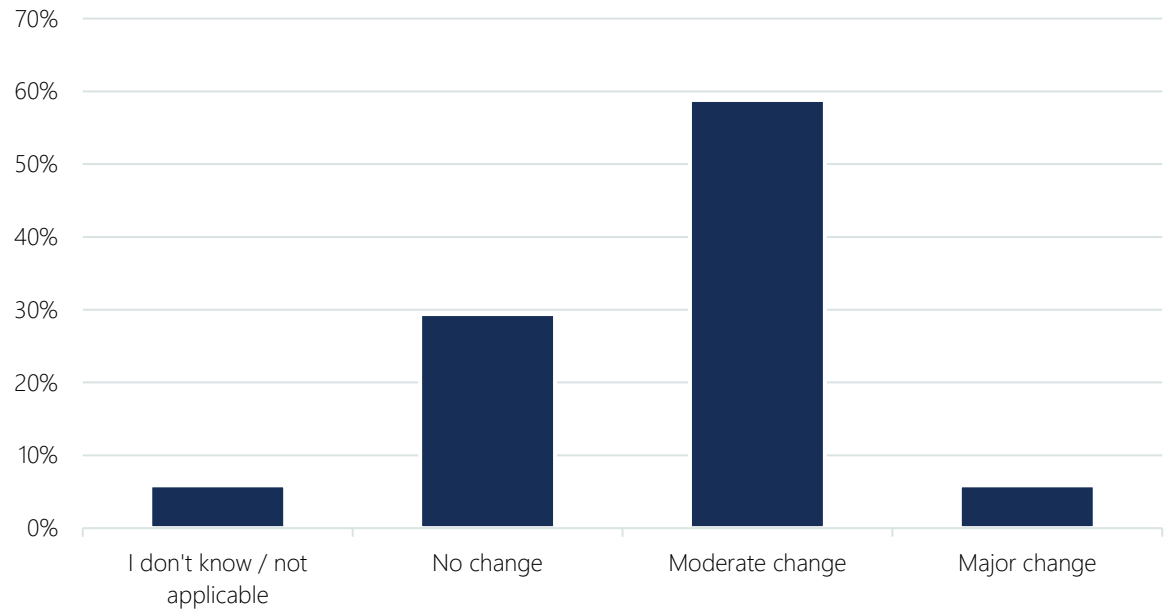


Question 15: Has QWMN developed new models, or improved existing models?

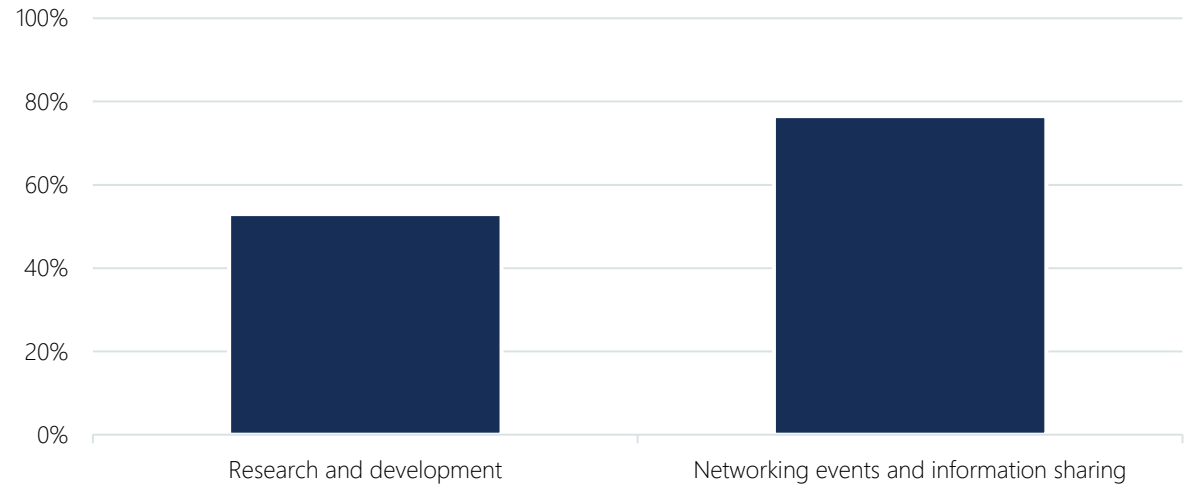


Note Respondents were able select more than one answer for this question.

Question 16 Have QWMN funded events improved you or your organisation's capacity and capability to use and apply models?

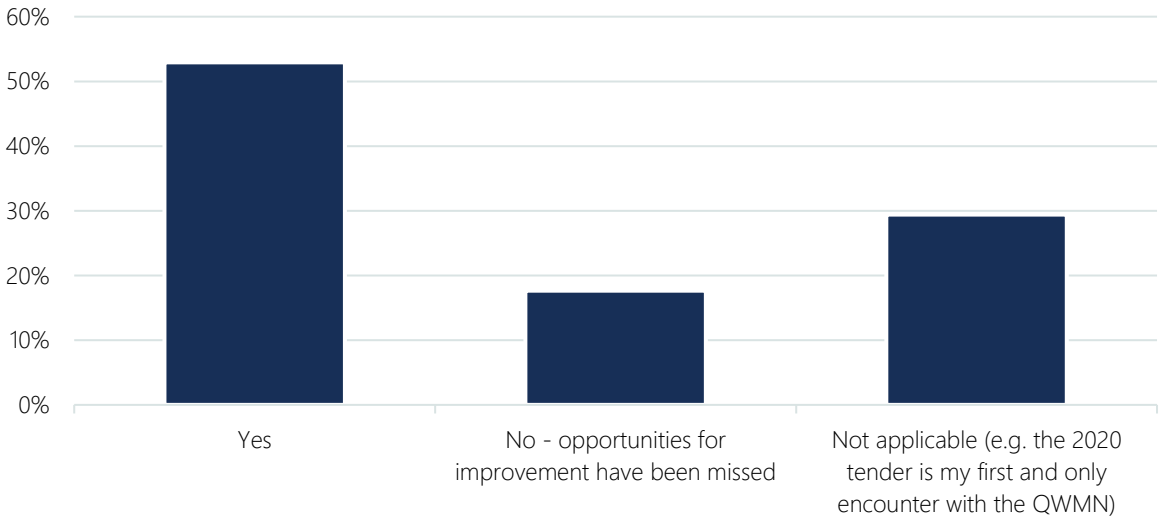


Question 17: What part of the QWMN have you found most useful?



Note Respondents were able select more than one answer for this question.

Question 18: Has the QWMN adopted and changed to better meet user needs since its establishment in 2017?



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