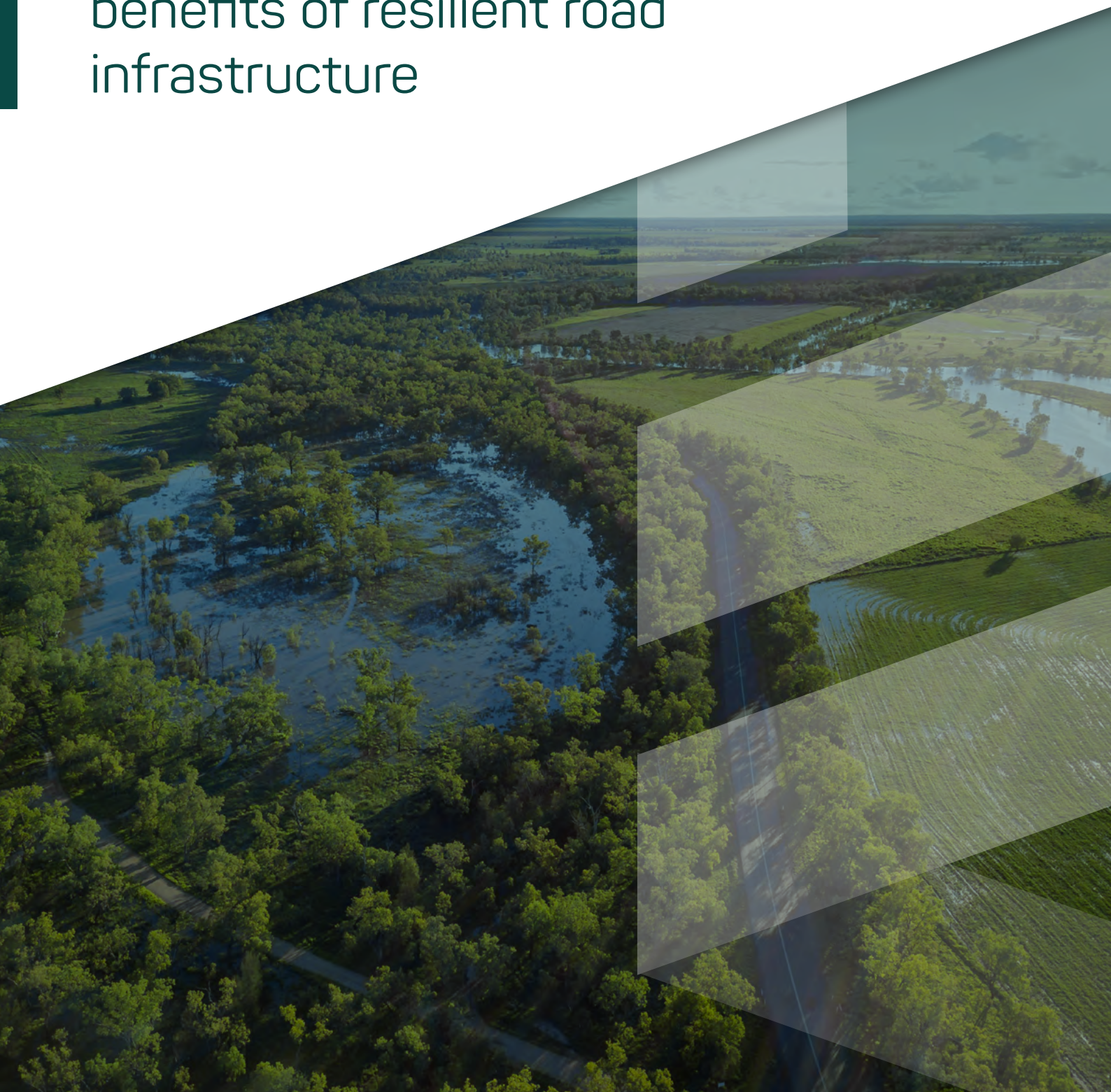
RESILIENT FUTURES INVESTMENT ROUNDTABLE

Rethinking Resilience Investment in Queensland: Quantifying the socio-economic and environmental benefits of resilient road infrastructure



Rethinking Resilience Investment in Queensland: Quantifying the socio-economic and environmental benefits of resilient road infrastructure

1. Introduction

Queensland is the most disaster affected state in Australia. Disasters are a part of life for Queenslanders, but the impacts on communities, businesses and the natural environment can be catastrophic. With the frequency and severity of disasters projected to increase as the climate changes, it is more important than ever to find ways to make the best possible decisions about when, where and how to invest in disaster risk reduction and resilience.

Continuity and connectivity are key to the resilience of communities following a disaster. The Queensland Reconstruction Authority (QRA) is the lead agency responsible for disaster recovery and resilience policy in Queensland. QRA is also responsible for managing and coordinating the Queensland Government's program of infrastructure renewal and recovery within disaster-affected communities, with a focus on working with national, state and local government partners to deliver best practice administration of public reconstruction and resilience funds.

The Queensland Betterment Fund help keep communities connected during and after disasters by supporting local governments and state agencies to restore essential public assets damaged in a disaster to a more resilient standard so that they are better able to withstand future disasters. Since the establishment of the first Betterment Fund in 2013, more than 750 Betterment projects across Queensland have been approved, with more than $533 million allocated for Betterment programs in response to severe disaster events. QRA reviewed the reconstruction costs, which revealed that from an investment of $244 million in projects that have been re-impacted, approximately $988 million dollars have been saved in avoided reconstruction costs.

The benefits of having infrastructure that is built back better to withstand future disasters is not limited to avoided reconstruction costs. To look beyond avoided costs, QRA has partnered with the International Institute for Sustainable Development (IISD) customise their Sustainable Asset Valuation initiative (SAVi) tool to quantify the social, economic and environmental benefits that can flow from investments in resilient road infrastructure.

IISD has developed the Sustainable Asset Valuation initiative (SAVi) tool, an assessment methodology that estimates the social, economic and environmental benefits of greater disaster resilience. These tend to be overlooked in a traditional cost-benefit analysis that focuses on tangible financial impacts. SAVi helps policy-makers and investors make informed decisions on financing sustainable infrastructure.

The SAVi tool uses 15 indicators that include road disruption, access to services, access to essential items such as crops, fruit and livestock, and environmental impacts including air, noise and water pollution.

This case study explores the co-design and data approach taken by QRA in partnership with IISD to develop a customisable SAVi tool.

2. Choosing the right approach

There are many initiatives, frameworks and standards, tools and methodologies and local research and knowledge providers working in the space of improving resilience valuation.

The Resilient Futures Investment Roundtable (the Roundtable) is a group of private, public, research and not-for-profit organisations collaborating to improve the way that value of resilience is measured and incorporated into decision-making about when, where and how to invest in resilience. QRA is an active member of the Roundtable. After extensive mapping of the landscape, the Roundtable has found that:

- Rather than taking a broad approach, many tools can be specific and fragmented, and many only cover one sector (eg. roads), hazard (eg. flood) or step in the decision-making process (eg. option assessment).
- Using these tools and interpreting their outputs often requires highly specialised expertise, making them difficult to use and apply.

Many approaches tend to focus on financial costs and benefits, in particular the avoided loss and damage of assets. One of the barriers to investment in resilience is that the benefits are perceived as long term, uncertain and intangible. Using a traditional cost-benefit analysis that focuses on avoided losses from future disasters only provides a partial picture of the impact of investing in resilience. Finding an approach that can analyse the broader economic, social and environmental costs and benefits can help to create a stronger business case for investing in resilience.

The Roundtable and QRA identified the SAVi tool as a suitable methodology to further explore the indirect and intangible benefits of road infrastructure Betterment projects.

3. Co-designing a custom tool to quantify the benefits of resilience

The IISD team presented QRA with a variety of options that had varying levels of customisation and replicability. This was the first time that IISD had worked with a client to develop a customised SAVi tool to take a holistic view of the intangible benefits that can be generated from investing in resilient road infrastructure. The co-design approach was developed by both QRA and IISD with an innovation mindset, and room for a flexible, adaptive and creative approach that allowed the project team to respond to changing circumstances, timeframes and expectations.

The process to develop the tool outlined by the SAVi team included:

1. Engage with the client to understand and record asset characteristics
2. Identify material risks and externalities and determine scenarios
3. Obtain and verify data. Build in assumptions using robust international data sets
4. Customise the SAVi tool and run models
5. Analyse and write up results
6. Present results and explore how values change under different scenarios

Queensland has a diverse landscape, and this diversity is also reflected in the communities, roads and levels of isolation that impact on betterment projects. The final approach had sufficient customisation to be able to be applied to different betterment projects across Queensland.

Outputs for the partnership between QRA and IISD included the tool itself, along with supporting resources, such as:

- an Excel-based model that had the potential to be adapted internally within QRA to analyse future investments beyond the initial project, embedding all key equations, and grouping model inputs and model outputs in different sheets
- a user guide to enable parametrisation of the model to a variety of existing projects
- a technical report.

The technical report for the SAVi tool pilot project outlines the initial development of the tool and includes a detailed breakdown of the indicators and summary of processes undertaken. The technical report is available on IISD's website: www.iisd.org/system/files/2023-04/savi-queensland-australia-road-infrastructure.pdf

One of the challenges of creating a useful and accessible tool that retains sufficient complexity to support informed decision-making is translating and brokering knowledge.

Multiple workshops and meetings were held with QRA and IISD to find ways to make the tool and its supporting resources accessible and useable for QRA staff without needing to have expertise in economic analysis, while still retaining analytical rigour and reliable outputs. Balancing useability with non-experts is an ongoing challenge. QRA will continue to work with stakeholders to further test and refine the SAVi Tool and explore opportunities for others to use this tool or aspects of it in their work to inform future investments in resilient infrastructure.

3.1. Defining how to measure the costs and benefits of resilience

Case studies of betterment projects were analysed through several workshops to identify indicators for a broad range of benefits. 15 indicators were identified to cover a diverse range of indirect costs that can be avoided if a road is able to continue functioning during and after a disaster. The indicators range from costs of road disruption and diverted traffic, additional pollution from diverted traffic, reduced access to markets, reduced access to services and mental health impacts of road disruptions. Figure 1 below describes the holistic indicators used in this analysis.

Every disaster and every place is different, meaning that not all indicators will be relevant to every road infrastructure project. For example, not all road damage events will impact market access, or may only do so for

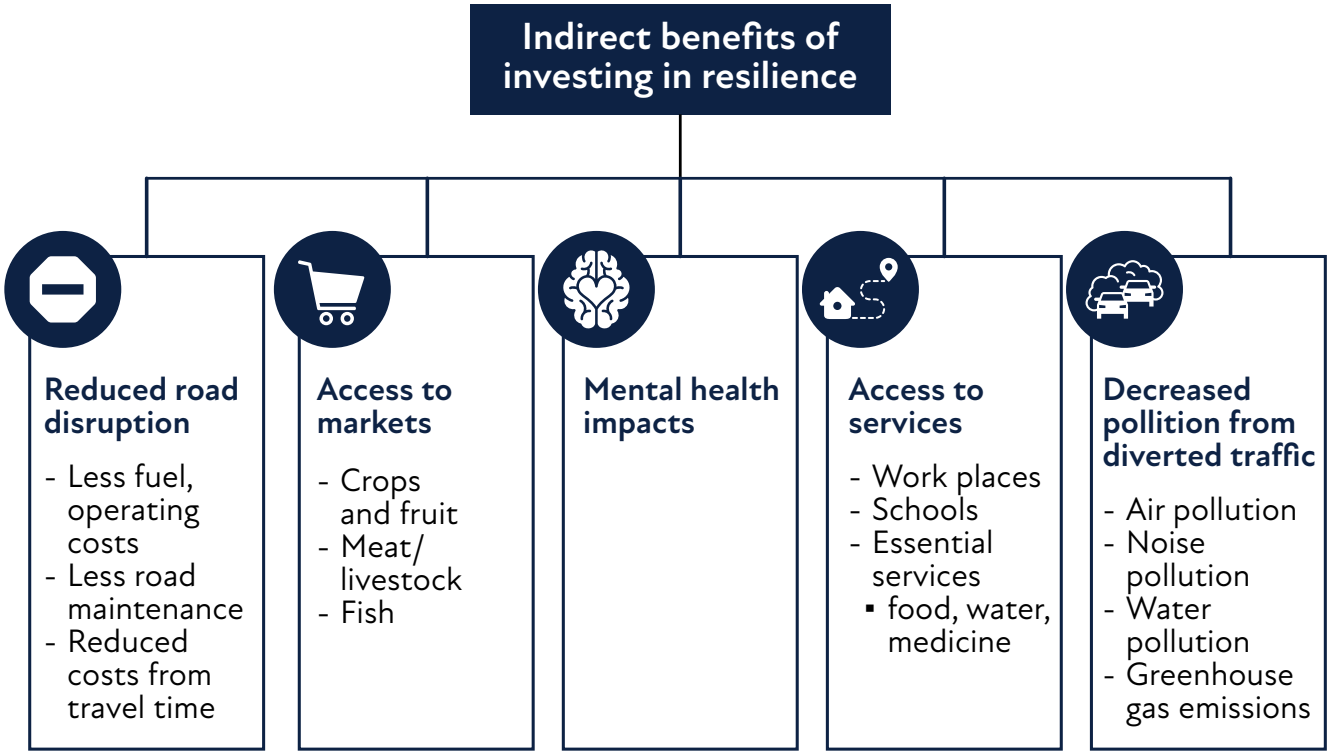


Figure 1: Summary of indicators for a wide range of benefits

agriculture production but not for fish. The Excel-based tool allows users to select the specific indicators that are relevant to the project, and then parametrise the model for the specific indicators considered. The key inputs for each of the indicators are changed manually. This allows for adjustment of inputs and assumptions to develop different scenarios for a single infrastructure asset.

The impacts of disasters also have different timescales. The SAVi tool allows for presenting costs and benefits per day, creating a simple output for non-experts that allows for comparison across projects.

3.2. Incorporating localised data

The impacts of disasters are felt locally and interact differently with the infrastructure in each place. It was therefore critical to obtain localised data where possible.

Throughout the duration of the project, challenges in obtaining relevant and localised datasets were identified. Lessons learned identified that the project would have benefitted from an analysis of the availability and accessibility of localised data. This would have included a consideration of data gaps and the expiry timeframes of data and information.

There is functionally in the tool to allow for the analysis to be indexed, reducing the need for manual input. However, using a tool such as this on a regular basis will require an ongoing investment to maintain and update data. As more data become readily available, there may be opportunities to expand or improve the analysis within the tool.

4. International, cross-disciplinary collaboration

This project looked beyond business as usual to explore a more expansive perspective on how to measure and quantify the benefits that can be generated by investing in resilience. At the beginning of this project, workshops and meetings were held to ensure that both teams understood the shared goal and the different roles and responsibilities of each organisation. However, given the experimental and complex nature of this project, the pathway to creating a customisable SAVi tool for resilient road infrastructure was constantly evolving. To manage this complexity, time was spent early on to establish a shared culture of flexibility and adaptability. This allowed both project teams to navigate uncharted territory with agility and adjust their approach to meet evolving circumstances.

To ensure progress was made in this context of high complexity and uncertainty, the teams employed a ‘learning by doing’ approach. This led to timelines being adjusted as the project partners learned more about the work, and what exactly would be required to deliver specific outputs. The different organisations brought

different skillsets and perspectives to the project, with IISD bringing technical expertise in economic analysis and QRA bringing subject matter expertise in disasters, emergency management and public policy in Queensland.

Ways of working that supported a collaborative, co-design approach:

1. Regular communication between the multi-disciplinary and international teams, including regular meetings and interactive workshops to design, define and iterate.
2. Establishing a shared understanding and regularly checking-in and re-confirming project goals, expectations and outputs.
3. Establishing agreed ways of working that prioritised flexibility and adaptability to allow the pilot project to develop

Figure 2 below shows the different stakeholders involved in this pilot project, and outlines the different contributions made. Collaborating across sectors and geographies was critical to the success of this pilot.

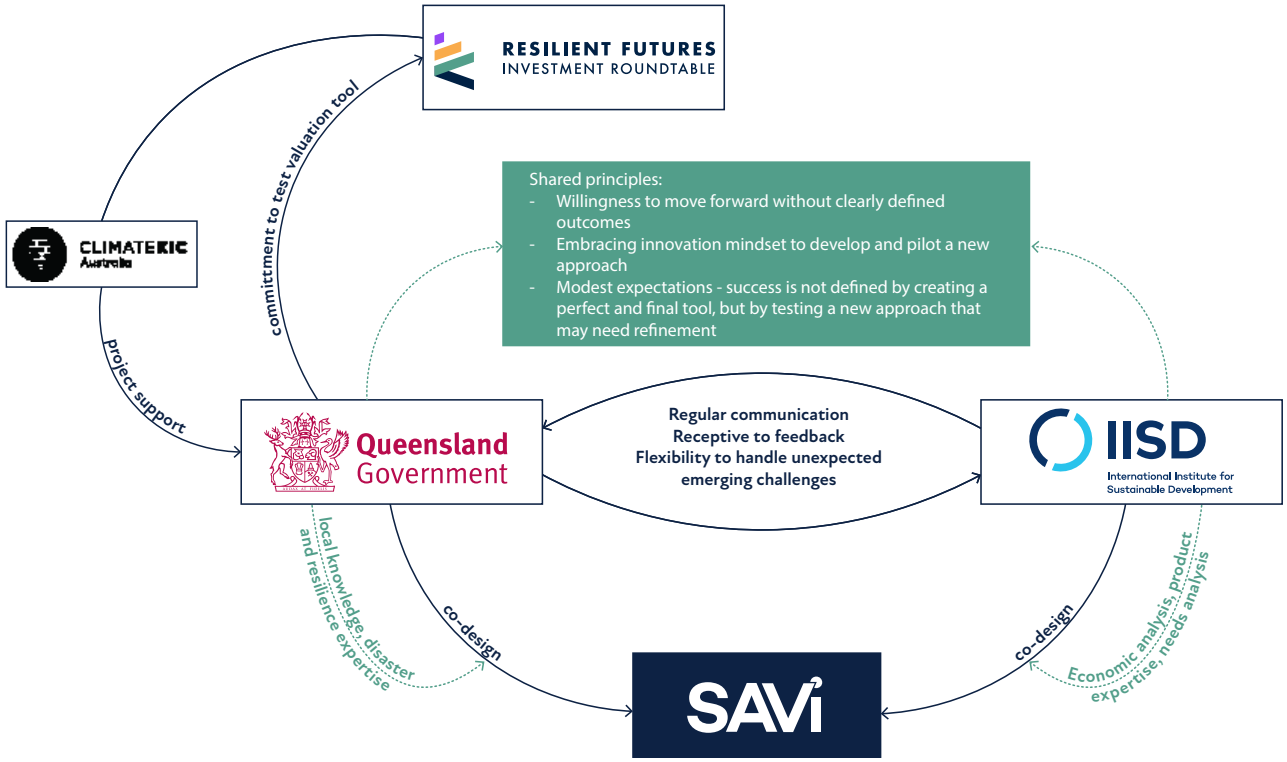


Figure 2: The actors and their respective roles

5. Applying the tool

SAVi has been used to analyse road infrastructure projects retrospectively to help understand the costs and benefits of investments in betterment. A holistic consideration of the value of investments in disaster resilience can be used to:

- inform future betterment investment decisions
- inform the development and design of future business cases for betterment funding
- understand how to prioritise investments in betterment to achieve maximum value for money
- support investments in regional and remote roads.

5.1. Understanding the positive impacts of past betterment projects

IISD has analysed two betterment projects to highlight the benefits that can be achieved through betterment.

This new analysis of the wide range of benefits was applied retrospectively to betterment projects to understand the full benefits that investments in resilient infrastructure can generate, as described below. This will help to inform future resilience investment decisions in infrastructure resilience by drawing on available data and information to predict future impacts on infrastructure and determine which projects would be most beneficial in strengthening overall community resilience.

Aurukun Access Road, Aurukun Shire Council

The Aurukun Access Road was a gravel road that provides the only link to and from the Aurukun community. The road was damaged by flooding in 2010, 2011, 2012 and 2013. Betterment funding from 2013 was used to bitumen-seal a 10-kilometre section of the road that was particularly vulnerable to flood damage. The road has since withstood the impacts of 10 separate natural disaster events, remaining functional with only very minor damage. By inputting project data into the SAVi tool across the 15 indicators, it was estimated that an additional $29,228 per day was saved when considering the indirect social, environmental, and economic benefits of the project.

Based on the duration of disaster events and impacts to communities, the net benefit of the indirect benefits of investments in road resilience were:

- Restoration (two projects): $979,366
- Betterment (two projects): $2,299,783
- Avoided cost over 10 events: $8,637,947
- Value of indirect benefits: $3,945,762 (based on 135 days of impact to communities)
- **Total benefit over 10 events: $10,283,926**

Gayndah Mundubbera Road, North Burnett Regional Council

Gayndah Mundubbera Road is an essential freight and transport link for the North Burnett region, connecting the highly productive agricultural towns of Gayndah and Mundubbera. The road was damaged in 2011 and rebuilt only to be re-damaged in 2013. Betterment funding from 2013 was used to increase the resilience of the two-kilometre section of road adjacent to the Burnett River that was washed out, relocating it 11 metres uphill. New stormwater drainage works were also completed, improving functionality of the entire Gayndah Mundubbera Road.

The road has since been impacted by 7 natural disaster events in 2015, 2016, two in 2017 and three in 2022, and has remained functional with only minor expenditure required to clean up and remove debris.

By inputting project data into the SAVi tool across the 15 indicators, it was estimated that an additional $57,041 per day was saved when considering the indirect social, environmental, and economic benefits of the project.

This figure was then used to calculate the net benefit of the indirect benefits of investments in road resilience:

- Restoration: $6,785,707
- Betterment: $1,308,863
- Avoided cost over 7 events: $47,499,499
- Value of indirect benefits: $7,700,564 (based on 135 days of impact to communities)
- **Total benefit over 7 events: $53,891,200**

More information about the Aurukun Access Road and the Gayndah Mundubbera Road can be found on the QRA website. **www.qra.qld.gov.au/betterment/betterment-in-action**

5.2. Learning from practical application

This pilot project allowed QRA to customise the SAVi tool to gain a broad understanding of the benefits and costs generated by investments in road infrastructure resilience. It is hoped that this improved understanding will help build a case for continued and increased funding towards betterment projects, and to help prioritise projects that will maximise the positive impact of funding decisions.

This pilot project was a learning process for both QRA and IISD. Both organisations were working in new and different ways to explore innovative tools for investment decision making. As the project progressed, challenges arose that were not fully accounted for in the scoping. Both teams were able to adapt and respond to changing circumstances and some key learnings became apparent.

Challenges:

- Access to and availability of data - The importance of locality driven data was acknowledged at the project initiation stage, but the degree to which accessibility and availability would present challenges was not anticipated. This included data sharing agreements and protocols and privacy considerations on data access.
- Ongoing commitment to maintain data - Data can quickly become out of date. This was accounted for in the way that data is analysed using the SAVi tool, and the ongoing need to maintain high quality data will be an ongoing process.
- Complexity of the tool - In its current state, the tool is still quite complex and requires further work to explore ways to make the tool more user friendly.

Opportunities:

- Simplification of the tool – Work is underway to improve and simplify the tool to improve useability for non-expert users.
- Expanding usage of the tool beyond road infrastructure – Betterment projects include a wide range of public assets and infrastructure beyond roads.
- Transitioning the tool into business as usual activities – this will require not only simplification, but also internal capability building to increase awareness of the benefits of incorporating the broad costs and benefits into decision-making.

6. Next steps

The SAVi Tool has the potential to support decision makers to prioritise future investments in resilient infrastructure and to advocate for increased investment in resilience programs, such as betterment, and for embedding resilience in all infrastructure decision-making, beyond disaster-related infrastructure reconstruction.

QRA will continue to contribute as a member of the Resilient Futures Investment Roundtable, and explore different methodologies to inform the way investments in resilient infrastructure are valued, and continue to work with stakeholders to further test and refine the SAVi Tool and explore opportunities for others to use this tool in their work.