

Applying the concept of resilience to an integrated research programme

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1. Executive Summary

This report presents a systematic exercise to catalogue the intended outcomes, measurement of progress and alignment of Theme 3 in the Our Land and Water National Science Challenge. Theme 3, Collaborative Capacity, contains multiple research Programmes that contribute to the multidisciplinary Theme and wider Challenge. The exercise was structured using the resilience framework, a tool developed in the AgResearch Resilient Rural Communities Programme. The resilience framework demonstrates how the scope of Programmes can be described by the dimensions of resilience that they address and by the spatial scales at which they operate.

We find that the Programmes are spread widely across the resilience dimensions and scales. All the Programmes cover the **Institutional** dimension of resilience, supporting the main focus of Theme 3. Further, some Programmes specifically aim at building **Economic** and **Environmental** resilience, so they directly support the main goals of the Challenge as well as its other Themes. Because many Programmes are clustered around the same resilience dimensions, the Theme 3 **Institutional** focus and its contribution to the Challenge's **Economic** and **Environmental** goals are likely to continue regardless of changes at the Programme level. We also find that the Programmes, and therefore the Theme, are principally focused at the **Intermediate** scale of resilience.

The exercise points to two linkages that could benefit from more explicit articulation. First, the Programmes operate at the **Intermediate** scale, so their impacts could be better linked to the Challenge's KPIs at the **National** scale. Secondly, the Theme focuses on the **Institutional** dimension while the Challenge KPIs are **Economic** and **Environmental**; the mechanism that links one to the other could be explored.

The development of the Programmes and Theme is ongoing. There is still work to be done in developing indicators for the Programmes so that progress towards achieving Theme and Challenge outcomes can be tracked and described. In addition, the Programmes could benefit from some flexibility in the Collaborative Capacity Theme to allow for the inclusion of dimensions that emerge as important towards meeting the Challenge's goals in the course of research.

2. Introduction

2.1 Background

The Our Land and Water National Science Challenge (the Challenge) was established with the mission to enhance primary sector production and productivity while maintaining and improving New Zealand's land and water quality for future generations. The overarching goals of the Challenge are to:

1. double the total value of export production to close to 40 per cent of GDP
2. improve the performance of key indicators of land and water resources by 20 per cent at the enterprise and catchment scales.

Figure 1 shows the Challenge's three Themes connected by a central Nexus. The Nexus provides strategy, leadership, co-ordination and integration for the Challenge while the three Themes aim to build greater value in global markets, innovative and resilient land and water use, and collaborative capacity.

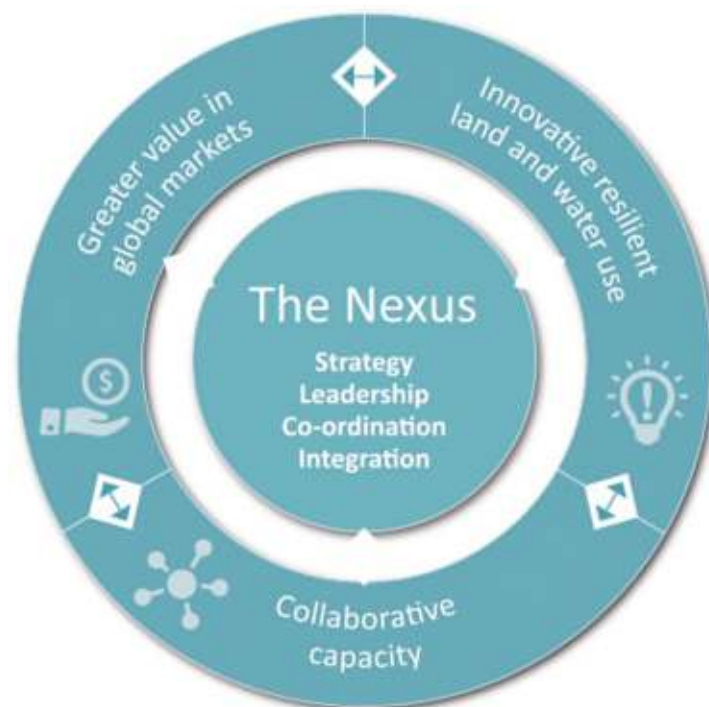


Figure 1. The Challenge Nexus and Themes

The Challenge recently conducted a stocktake of funded- and aligned-research Programmes. The stocktake concerns \$35 million of research, including \$6 million in Theme 3: Collaborative Capacity. The stocktake identified the research portfolio in each Theme and asked Principal Investigators to supply research summaries to Theme Leaders.

The recent stocktake provided an opportunity to seek improved strategy, co-ordination and integration in the Challenge. The aim of this report is to provide transparency for improved strategy, co-ordination and integration of Theme 3 within the Challenge using a

resilience framework developed by the AgResearch Programme Resilient Rural Communities. The resilience framework builds on prior research on sustainability, resilience and multiple capitals. It provides a tool for structuring thinking about research, planning and impacts. The analysis shows how the resilience framework can be a useful tool to support management and success of the Challenge.

This report contributes to discussions emerging in the Challenge around indicators and how to measure success of the Challenge. These discussions include Garrett, Ausseil, Williams, Dominati and Dymond (2016) and the Challenge's Monitoring & Evaluation Strategy and Plan (Our Land and Water, 2017). Garrett, et al (2016) embrace the idea that collaboration can lead to high impact indicators because the Challenge has already committed to delivering its outcomes using co-innovation approaches. The Challenge has developed a monitoring and evaluation strategy to monitor and measure progress towards achieving the Challenge's mission and outcomes. It has identified key performance indicators that fall under eight performance areas. Indicators, measures and accountabilities are outlined for each criteria in each performance area.

2.2 Purpose of the report

The Challenge's Monitoring & Evaluation Strategy and Plan (2017) posed the key question: "To what extent has progress been made towards achievement of the Challenge's objectives?" This report is designed to support informed decision-making about research in the Collaborative Capacity Theme and the Challenge. This report analyses research Programmes in the Collaborative Capacity Theme and synthesises the information by:

- cataloguing the expected impacts of Programmes in the Collaborative Capacity Theme using the resilience framework
- showing areas of impacts most targeted by the Collaborative Capacity Theme
- highlighting less-covered areas of impact
- linking the Collaborative Capacity Theme portfolio to Nexus activities.

This report is presented in two parts. The first part, the analysis, begins by rolling down the Challenge: working backward through the Challenge's Programme logic as shown in [Figure 2](#) (Our Land and Water, 2017). We break down the Challenge goals and consider them with the lens of the resilience framework. This enables us to break down the Collaborative Capacity Theme's outcomes and superimpose resilience dimensions and scales onto them. We then take each funded- and aligned-Programme that falls in the ambit of the Collaborative Capacity Theme, briefly summarise the Programme and apply the resilience framework to its focus and its outcomes and indicators.

The second part of the report, the synthesis, rolls back up the Challenge. Having organised the information under the resilience framework lens, we then begin from the bottom up, exploring common linkages across the Programmes, how their resilience dimensions and scales line up with the Collaborative Capacity Theme's outcomes. Finally, we roll the Programmes and Theme up to the Challenge with a discussion of how they link with and fit into the overall Challenge.

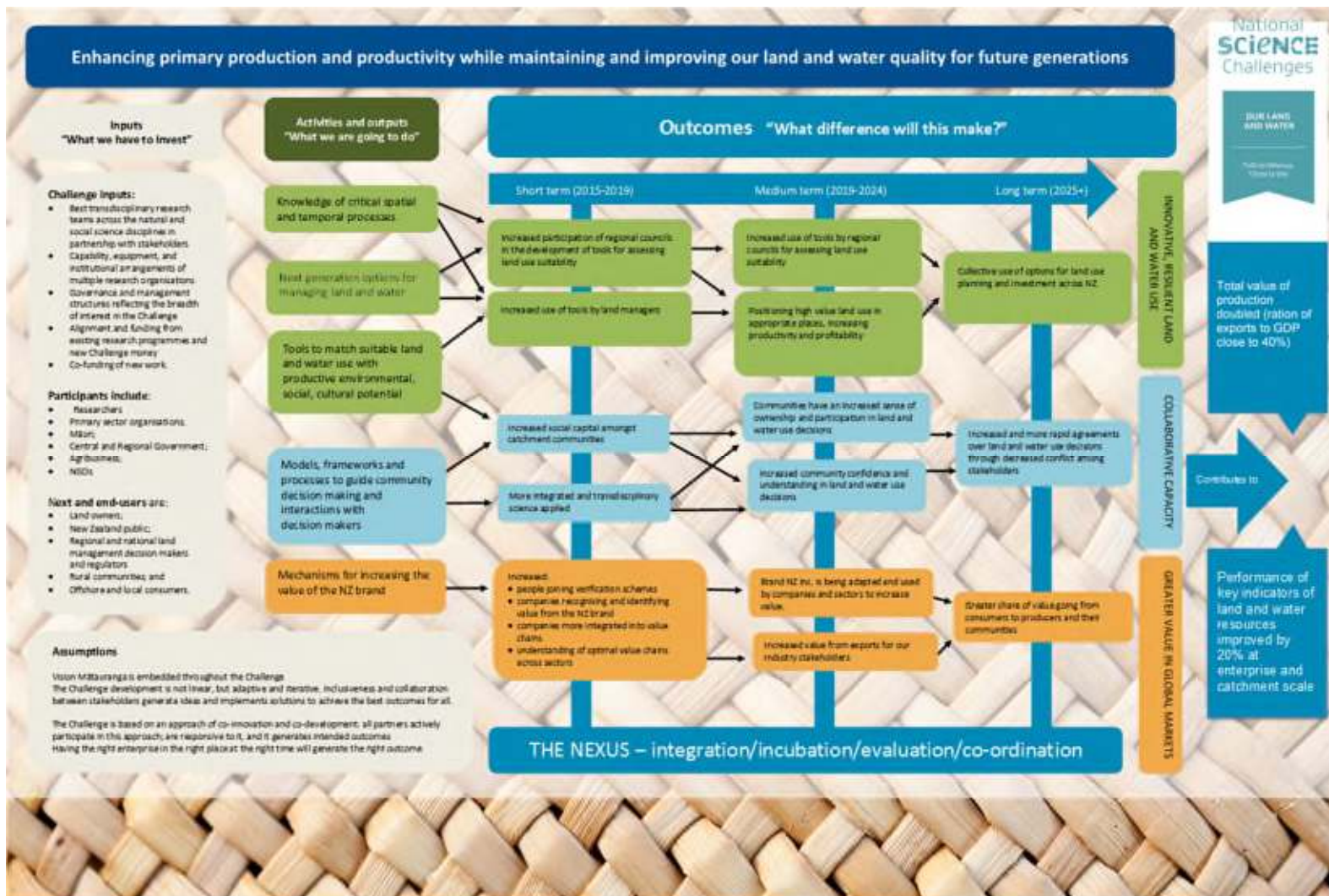


Figure 2. Challenge outcomes and impacts logic

The aim of the work was to report on Theme 3 as a whole. The Programmes in Theme 3 also contribute to other assumptions, other Themes and the Nexus, which together make up the Challenge. While recognising these interrelations, we limit the scope of this report to the Collaborative Capacity Theme. Accordingly, while there are Programme focuses, outcomes and indicators that fit elsewhere in the Challenge (for example, by embedding Vision Mātauranga in the Challenge) we touch on them only lightly where they fit with other aspects of the Challenge.

2.3 Terms used

Table 1 shows a list of terms and their definition used in this report. The first four items are hierarchical in nature, and the last three items interact with all levels of the hierarchy. We defined these terms to impose some order on the language used to describe the research and its impacts, although we recognise that others may use terms differently.

Table 1. Terms and their definitions used in this report

Term	Definition
Challenge	The Our Land and Water National Science Challenge.
Theme	Large, multidisciplinary areas of research spanning different applications linked by an idea that recurs in or pervades Programmes of research.
Programme	A planned series of projects under one overarching research aim or focus.
Project	A discrete piece of research exploring an idea or testing a hypothesis.
Focus	The central aim or purpose of a Project, Programme, Theme or Challenge.
Outcomes	The end result of a Project, Programme, Theme or Challenge.
Indicator	A qualitative or quantitative measure of progress towards achieving an intended outcome of Project, Programme, Theme or Challenge.

2.4 Organisation

The following sections are organised as follows. Section 3 discusses the resilience framework, which gives the overarching structure used to assess Theme Programmes. Section 4 applies the resilience framework to the Challenge and the Collaborative capacity Theme. Section 5 outlines the Theme's two funded and five aligned Programmes and applies the resilience framework to the Programmes' intended outcomes and indicators. Section 6 synthesises the main findings from the Programmes, before Section 7 concludes the report.

3. The resilience framework

Resilient Rural Communities (RRC) is an AgResearch core-funded Programme. RRC was aligned with the Challenge when the Challenge was established in January 2016. RRC researchers have been exploring ways to develop that alignment so that it benefits RRC and the Challenge.

RRC researchers have been grappling with some of the same issues of strategy, coordination and integration, first in the Rural Futures Programme between 2007 and 2015, and in the ongoing RRC Programme that began in 2014. These multidisciplinary research Programmes have examined agriculture and rural communities using lenses from physical and social sciences, and have had success at integrating the information across the disciplines. The current state of thinking is captured in the resilience framework as shown in the key infographic in Figure 3 (Fielke, Kaye-Blake, Smith, & Vibart, 2017).

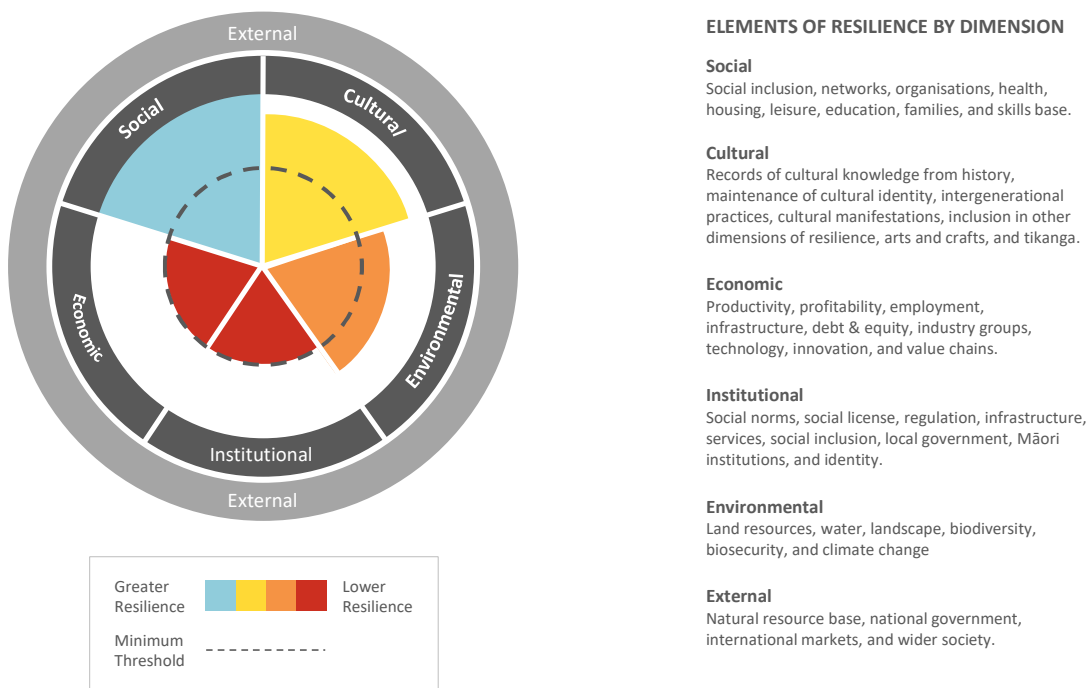


Figure 3. The resilience framework

The infographic shows five dimensions of resilience as wedges of a circle. These resilience dimensions are **Institutional**, **Cultural**, **Economic**, **Social**, and **Environmental**. Surrounding them is a sixth **External** dimension that sets the context. This presentation is simple to understand and captures a number of aspects of the discussion around resilience.

One aspect of resilience this diagram captures is quantification. Resilience is often represented as a quantity or amount. We can talk about ‘more’ or ‘less’ resilience, and about changing the amount of resilience. It follows that resilience and its dimensions can be represented as a quantity. In this case, the quantity is presented as the area of a wedge, which can be made larger or smaller to represent different amounts of resilience. In this way, the diagram is similar to a radar plot, which can also be used to represent quantities of different items on a number of axes simultaneously. Quantification is

established by using indicators, which should represent the phenomenon being studied and should be sensitive to changes in it. For example, we do not measure ‘the economy’, but instead we measure gross domestic product, unemployment, job growth and other metrics that indicate the economy’s performance.

Resilience also occurs at different spatial scales and the scales interact with each other as shown in Figure 4.

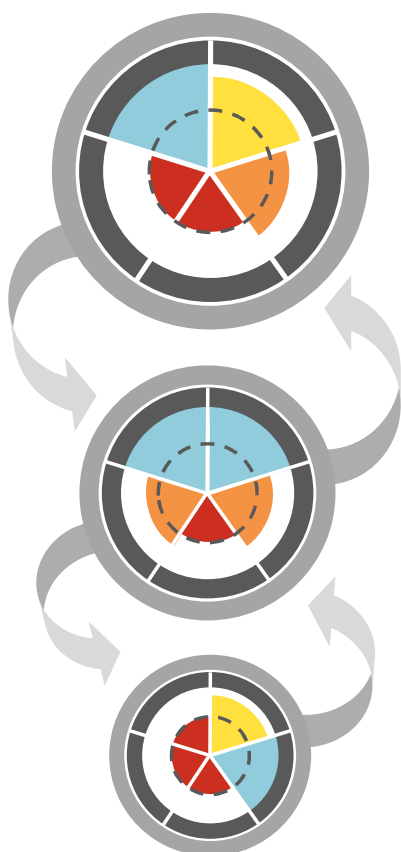


Figure 4. Resilience at multiple scales

RESILIENCE AT MULTIPLE SCALES

Resilience occurs at different scales and the scales interact with each other.

National

National resilience sets an important context for rural community resilience. National trends are drivers of resilience: demographics, economic performance, and political issues need to be recognised.

Intermediate

Regional, district, and catchment resilience creates the immediate context for people, whānau and families, local communities, and farmers. This is a key scale at which Resilient Rural Communities operates.

Farm Households

Farm households are ultimately where decisions are made and where resilience affects people, whānau and families. It is where the future of pastoral farming is decided.

The focus on six resilience dimensions combined with the notion of different scales of resilience gives rise to the matrix shown in Figure 5. This grid or matrix provides a way to catalogue information about resilience. In RRC, for example, researchers have used this matrix to record the three to five main aims of each Project in the Programme. The result is a summary view of where the overall Programme is particularly strong and is focusing its research effort, and where there are gaps. This information allows Programme management to make informed decisions about whether they are getting the focus right and whether they should be strengthening specific areas of research. The matrix is also being used in the Challenge to investigate indicators for the Indicators Working Group. The intention is to identify metrics that can be used to measure impacts on the resilience dimensions, then consider ways in which those metrics can be a bridge between scientists measuring the metrics and policy-makers using them to inform policy.




	Social	Cultural	Economic	Institutional	Environmental	External
National 						
Intermediate 						
Farm Households 						

Figure 5. Resilience framework matrix for planning and evaluation

4. Applying the resilience framework to the Challenge and Theme 3

4.1 The Challenge

The mission of the Challenge is to enhance primary production and productivity while maintaining and improving our land and water quality for future generations. Under the resilience framework, the **Economic** and **Environmental** dimensions at the **National** scale are clearly embodied in the Challenge's mission. **Economic** and **Environmental** resilience are echoed, respectively, in the two long-term goals of the Challenge, which are to:

1. double the total value of export production to close to 40 per cent of GDP
2. improve the performance of key indicators of land and water resources by 20 per cent at the enterprise and catchment scales.

The goals address different dimensions of resilience. The first goal focuses on **Economic** resilience at the **National** scale employing exports as a proportion of GDP as the indicator of progress. The second goal has a focus on **Environmental** resilience at the **Farm Household, Intermediate** and **National** scale.

4.2 Collaborative Capacity Theme

While the other two Themes directly relate to the **Economic** dimension (Theme 1) and **Environmental** dimensions (Theme 2) of resilience, Theme 3, Collaborative Capacity, is based on an assumption that close stakeholder engagement throughout the design and delivery of the Challenge will increase the prospects of achieving the Challenge's outcomes. Under the resilience framework, this assumption is framed as the **Institutional** dimension of the Challenge facilitating the Challenge meeting the **Economic** and **Environmental** resilience outcomes. The Theme or the Challenge could assess this assumption using evidence of how stakeholder engagement is enabling progress towards delivery of the Challenge's mission and vision and associated benefits for New Zealand (Our Land and Water, 2017).

Theme 3 has multi-staged outcomes addressed in the Programme logic (Our Land and Water, 2017). Its activities and outputs to achieve these goals are models, frameworks and processes to guide community decision-making and interaction with decision makers, as well as tools to match suitable land and water use with productive environmental, social, and cultural potential.

Activities and outputs in Theme 3 are intended to lead to:

- short-term outcomes of increased social capital amongst catchment communities, and more integrated and trans-disciplinary applied science
- medium-term outcomes that communities have an increased sense of ownership and participation in land- and water-use decisions, and increased confidence and understanding in land and water use decisions

- the long-term outcome of increased and more rapid agreements over land and water use decisions through decreased conflict among stakeholders.

Accountability for reporting progress towards achieving these outcomes falls with the Theme 3 leader, the Collaboration Lab and Mauri Whenua Ora Programme leaders, and other contestable Programme leaders.

We outline below the Collaborative Capacity Theme's outcomes and indicators, as well as an explanation of where they fit in the resilience framework.

4.2.1 Short-term outcomes

The short-term outcomes of Collaborative Capacity between 2015 and 2019 include:

1. increased social capital amongst catchment communities
2. more integrated and transdisciplinary science being applied.

The outcome of increased social capital amongst catchment communities by 2019 will be measured by setting a 2017 baseline of up to four indicators of social capital from Spellerberg (2001). By 2019, at least two catchment communities participating in the Challenge Programmes will have increased social capital from the 2017 baseline as measured by the four indicators (Our Land and Water, 2017). The target group for improved social capital fits under the **Intermediate** scale of resilience. Spellerberg (2001) suggests several categories of indicators of social capital. These social capital indicators fit under the **Social** and **Institutional** dimensions of resilience.

The second short-term outcome is, by 2019, for there to be more evidence that integrated and transdisciplinary science is being applied. Evidence is gathered from diverse sources of knowledge and data that are increasingly being shared among Challenge stakeholders and integrated into land and water management solutions.

Measures of progress towards this outcome include social network analysis and surveys of Challenge participants to confirm engagement, transdisciplinary collaboration and increased awareness of Challenge vision and outcomes. Baseline measures will be set in 2017 with changes in scores assessed to 2019. Increased awareness of research and network measures between researchers fall under the **Institutional** resilience at a **National** scale across the Challenge.

4.2.2 Medium-term outcomes

The medium-term outcomes of Theme 3 are intended to occur between 2019 and 2024 and are that:

1. communities have an increased sense of ownership and participation in land and water use decisions
2. there is increased community confidence and understanding in land and water use decisions.

The indicators for the first medium-term outcome include that by 2018, there is an increase in community ownership of, and participation in, limit-setting processes previously evaluated by Sinner, Newton, and Brown (2016) and baseline is set in at least two other

community-led limit-setting processes. The specific key performance indicator relating to this goal is that by 2021, there will be a 10 per cent increase and by 2024 there will be a 20 per cent increase in community ownership of land and water use decisions from the 2018 baseline measure.

The second medium-term outcome of increased community confidence in and understanding of land and water use decisions by 2024, has baseline measures of catchment community confidence in land and water use decisions that are yet to be defined. However, the intended outcome is that by 2021 there will be a 10 per cent, and by 2024 there will be a 20 per cent increase in community confidence in land and water decisions from the baseline measure.

These medium-term outcomes and their indicators concern social inclusion and confidence, falling under the **Social** and **Institutional** dimensions of the resilience framework. The limit setting process falls under **Environmental** resilience. Community ownership implies these dimensions of resilience are targeted at the **Intermediate** scale.

4.2.3 Long-term outcome

The long-term outcome of Theme 3 is that beyond 2025 there is increased and more rapid agreements over land and water use decisions through decreased conflict among stakeholders. This long-term goal fits mainly into the **Institutional** dimension of resilience at the **Intermediate** and **National** scales. An indicator that will measure progress towards achieving this outcome is not yet defined.

5. Collaborative Capacity Programmes

There are seven Programmes under Collaborative Capacity, two of which are funded by the Challenge. In this section, we outline and catalogue the seven research Programmes, and discuss how their focus, intended outcomes and indicators fit into the resilience framework.

5.1 The Collaboration Lab

5.1.1 Description

The Collaboration Lab is built on 20 years of previous social science research that has emphasised the importance of collaboration for achieving outcomes in complex systems. However, there are still gaps in understanding (Our Land and Water, 2017):

- there is insufficient long-term evaluation of collaborative approaches
- there is a scarcity of studies on how researchers undertake interdisciplinary research
- translating concepts of collaboration into practice has proven very difficult
- there is a lack of important information about Māori participation in collaborative processes.

The Collaboration Lab is intended to address these gaps and opportunities. It has a participatory nature, involving the research end-users in the creation of the research through the Collaboration Lab. There are multiple groups in the Collaboration Lab: the trustees, research team and the lab participants. These may include iwi and hapū, planners, development practitioners, community members, scientists, and farmers and growers who are successfully implementing collaborative approaches.

The Collaboration Lab currently has three projects:

1. Project one will use practitioner insights about how the use of collaborative processes enables new practices, ways of organising and social relations that support decision-making and practice change.
2. Project two will survey participants of seven current limit-setting processes and the wider community. These surveys are designed to evaluate both the collaborative process and the outcomes of the collaboration.
3. Project three will examine collaboration case studies using the Integration and Implementation Science (I2S) framework (Bammer, 2013). This is to understand if using the I2S framework could lead to improved outcomes in land and water management through improved researcher practice.

5.1.2 Focus

The Collaboration Lab has three research aims and a fourth capacity-building aim. These are to (Robson, et al., 2017):

1. build evidence of whether collaboration is successful in delivering multiple outcomes from decision-making

2. understand how collaborative practice contributes to multiple outcomes to support better design of and practice in collaboration processes
3. enhance understanding of critical factors that affect the impact that research in land and water has on overall outcomes
4. build collaborative practice and capacity in New Zealand for both collaboration practitioners and researchers.

The Collaboration Lab addresses two hypotheses:

1. Collaboration yields successful outcomes for land and water management in New Zealand
2. Integrative applied research is better able to address issues of concern to communities in the management of land and water in New Zealand, than single disciplinary and multidisciplinary research that is not integrative or applied.

The Programme aims build an **Institutional** dimension of the resilience at the **National** scale. The Programme is seeking to change the research and decision-making processes.

The Programme intends to achieve its goals within the context of managing land and water. The first hypothesis is based around enhancing outcomes in land and water management, which is equivalent to enhancing the **Environmental** resilience. There are also aspects of **Cultural** resilience by exploring the Māori role in collaboration, at the iwi level, fitting into the **Intermediate** scale. While the main aim is at the **National** scale, Collaboration Lab participants involve communities on a smaller scale including iwi, scientists and farmers, which fit into the **Intermediate** and **Farm Household** scales. Effectively, the Collaboration Lab aims to enhance **Environmental** resilience at a **National** scale by targeting **Cultural** and **Institutional** dimensions at lower scales.

5.1.3 Outcomes and Indicators

The Collaboration Lab has intended outcomes across the **Cultural**, **Institutional** and **Environmental** dimensions of resilience. **Cultural** outcomes include increased understanding and capacity for collaboration centres around increased understanding of and role of tikanga Māori in collaboration in land and water management and planning.

Institutional resilience as an outcome is measured by improved understanding and capacity for collaboration in and external to the Collaboration Lab, increased evidence of how collaboration leads to improved outcomes, improved understanding of practices that support effective collaboration processes, improved understanding of the multiple perspectives on what collaboration means, increased evidence of characteristics and practice of interdisciplinary research (including mātauranga Māori), more effective collaboration. Efficacy is that the agreed social, cultural, economic and environmental outcomes are achieved and the time spent on collaborative processes is reducing and enhanced impact in addressing problems of land and water for interdisciplinary research.

The practitioners in the Collaboration Lab include scientists, farmers and growers and includes iwi and other community members, fitting in the **Intermediate** scale. It is unclear whether this also fits at the **Farm Household** scale and ultimately depends on what level

the decision making is set. This deals with decision-making and community resources, which is the **Institutional** dimension of resilience. Increased understanding and capacity for Māori collaboration in land and water management. This outcome involves capacity for decision-making in a Māori context, addressing the **Cultural** and **Institutional** dimensions at the **Intermediate** scale. There are outcomes that fit in the **Institutional** and **Environmental** dimensions at the **National** scale, as well as **Cultural** and **Institutional** outcomes at lower scales. These lower scale outcomes and secondary aims appear to be there in order to aid in reaching the national outcomes and primary aims.

The Collaboration Lab will contribute to the Challenge's short-term goals. The first is through increased awareness and use of new knowledge and tools by enterprise and catchment decision-makers. This fits into the **Institutional** dimension of resilience at the **Farm Households** and **Intermediate** scales. Further, the Collaboration Lab should increase the ability amongst target communities and the Challenge partners to collaborate within and beyond the challenge. This is a primarily an **Institutional** goal at the **Intermediate** scale.

The lower-scale **Institutional** outcomes are there to assist in achieving the **National Institutional** and **Environmental** aims and intended outcomes. However, these lower scale aims of The Collaboration Lab are only secondary aims. The primary aims of The Collaboration Lab do not directly align with short-term outcomes of the Challenge.

Indicators for the Collaboration Lab were scheduled to be decided on amongst the Challenge participants in September 2016. These indicators to measure success are likely to include measures of: understanding and capacity for Māori collaboration (**Cultural**), knowledge and resources for more effective collaboration (**Institutional**) and impact in addressing land and water issues in New Zealand (**Environmental**).

5.2 Integrated Systems Research

5.2.1 Description

Integrated Systems Research is a separately funded project nested in the Collaboration Lab Programme. The project's aim is to enhance the understanding of critical factors that affect the impact of research in land and water (Robson, et al., 2017).

The Integration and Implementation Sciences (I2S) framework (Bammer, 2013) has been developed to support interdisciplinary or transdisciplinary research in solving complex real-world problems. The framework is not designed to replace other frameworks. Instead, it is intended to provide a conduit for communication across the various frameworks on the how, and a disciplinary underpinning of this field of research.

The project intends to test the I2S framework using case studies across New Zealand, and collect data to critically assess the I2S framework itself. Of the nine case study identified, those involved in the research and knowledge provision are identified, and a small working group format is used to capture relevant information for I2S framework analysis, as well as researcher reflections on the framework. In addition, users of the

information will be interviewed to get reflections on the process from different perspectives.

5.2.2 Focus

This research aim is **Institutional** focusing on the I2S framework on research practice. The Programme's focus is on knowing the likely impact of the I2S framework on research practice in New Zealand.

5.2.3 Outcomes and Indicators

The intended outcome is improved transdisciplinary research practice supporting land and water management and delivered through researcher capability development. When complete, the nine case studies of interdisciplinary research are intended to build **Institutional** resilience at the National scale. The nine case studies will be used to assess the likely impact of the I2S framework on researcher practice and use by policymakers, iwi and stakeholders.

5.3 Mauri Whenua Ora

5.3.1 Description

Mauri Whenua Ora is a Challenge-funded research Programme seeking to unlock the potential of Māori land by advancing new production systems and market opportunities, and translating the learning from this to other regions (Our Land and Water, 2017). Mauri Whenua Ora is a mātauranga-centred framework to assist land and water utilisation. Through collaboration of Tai Tokerau land entities, iwi and hapū organisations and multidisciplinary research, the Programme aims to develop models and frameworks, innovative tools and processes, to guide communities' innovation aspirations for their land, water and people. The Programme is intended to result in targeted investment, innovative production systems and new market channels that will enhance Māori agribusiness and align it with community values. The outcome is that mātauranga from these will inform collaborative processes New Zealand-wide.

5.3.2 Focus

Mauri Whenua Ora is focused on mātauranga Māori and economic development from Māori agribusiness, deriving from Tai Tokerau land entities, iwi and hapū organisations. The Programme is therefore focused on the **Economic** and **Cultural** dimensions of resilience at an **Intermediate** scale. The Programme's decisions focus on land and water use, providing a case where **Environmental** resilience can be built.

5.3.3 Outcomes and Indicators

The research identifies three outcomes to develop (Our Land and Water, 2017):

1. Shared, multi-iwi led innovation in mānuka honey and forestry, or other identified innovation. This is intended to result in enterprise owners and descendant

communities being better positioned to lead and operate land innovation within environmental, cultural and economic parameters. This is a joint objective of increasing **Economic, Cultural** and **Environmental** resilience.

2. A comprehensive economic platform, guided by Te Hiku lands and leadership as a sub-regional study. This is intended to result in regional Māori representative groups being able to progress their own land schemes and develop improved decision-making with the aid of new science and tools. This is aimed at increasing **Economic, Cultural** and **Institutional** resilience.
3. The socio-cultural indigenous micro-economy concept 'Pā to Plate', an enterprise-to-descendant consumer study. This is intended to develop a micro-economy model that captures optimal land qualities and community values, including cultural and economic wellbeing. This is focused on building **Social, Cultural, Economic** and **Institutional** resilience.

In order to achieve the outcomes, the Programme will map land, water and people assets, explore relevant international models, find out what Tai Tokerau people know and want through collaborative processes and develop tools and plans with Tai Tokerau people. These intended outcomes focus on the **Cultural, Economic** and **Institutional** dimensions of resilience. These are at the iwi, community and regional levels, implying the intended outcomes fall in the **Intermediate** scale of the resilience framework.

5.4 Resilient Rural Communities

5.4.1 Description

Resilient Rural Communities (RRC) is an AgResearch-funded Programme, and was aligned with the Challenge in January 2016. The purpose of RRC is to co-design, construct and evaluate pathways that will build greater rural community resilience at the farm and community scale.

RRC aims to increase the capacity of rural communities to adapt to social and cultural changes and to grow their economies, while working within environmental limits. Changes to rural communities are causing public and political concern. Many aspects of farming are also changing, and farmers are having to respond to new limits. These community and farm changes are affecting the viability of pastoral farming.

RRC also aims to better understand the characteristics and drivers of social, cultural, economic, institutional and environmental resilience, while supporting communities to improve their resilience under land-use change. RRC's portfolio is one of transdisciplinary research that includes case studies, analysis and modelling. The research is demonstrating how people create and support resilience at the farm and community scale.

The Programme has had a large number of specific Projects, some of which are now complete. The Projects include social and physical science across a number of topics, and have been undertaken in several places around the country. A few of the Projects include:

- Kaitiaki Decision-Making Framework – working with Māori entities to develop a tool for decision-making that is embedded in and appropriate for Māori contexts

- Farm-Community Relationships in Wairoa – exploring the linkages in the context of the Wairoa District and the current political agenda to marshal regional resources to increase regional economic potential
- Next Generation Solutions – identifying farming strategies and decisions that will provide economic and environmental success in the future
- Farmer Wellness and Community Resilience: Improving Social Capital – examining the drivers and impacts of farmer suicide.

5.4.2 Focus

The Programme aims to support resilience at the farm and community levels, identifying pathways to building resilient rural communities across social, cultural, environmental, economic and organisational change. RRC is aimed at different scales, and was originally set up in response to assessing community resilience with respect to agricultural land-use change. RRC therefore includes work in the **Social, Cultural, Economic, Institutional** and **Environmental** dimensions of resilience, although the Programme used the resilience framework to identify a clear tendency toward **Economic** and **Environmental** research. The work also tends to focus at the **Farm Households** and **Intermediate** scales, but does include some work at the **National** scale.

Although it sits under Theme 3, RRC draws on the other two Themes and the Nexus, by focusing research across **Economic** (Theme 1) and **Environmental** (Theme 2) resilience and building frameworks to supporting strategy, co-ordination and integration across the Challenge. For example, RRC contains the Project Next Generation Solutions, which is part of Theme 2 in the Challenge. The present report is an example of using RRC-developed thinking – the resilience framework – to help inform management and strategy for the Challenge.

5.4.3 Outcomes and Indicators

The main intended outcome of RRC is to produce good science. This outcome is being measured in terms of publications and obtaining recognition of the Programme's and researchers' outputs. This outcome represents the **Institutional** dimension of resilience, building up the scientific knowledge around pathways to building resilient communities. We understand there is currently no target number of publications from which to benchmark RRC's outcome against. The external impact of research is becoming more of a conversation in the Programme.

The individual Projects in RRC undertook a stocktake in FY2016, which led to them being explicit about their research questions or hypotheses and identifying specific outcomes they were targeting. Some Projects identified outcomes that could be measured or proxied with indicators. RRC has not gathered up these indicators into Programme-level targets, but they can be identified. For example, the Farm-Community Relationships in Wairoa Project, mentioned earlier, identified job opportunities and community linkages as target outcomes. The Farmer Wellness Project, for its part, targeted improvements in help-seeking behaviours and support from industry bodies.

5.5 Primary Innovation

5.5.1 Description

Co-learning and Co-innovation to Achieve Impact in New Zealand's Biological Industries (Primary Innovation) is an MBIE-funded research Programme aimed at stimulating innovation in New Zealand's agricultural sector. The Programme's aim is to implement co-innovation principles in five innovation platforms, based on an Agricultural Innovation Systems (AIS) approach. It also aims to evaluate the processes and outcomes, and to increase co-innovation in the national innovation system (Botha, Klerkx, Small, & Turner, 2014b).

The Programme has three streams of work that have been set up:

1. An academic stream translates between theory and practice.
2. An application stream is responsible for implementing co-innovation principles in five innovation platforms.
3. The Community of Practice stream is responsible for scaling up: influencing and stimulating change at the national level.

The academic stream and Reflexive Monitors play key roles in ensuring the application of AIS principles and adaptive management.¹ The five innovation platforms are: dairy herd reproductive performance, potato crop pest management, forestry product links to the market, dairy farm nutrient management and water management in a Canterbury irrigation scheme.

Primary Innovation has published material evaluating co-innovation and assessing its benefits. These publications include, for example, lessons from the innovation platform case studies (Botha, Klerkx, Small, & Turner, 2014a), and qualitative evaluations and costs and benefits assessments of the co-innovation approach (Coutts, Botha, & Turner, 2014; Botha, et al., 2015)

5.5.2 Focus

The Programme aims to contribute to an increase of productivity growth with decreased environmental impact. Improvement of the agricultural sector's contribution to the economy through sound environmental decisions are focused on building **Economic** and **Environmental** resilience at the **National** scale.

In the AIS approach, innovation is considered the result of networking and interactive learning processes among a heterogeneous set of actors (Botha, Klerkx, Small, & Turner, 2014b). Therefore, the means of achieving the above is through co-innovation in practice focused on building **Institutional** resilience at the **National** scale.

¹ A Reflexive Monitor is a person whose role is to help the Innovation Platform reflect on process, action and progress towards the research goal.

5.5.3 Outcomes and Indicators

First, increased productivity growth in biological industries and a 30 per cent decrease in environmental impact in RS&T investments are **Economic** and **Environmental** outcomes that align with the overarching Programme aim. Productivity growth in industries can be measured by this **Economic** quantified baseline or target against which to benchmark achieving the outcome. The **Environmental** outcome of 30 per cent decrease in environmental impact in RS&T investments is a target, without a specific indicator to measure the decrease in impact over time.

Secondly, Coutts, Botha and Turner (2014) state some key results areas for Primary Innovation:

1. There will be an effective Community of Practice operating across 24 industry organisations, universities and crown research institutes and three sectors: forestry, cropping and pastoral. The Community of Practice will understand co-innovation and technology uptake as part of the innovation system and will have directly contributed to an improved innovation system. This will be measured by an increase in the understanding and use of the Innovation Systems approach and principles by Community of Practice members and individuals they have influenced, and continuing to work together as co-learners within the innovation system.
2. There will be four ongoing effective Innovation Projects across three industry sectors that provide solutions to industry problems and have contributed to improved sector innovation systems. This includes a measurable increase in the understanding and use of the Innovation Systems approach and principles in the innovation platforms and continuing to use the Innovation Systems approach in other projects

These key result areas are primarily **Institutional** at the **National** and **Intermediate** scale, which aligns with the overall aims of the Programme. There is also a secondary **Environmental** dimension involved in these results. However, the key results area does not relate to the **Economic** dimension of resilience, although the motivation of **Institutional** change is to improve the agricultural sector performance through innovation.

Lastly, specific evaluation criteria have been outlined (Coutts, Botha, & Turner, 2014) and fit under the **Institutional** dimension of resilience at the **National** level:

- the extent to which there has been change in the understanding, commitment to and changed institutions and practices around the use of Innovation Systems and Community of Practices
- the extent to which the innovation platforms have worked effectively by using Innovation Systems methodologies
- what was learned about the value of Innovation Systems and its applications
- the extent to which the Innovation Systems principles are practised
- the extent that Community of Practice members interacted as a team, understood and adopted the principles of AIS and made changes based on reflexive practices
- the extent to which co-innovation principles and practises, participatory methods and reflexive practise have been used and their effectiveness in influencing the innovation platforms.

5.6 Making SENZS

5.6.1 Description

The MBIE-funded Programme, *Making SENZS: Richer decisions for engaged communities*, was set up to address the issue of decision-makers and resource users struggling to cope with increased complexity and higher expectations around engagement and rates of behaviour change.

Participants have identified the need for more locally-relevant decision-making that is relevant and credible while recognising individual capacity to make and implement decisions. They want to understand the resource user behaviours and outcomes from decision-making approaches such as public-private partnerships and iwi co-governance, and how these can be applied in different socio-ecological systems. The main focus is freshwater ecosystems, but other ecosystems could be studied.

To address this, biophysical and social science, economics and mātauranga Māori are brought together to answer the research question: “How do components of socio-ecological systems interact to enable behaviours that enhance outcomes from different decision-making approaches?” Particular attention is being paid to three components: governance, knowledge and enabling change beyond those who participated in the decision-making process.

The socio-ecological systems framework is being adapted to New Zealand context. The framework is applied in qualitative comparative and thematic analyses of at least eight local and overseas examples of environmental decision-making by broadening and deepening analysis from existing components studies of these cases. Comparative analysis will highlight which components of socio-ecological systems framework combine to enable outcome-enhancing behaviours. Thematic analysis provides insights as to how and why these components combine to create successes. A trans-disciplinary approach to adapt and implement the socio-ecological systems framework to New Zealand will be used in three ways:

1. Incorporating mātauranga Māori and co-governance concepts into the framework
2. Using behavioural economics concepts to add to existing drivers of individual behaviour in the socio-ecological systems framework
3. Capturing how multiple uses of resources are connected.

5.6.2 Focus

This Programme aims to achieve improved environmental decision-making that is locally relevant and credible. Ostrom’s (2009) socio-ecological systems framework is well-established for evaluating how social, ecological, economic and governance systems influence user behaviours and outcomes from different decision-making approaches, but has had limited application in New Zealand.

The research question addresses the decision-making processes and governance around freshwater ecosystems. The outcomes of organisational behaviour change around decision-making fits into the **Institutional** dimension. The **Environmental** dimension is

also addressed, as the requirement of better decision-making is focused on freshwater and other ecosystems. There is an element of **Cultural** resilience though incorporating mātauranga Māori. The Programme focuses at the **National** scale as it is aiming for the change in the decision-making process to be nationwide.

5.6.3 Outcomes and Indicators

The Programme's output will be a menu of success factors that environmental decision-makers can be confident will enable behaviours for improved outcomes. In short, the idea is to specify what decision-making approaches work where, when and how. The four critical steps to achieve this are:

1. Establishing and facilitating networking of individuals from environmental decision-making organisations at local to national scales
2. Developing an evaluation framework for analysis of a range of environmental decisions
3. Characterising success factors for decision-making based on case analysis
4. Identify the 'what, when, where and how' of success factors which enable behaviours that will achieve enhanced outcomes.

Turning to outcomes, the long-term vision of the Programme is the following: by 2030, there is a generational shift in the way New Zealand governs and manages its environment to a culture of shared responsibility and action for the joint achievement of environmental, cultural, social and economic outcomes. The outcome fits within the **Institutional** dimension at the **National** scale, being primarily concerned with organisation change and governance in New Zealand. The indirect results of this outcome are achievements of **Cultural, Economic, Environmental** and **Social** resilience.

The Programme has identified several outcomes that directly support the vision and Programme aim:

- By 2020, at least five examples of environmental decision-makers efficiently implementing refined approaches to decision-making. Supporting refined approaches to decision-making is an example of building **Institutional** resilience at the **Intermediate** scale.
- Percentage of resource users that have increased confidence to take actions that enhance their own outcomes. This shift in behaviour embodies the **Institutional** dimension of resilience at the **Intermediate** and **Farm Household** scale.
- By 2023, \$2.8 million will be added to the regional economies, with a spill-over tourism benefit of \$5 million value add per year. Regional value add (GDP) is a **Regional Economic** indicator.
- By 2028, the intended outcome is to have \$20 million value added to the economy with spill-over benefits of tourism revenue of \$27 million as a result of enhanced environments. National value add (GDP) is a **National Economic** indicator.
- Other long-term (2023 to 2028) outcomes represent the **Economic** dimension at the **National** and **Intermediate** scales.

There are also intended outcomes addressing the **Cultural** dimension:

- Environmental decision-makers will ensure that iwi perspectives are valued.
- Increased capability of effective iwi co-governance, resulting in greater realisation of iwi rights and interests, and broader recognition of the benefits of co-governance. This also addresses the **Institutional** dimension.
- Decisions will be made that target enablers of behaviours. Examples include the integration of mātauranga, experiential and science knowledge in decision-making). This also has an **Institutional** and **Social** dimensions. It is hoped that this outcome will lead to an **Economic** outcome of reduced time to implement actions by resource users by 30 per cent compared to existing regional councils: a dollar saving of \$145,000 per annum from 2018.

The Programme has identified specific indicators. The **Economic** dimension has indicators that appear to be indirect measures of the Programme's impacts: they relate to the **Economic** dimension while the Programme aim is the **Institutional** dimension of resilience. Making SENZS does not have indicators under the **Cultural** or **Social** dimensions. There is a focus on these aspects and several short-term goals that fit in these dimensions, yet there are no indicators against which to benchmark progress toward achieving these goals. The long-term vision addresses these dimensions only as secondary aspects. The long-term vision also addresses the **Environmental** dimension; however, there are no indicators for this dimension over the long term. There are secondary goals and some **Cultural** short-term goals that do not have indicators aligned to those areas.

5.7 Weaving the Korowai of Papatūānuku

5.7.1 Description

Weaving the Korowai of Papatūānuku: Adaptive governance and supported environmental decision making aims to demonstrate how decision-making around complex environmental problems may be enhanced and accelerated only through a transformational approach to inter-agency partnership, a systemic understanding of roles and functions, and an innovative approach to the co-development of solutions with end-users. The Programme's overarching hypothesis is that new approaches are required to create adaptive governance landscapes that reflect jointly negotiated and agreed impacts.

Weaving the Korowai of Papatūānuku uses the Waiapu Catchment to demonstrate its approach. The Waiapu River lies at heart of the rohe of Ngāti Porou and is of great cultural significance. The Waiapu Catchment and the people who depend on its resources have been subjected to a series of significant environmental, social and economic shocks, leaving it one of the poorest communities in New Zealand.

In 2014, the Government committed to a 100-year partnership with iwi to restore the Waiapu Catchment under a Memorandum of Understanding signed in 2014 (the MOU) with the aim of healthy land, healthy rivers and healthy people. Using adaptive governance approaches the researchers aim to show how transformational change may be achieved in one of the most challenging and culturally significant environments (Edwards, et al., 2016).

5.7.2 Focus

The Programme focuses on developing systems and adaptive governance approaches to decision-making. This approach will be applicable to any context in New Zealand where multiple agencies and communities are wrestling with complexity, especially where there are limited resources or a lack of clarity over desired outcomes.

The research Programme is intended to create new approaches to governance and decision-making for communities facing complex environmental problems. This is primarily an **Institutional** dimension looking to change organisational behaviour with respect to decision-making institutions at the community level (**Intermediate** scale).

5.7.3 Outcomes and Indicators

The core aims of the Programme are to show how agency interventions and support for decision-making must reflect the livelihoods, aspirations and assets of the communities in which they occur, and demonstrate how communities may be empowered, building capacity and capability with all actors so that they may play a full and equitable role in the decision-making process.

The outcome will be the provision of planning tools and means to allow effective decisions. Providing planning tools is designed for long term outcomes outlined in the MOU. Providing planning tools builds **Institutional** resilience to support long-term goals of the MOU are set out in centre on healthy land, healthy rivers and healthy people. The central themes of the desired outcomes are **Environmental** restoration, **Cultural** revitalisation, and **Economic** and **Social** prosperity. These all fall under the **Intermediate** scale with respect to the Waipua Catchment area.

6. Discussion

We have outlined some key information about the seven Programmes. We now discuss the general insights, rolling up from the Programmes to the Theme and then to the Challenge level. We focus on the extent to which progress towards achievement of the Challenge objectives is supported by the Programmes and can be evidenced.

6.1 Programme level

Figure 6 uses the resilience framework project/planning matrix to catalogue the Programmes by resilience dimensions and scales. The figure provides a summary view of the focus of the Programmes and therefore Theme 3. Each cell of the matrix represents one resilience dimension at one spatial scale. In each cell, the Programmes with that focus are shown in **bold** type. For reference, we have highlighted the key dimensions and scales for Theme 3 in green, and the dimensions and scales for the Challenge as a whole in blue.

In determining which Programmes to highlight in each cell, we considered the main aims and outcomes of the Programmes. In many cases, the outcomes were expressed as qualitative markers of success. There were fewer quantitative indicators identified to measure progress towards Programme, Theme and Challenge outcomes. Principally, the quantitative indicators concerned internal research targets including number of publications, research network measures and stakeholder engagement in the Challenge.

Looking across the dimensions, it is clear that the Programmes collectively address all the dimensions of resilience. Four of the Programmes could themselves be considered holistic. RRC, Mauri Whenua Ora and Weaving the Korowai of Papatūānuku, particularly at the **Intermediate** scale, contain elements focused on all the dimensions. Likewise, Making SENZS considers all the resilience dimensions, but at the **National** scale. The Collaboration Lab had a narrower focus, taking in the **Cultural**, **Institutional** and **Environmental** dimensions. An even more focused Programme was Integrated Systems Research, which appeared to target only the **Institutional** dimension of resilience.

The Programmes also operated at different scales. Only two programmes appears to have much focus on the **Farm Household** scale: RRC worked across several resilience dimensions at that scale, and the Collaboration Lab focused on **Institutional** resilience. Four of the seven programmes were working at the **Intermediate** scale, including communities, regions, catchments, etc. They were the Collaboration Lab, RRC, Mauri Whenua Ora and Weaving the Korowai of Papatūānuku. Other programmes were focused at the **National** scale, principally the Collaboration Lab and Making SENZS.

The Programmes' focus, outcomes and indicators do not directly address the **External** dimension of resilience. There appears to be little explicit investigation of the short- and long-term **External** resilience factors that could impact on each Programme, the Theme or the Challenge. Because the Programmes cover the whole research and outcome space, the seven Programmes indirectly contribute to this **External** resilience through addressing all the internal dimensions of resilience. New Zealand and communities are susceptible to **External** factors and future research in the programmes could directly address this by measuring the impact of these factors.


	 Social	 Cultural	 Economic	 Institutional	 Environmental	 External
National 	<ol style="list-style-type: none"> The Collaboration Lab Integrated Systems Research Mauri Whenua Ora Resilient Rural Communities Primary Innovation Making SENZS Weaving the Korowai of the Papatūānuku 	<ol style="list-style-type: none"> The Collaboration Lab Integrated Systems Research Mauri Whenua Ora Resilient Rural Communities Primary Innovation Making SENZS Weaving the Korowai of the Papatūānuku 	<ol style="list-style-type: none"> The Collaboration Lab Integrated Systems Research Mauri Whenua Ora Resilient Rural Communities Primary Innovation Making SENZS Weaving the Korowai of the Papatūānuku 	<ol style="list-style-type: none"> The Collaboration Lab Integrated Systems Research Mauri Whenua Ora Resilient Rural Communities Primary Innovation Making SENZS Weaving the Korowai of the Papatūānuku 	<ol style="list-style-type: none"> The Collaboration Lab Integrated Systems Research Mauri Whenua Ora Resilient Rural Communities Primary Innovation Making SENZS Weaving the Korowai of the Papatūānuku 	<ol style="list-style-type: none"> The Collaboration Lab Integrated Systems Research Mauri Whenua Ora Resilient Rural Communities Primary Innovation Making SENZS Weaving the Korowai of the Papatūānuku
Intermediate 	<ol style="list-style-type: none"> The Collaboration Lab Integrated Systems Research Mauri Whenua Ora Resilient Rural Communities Primary Innovation Making SENZS Weaving the Korowai of the Papatūānuku 	<ol style="list-style-type: none"> The Collaboration Lab Integrated Systems Research Mauri Whenua Ora Resilient Rural Communities Primary Innovation Making SENZS Weaving the Korowai of the Papatūānuku 	<ol style="list-style-type: none"> The Collaboration Lab Integrated Systems Research Mauri Whenua Ora Resilient Rural Communities Primary Innovation Making SENZS Weaving the Korowai of the Papatūānuku 	<ol style="list-style-type: none"> The Collaboration Lab Integrated Systems Research Mauri Whenua Ora Resilient Rural Communities Primary Innovation Making SENZS Weaving the Korowai of the Papatūānuku 	<ol style="list-style-type: none"> The Collaboration Lab Integrated Systems Research Mauri Whenua Ora Resilient Rural Communities Primary Innovation Making SENZS Weaving the Korowai of the Papatūānuku 	<ol style="list-style-type: none"> The Collaboration Lab Integrated Systems Research Mauri Whenua Ora Resilient Rural Communities Primary Innovation Making SENZS Weaving the Korowai of the Papatūānuku
Farm Households 	<ol style="list-style-type: none"> The Collaboration Lab Integrated Systems Research Mauri Whenua Ora Resilient Rural Communities Primary Innovation Making SENZS Weaving the Korowai of the Papatūānuku 	<ol style="list-style-type: none"> The Collaboration Lab Integrated Systems Research Mauri Whenua Ora Resilient Rural Communities Primary Innovation Making SENZS Weaving the Korowai of the Papatūānuku 	<ol style="list-style-type: none"> The Collaboration Lab Integrated Systems Research Mauri Whenua Ora Resilient Rural Communities Primary Innovation Making SENZS Weaving the Korowai of the Papatūānuku 	<ol style="list-style-type: none"> The Collaboration Lab Integrated Systems Research Mauri Whenua Ora Resilient Rural Communities Primary Innovation Making SENZS Weaving the Korowai of the Papatūānuku 	<ol style="list-style-type: none"> The Collaboration Lab Integrated Systems Research Mauri Whenua Ora Resilient Rural Communities Primary Innovation Making SENZS Weaving the Korowai of the Papatūānuku 	<ol style="list-style-type: none"> The Collaboration Lab Integrated Systems Research Mauri Whenua Ora Resilient Rural Communities Primary Innovation Making SENZS Weaving the Korowai of the Papatūānuku

Figure 6. Programme matrix

Collectively, the seven Programmes cover the whole research and outcome space delineated by the resilience framework. Every cell in the matrix has at least one Programme operating in it, and at the **Intermediate** and **National** scales, there are multiple programmes working across several resilience dimensions.

The cells with the most focus are in the **Institutional** dimension. At the **National** and **Intermediate** scales, the **Institutional** dimension contains more Programmes than any other dimension. It is also the most-studied dimension at the **Farm Household** scale. This result visually represents the focus of the Programmes on collaboration and building **Institutional** resilience in the research community, within government, for a number of entities in the agricultural sector, and more generally in communities and regions. Nevertheless, the Programmes also address other elements of resilience.

Importantly, this assessment of the Programmes is based on the current understanding of resilience as developed through one of its own Programmes, Resilient Rural Communities. As a result, there is a certain amount of reflexivity in the assessment: RRC appears active throughout the resilience framework because it has worked to understand resilience holistically and across the different scales (which RRC has itself defined). RRC is now in its final two years of funding and is focusing on producing published outputs. There are two potential implications for the situation illustrated in [Figure 6](#). On the one hand, RRC could shrink its focus. If RRC moves out of some of the dimensions and scales where it is one of the few contributors, Theme 3 could have a smaller research focus overall. This change could, for example, affect work in Theme 3 at the farm household scale, where RRC is the most active Programme. Similarly, RRC is the only Programme focused on the Social dimension outside of the three Vision Mātauranga Programmes.

The second potential implication concerns the resilience framework itself. The framework has been constructed based on current knowledge at a point in time, and it is a simplifying, summary approach for particular purposes. The framework is, therefore, and should be, subject to change. Researchers could recognise that other dimensions are important enough to be included, or that some of the current six dimensions should be dropped. Other scales could be added: the individual person, or multiple intermediate scales like 'catchment', 'super-catchment' or 'region'. If it is useful to understand how Programmes contribute to the study of resilience, then it may also be useful to update that understanding as the concept of resilience changes. The risk is that the research capability around resilience depends considerably on RRC and how it develops. Ironically, the study of resilience across these Programmes appears to be itself somewhat fragile or contingent.

6.2 Theme level

Theme 3, Collaborative Capacity, has an explicit focus on building Institutional resilience, as well as Social and Environmental resilience at the Intermediate scale. This focus is represented in [Figure 6](#) by the green-shaded cells. The goal is to support the Challenge's **Economic** and **Environmental** goals by aiming to have increased and more rapid agreements over land and water use decisions through decreased conflict among stakeholders. The **Institutional** dimension is assumed to contribute indirectly to these goals and to facilitate the delivery of the Challenge KPIs.

The overlay in [Figure 6](#) of the green cells and the list of Programmes demonstrates the alignment between the Programmes and Theme 3. All of the Programmes have some focus on **Institutional** resilience, either at the **National** or **Intermediate** scale. In addition, there are several Programmes contributing to the other goals of Theme 3, the **Social** and **Environmental** dimensions. Most of the programmes in the **Social** dimension have a Vision Mātauranga focus; the exception is the RRC Programme, as discussed above. What the pattern shows is that the Programmes are aligned with and support the intended outcomes of Theme 3. As well, they are working across other dimensions and scales. Another way to view the alignment is shown in [Figure 7](#), which paints a clear picture of the Programmes and how they relate to the Collaborative Capacity Theme. All Programmes have an **Institutional** focus and they are therefore aligned with the **Institutional** focus of the Theme.

6.3 Challenge level

[Figure 6](#) and [Figure 7](#) also show the alignment across the Programmes, Theme 3 and the Challenge as a whole. The mission and main KPIs for the Challenge are **Economic** and **Environmental** mainly at the **National** scale, represented by the blue cells in [Figure 6](#) and the indicators listed in [Figure 7](#). The figures show that the individual Programmes include elements of **Economic** and **Environmental** resilience, and thus they directly support the dimensions that are important for the Challenge. However, the Challenge has a **National** focus while only some of the Programmes are working at that spatial scale. The matrices also show that Theme 3 is focused on **Institutional** resilience and tends to consider the **Intermediate** scale, while the Challenge is focused on other dimensions and the **National** scale. Overall, the focus of Theme 3 and its contribution to the Challenge seem likely to continue regardless of changes in any of the specific Programmes. The Programmes are clustered around the Challenge's **Economic** and **Environmental** dimensions and the Theme 3 **Institutional** focus, so a change in any one Programme is not enough to change the overall pattern.

The matrices provide a visual representation of two assumptions that appear to underpin the relationship between Theme 3 and the Challenge. The two assumptions are:

- improving **Institutional** performance will produce better **Economic** and **Environmental** outcomes, as measured by the indicators in [Figure 7](#)
- having success at the **Intermediate** scale will produce measureable outcomes at the **National** scale.

In the Programme documents, the first assumption is recognised. Some of the information specifically discusses that the goal of better institution is better economic and environmental outcomes. For example, the Collaboration Lab makes this assumption explicitly. Given that this assumption is a key link between the Theme and the Challenge, one possible approach is to turn the assumption into a research question or testable hypothesis and devote resources to it. Indicators are starting to emerge from the Challenge that could be used to test this hypothesis that, for example, increased and more rapid agreements over land and water use decisions through decreased conflict among stakeholders can lead to enhanced primary production and productivity while maintaining and improving our land and water quality for future generations.

The second assumption is perhaps less recognised. It operates in two ways, by aggregation and by generalisation. The aggregation sense is that, if regions are performing better and the national-level impacts are an aggregation of regional performance, then the national indicators should improve. If this direct aggregation effect is targeted, then the Challenge and Theme could give some consideration to the specific regions targeted. They could consider whether those regions are the ones that would produce the largest effects nationally. The generalisability is somewhat different. Similar to Garrett et al (2016), these **Intermediate** scale Programmes are value-driven, dealing with local issues and building local resilience. The caution here is to ensure the case study can be generalised, ensuring an appropriate balance is struck between establishing generalisable tools and frameworks that can be applied to other communities and regions, and supporting the development of resilience of local communities.

The final high-level point to make regarding the two matrices is the status of the **Cultural** dimension. Most of the Programmes in Theme 3 have a **Cultural** component, and collectively they are operating across all the spatial scales. However, it is not clear in this review how those aspects of the Programmes are intended to connect with the Theme and Challenge. Mostly likely, they should connect with the Vision Mātauranga part of the Challenge. However, what is not clear from the matrices is how the Vision Mātauranga relates to the intent of the Theme or the KPIs of the Challenge. We are aware that there is work in this area in the Challenge. However, the specific approach we took to review the Theme and its Programmes did not make the alignment in the **Cultural** dimension clear.










	Social 	Cultural 	Economic 	Institutional 	Environmental 	External 
Challenge 			Value of production doubled: ratio of exports to GDP increased to around 40%		Performance of key indicators of land and water resources improved by 20%	
Theme 				Increased and more rapid agreements over land and water use decisions through decreased conflict among stakeholders		
Programmes 	<ol style="list-style-type: none"> 1. The Collaboration Lab 2. Integrated Systems Research 3. Mauri Whenua Ora 4. Resilient Rural Communities 5. Primary Innovation 6. Making SENZS 7. Weaving the Korowai of the Papatūānuku 	<ol style="list-style-type: none"> 1. The Collaboration Lab 2. Integrated Systems Research 3. Mauri Whenua Ora 4. Resilient Rural Communities 5. Primary Innovation 6. Making SENZS 7. Weaving the Korowai of the Papatūānuku 	<ol style="list-style-type: none"> 1. The Collaboration Lab 2. Integrated Systems Research 3. Mauri Whenua Ora 4. Resilient Rural Communities 5. Primary Innovation 6. Making SENZS 7. Weaving the Korowai of the Papatūānuku 	<ol style="list-style-type: none"> 1. The Collaboration Lab 2. Integrated Systems Research 3. Mauri Whenua Ora 4. Resilient Rural Communities 5. Primary Innovation 6. Making SENZS 7. Weaving the Korowai of the Papatūānuku 	<ol style="list-style-type: none"> 1. The Collaboration Lab 2. Integrated Systems Research 3. Mauri Whenua Ora 4. Resilient Rural Communities 5. Primary Innovation 6. Making SENZS 7. Weaving the Korowai of the Papatūānuku 	<ol style="list-style-type: none"> 1. The Collaboration Lab 2. Integrated Systems Research 3. Mauri Whenua Ora 4. Resilient Rural Communities 5. Primary Innovation 6. Making SENZS 7. Weaving the Korowai of the Papatūānuku

Figure 7. Resilience of outcomes by Challenge, Theme and Programmes

6.4 Summary

The Challenge has a focus on **National** scale improvements to **Economic** and **Environmental** dimensions of resilience. Theme 3 is focused on **Institutional** resilience on the assumption that it will produce the **Economic** and **Environmental** gains targeted by the Challenge. The Programmes in the Theme are spread widely across the resilience dimensions and scales. As a result, the Programmes directly support the Theme's focus on **Institutional** resilience and also directly support the Challenge's focus on **Economic** and **Environmental** dimensions. In addition, the Programmes are engaged with the other dimensions, the **Social** and **Cultural** ones. The broad scope of research provides evidence that these are multidisciplinary research Programmes and make up a multidisciplinary Theme and Challenge.

In addition to the clear evidence of alignment, four possible issues have been identified:

1. The Programmes and Theme focused at the **Intermediate** scale, while the Challenge KPIs are at the **National** scale. The linkage between these scales could be made transparent or explicit.
2. The Theme, and particularly the Collaboration Lab and Integrated Systems Research Programmes, assumes that improving **Institutional** resilience will improve **Economic** and **Environmental** performance. This linkage and its mechanisms could be an area for focused research.
3. The Programmes have identified aims and visions, and most have identified outcomes. However, the indicators that can be used to measure progress towards intended outcomes have not been identified or developed across all the Programmes.
4. The Cultural dimension is an important part of the individual Programmes. This review has not explicitly investigated the Vision Mātauranga part of the Challenge (because it is separate from Theme 3). It could be useful to clarify the connections between the Programmes and their Cultural components on the one hand with the Vision Mātauranga and the whole Challenge on the other.

7. Conclusion

The aim of this report was to provide transparency for improved strategy, co-ordination and integration of the Collaborative Capacity Theme within the Challenge using a resilience framework. This report shows how the resilience framework can be a useful tool to support management and success of the Challenge by providing information about research in the Collaborative Capacity Theme.

We used the resilience framework to frame and catalogue the expected outcomes and impacts of Programmes, Collaborative Capacity Theme and the Challenge. This allowed us to break down and analyse the Programmes, Theme and Challenge in terms of their dimensions and scales of resilience. This allowed us to make general findings about the Programme, Theme and Challenge.

We found the funded- and aligned-Programmes are spread widely across the resilience dimensions and scales. All the Programmes cover the **Institutional** dimension, either at the **Intermediate** scale or **National** scale, supporting the Collaborative Capacity Theme. Further, some Programmes specifically aim at building Economic and Environmental resilience, directly supporting the Challenge mission and outcomes. Additionally, the Programmes are engaged with the other dimensions: **Social** and **Cultural**. The wide spread provides evidence that these are interdisciplinary research Programmes.

The Programmes support the Collaborative Capacity Theme, through its **Institutional** outcomes of building collaborative and co-development practices. This focus on **Institutional** resilience is based on an assumption that it will produce the **Economic** and **Environmental** gains targeted by the Challenge. This assumption could be converted into a testable hypothesis by Theme and Programme leaders.

One concern is that the Programmes, and therefore the Theme, are principally focused at the **Intermediate** scale. There is a question regarding the impact that these Programmes and the Theme could have at the **National** scale. For the Programme, this impact could be tested by converting the assumption that the **Institutional** Theme will indirectly impact the **Economic** and **Environmental** outcomes into a testable hypothesis. At the Programme level, the potential impact could be explored by evaluating how learnings from case studies could apply to the **National** context.

The second concern is that few indicators have been set for the Programmes to measure progress towards achieving outcomes of the Programmes, Themes and Challenge. Knowledge of the dimensions and scales of resilience into which the Programmes, Theme and Challenge fall can help researchers to select appropriate indicators and measure contribution of Programmes to the Theme and the Challenge. Within the Theme, selecting appropriate indicators could have a dual role: to measure progress towards achieving Collaborative Capacity outcomes and to test whether the Programme contributed to the Challenge goals and mission, thereby testing the assumption.

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10. Appendix – Documents reviewed

The following lists are the documents reviewed in the course of this project.

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