

2015  
RNC Short Project

# Co-creating solutions

Engaging New Zealand in RNC research



A review of stakeholder engagement  
and a study of perspectives on  
co-created research in NZ

Ma te tuakana e tika ai te teina,  
ma te teina e tika ai te tuakana.

Through relationships and respect  
we can find the way forward.

Whakataukī  
Māori proverb

# Executive Summary

Resilience to Nature's Challenges - *Kia manawaroa - Ngā Ākina o Te Ao Tūroa* (RNC) is one of eleven strategic National Science Challenges (NSC) aimed at developing collaborative and enduring solutions to some of New Zealand's largest and most complex issues. The 10-year RNC project aims to bring together researchers and stakeholders of diverse backgrounds to co-create solutions which will help transform New Zealand into a nation which is resilient to natural disasters. The RNC strategy outlines an approach in which a wide range of people, from different social, cultural, and professional backgrounds, are engaged in resilience-focused research. In order to achieve this vision, it is important to 1) review good practices for engaging with stakeholders in broad transdisciplinary research projects, and 2) understand how stakeholder engagement can be exercised in ways that help meet New Zealanders' expectations and definitions of "co-created" research.

This report presents a review of key literature on stakeholder engagement and transdisciplinary environmental research. It draws on landmark papers from business management, as well as more recent work from fields such as climate science, environmental sustainability, natural resource management, and biosecurity. We review definitions and concepts (Chapter 2), present established best practice guidelines, and critically reflect on how existing conceptual frameworks align with the goals and objectives of the RNC (Chapter 3).

We also present the findings of primary social science research which explores RNC stakeholder and researcher perspectives on co-created research (Chapter 4). An online survey of 43 people interested and/or active in natural hazard and risk research (43% scientists, 57% non-scientists) revealed that an overwhelming majority supported a co-created approach. Participants generally shared holistic and optimistic perspectives on what defines a co-created approach, and viewed the greatest challenges to be resource limitations and overcoming prevailing hierarchical structures. Small focus group discussions in Christchurch and Auckland revealed a similarly holistic view of RNC engagement and co-creation research, with participants acknowledging the multidimensional nature of resilience and the need to integrate people across all social and institutional levels in RNC research. A key theme which arose was the importance of connecting with existing stakeholder networks and activities to maximise impact and participation, and minimise fatigue. The value of establishing a boundary organisation to provide a familiar, open, safe forum for discussion among all stakeholders was also proposed. We outline the need to establish a strong partnership with tangata whenua and Māori organisations in the RNC, and emphasise the importance of respecting and integrating Māori world views throughout the RNC.

Based on the literature review and the results of the research, we propose and outline a conceptual framework for co-creating research in the RNC, which comprises an iterative cycle of co-designing, co-producing, co-disseminating, and co-evaluating (Chapter 5). This framework aims to reflect the best practice literature, as well as the unique perspectives and expectations of RNC stakeholders and researchers. We also suggest future work on evaluating and monitoring RNC co-creation and engagement efforts using a longitudinal approach (Chapter 6). We propose that such work would help the RNC maintain accountability and adaptive practice, as well as help to fill an important gap in the literature by documenting the evolution of a co-created project.

The report concludes with a summary of conceptual and pragmatic considerations presented throughout the report, which we recommend should be taken into account in future RNC research activities (Chapter 7). A number of additional resources are identified to provide further guidance on topics such as stakeholder analysis, stakeholder engagement planning and techniques, and special considerations for engaging with tangata whenua and Māori organisations.

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**Cover photos:** Images of New Zealand, representing the Vision Mātauranga, Urban, Rural, and Edge themes of RNC research - credit: M A Thompson

**Whakatauki:** BOPRC (2011)

National  
**SCIENCE**  
Challenges

RESILIENCE  
TO NATURE'S  
CHALLENGES

.....  
Kia manawaroa  
– Ngā Ākina o  
Te Ao Tūroa  
.....



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# About this report

The work presented in this report was commissioned as part of a three-month short-term research project which preceded the formal commencement of the Resilience to Nature's Challenges (RNC) National Science Challenge (NSC) in July 2015. This report is intended to facilitate discussion and critical thinking about the role of stakeholder engagement in the RNC, and to provide a basis for identifying and evaluating pathways to engage RNC stakeholders in ways that embrace a co-created approach.

This report comprises both a topical review of published literature and the findings of primary research carried out over the course of this short-term project. The purpose of this report is to:

- 1 present a conceptual review of established best practices and existing guidelines for stakeholder engagement in the context of the RNC project,
- 2 present empirical insight into how stakeholder engagement can be developed and maintained in a way that fulfils the co-creation aims of the project, and
- 3 propose a general framework for stakeholder engagement and co-creation in the RNC project, based on the above two components.

Discussions with more than 30 experienced researchers and stakeholders at 15 different organisations across New Zealand helped guide the scope and direction of this project. Over 120 publications from a number of different disciplines were consulted for the literature review, and more than 50 RNC stakeholders and researchers participated in the survey and focus groups which were used to collect primary social science research data. Accordingly, the work provides a broad, though bounded, overview of stakeholder engagement in natural hazard, risk, and resilience research.

This work was carried out within the context of the goals and aims of the RNC project, and is not considered a comprehensive review of the entire domain of stakeholder engagement. The recommendations put forth in this report are not prescriptive, but rather, aim to inspire and provide guidance for how to sustain a high standard of engagement throughout the duration of the RNC project. As research priorities and stakeholder concerns evolve over the ten-year lifetime of the RNC, engagement goals are also likely to change shape and focus, and frameworks should be adjusted to reflect this.

The report begins with an introduction and overview of concepts and theories from the stakeholder engagement literature, and a discussion of how these fit into the context of environmental research programmes in general, and the RNC in particular. The report then presents the findings of focus groups and a survey carried out as part of this study, together with a critical reflection of how these findings fit with existing ideas. The report concludes with a suggested generalised framework for how the RNC could approach engagement and co-creation in an inclusive, manageable, and sustainable way. Several stories of stakeholder engagement in scientific research are presented throughout the report as examples to inspire creative thinking about future engagement.

The National Science Challenges are one of the first long-term, nationwide, transdisciplinary, collaboratively-structured science projects of their kind in New Zealand. The Resilience to Nature's Challenges project introduces an exciting opportunity for New Zealand to set a leading example of how co-created research, founded in meaningful and regular stakeholder engagement and high-quality science, can be a positive driver of transformative change that leads to increased resilience in communities of all shapes and sizes.

# Acknowledgments

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This is one of two short-term research projects supported by the RNC project. Its companion project, “Resilience Benchmarking & Monitoring Review” by Joanne Stevenson, John Vargo, Vivienne Ivory, Chris Bowie, and Suzanne Wilkinson can be found on the RNC website.

# 1 Overview of the RNC

Resilience to Nature's Challenges - *Kia manawaroa - Ngā Ākina o Te Ao Tūroa* (RNC) is one of eleven strategic National Science Challenges (NSC) supported by New Zealand's Ministry of Business, Innovation, & Employment (MBIE). The NSCs are designed to develop overarching scientific insight and enduring solutions to large and complex issues facing New Zealand through collaborative transdisciplinary research (MBIE 2014). The RNC aims to use this innovative approach to bring together researchers and stakeholders from across the country to work towards enhancing New Zealand's resilience to natural disasters.

The RNC project acknowledges that resilience is a complex coupled human-natural system challenge, and that resilience research needs to transition away from a paradigm which relies principally on hazard and risk assessment, towards a wider, transdisciplinary, collaborative, and transformative context (RNC 2014). The RNC is underpinned by the belief that the key to achieving transformative resilience is through recognising shared visions and co-creating knowledge about hazard, risk, and resilience together. The project structure is conceptualised as a "resilience pipeline", built of concentric layers representing complementary research aims, an array of underpinning disciplines, and overarching collaborative partnership (Figure 1). This structure intends to remove the silos which have characterised traditional hazard, risk, and resilience research – and to create innovate and lasting solutions through a collaborative, participatory, co-creation approach.

The proposed RNC structure consists of four "Priority Co-creation Laboratories" (representing the inner circle of the pipeline) which focus on developing and implementing collaborative research solutions to critical resilience issues related to the urban environment, the rural environment, the Māori world view (Vision Mātauranga), and coastal margins where urgent hazard and risk issues are approaching a critical edge. A number of "Resilience Toolboxes" comprise the next supporting layer of the pipeline. These Toolboxes consist of interdisciplinary teams equipped with expertise, techniques, and methods which can be drawn upon and applied within each co-creation laboratory. The outer layer of the pipeline represents the players outside of the RNC team who will support, coordinate, and partner with the project and its goals.

This structure was strategically developed through a large-scale participatory process which identified

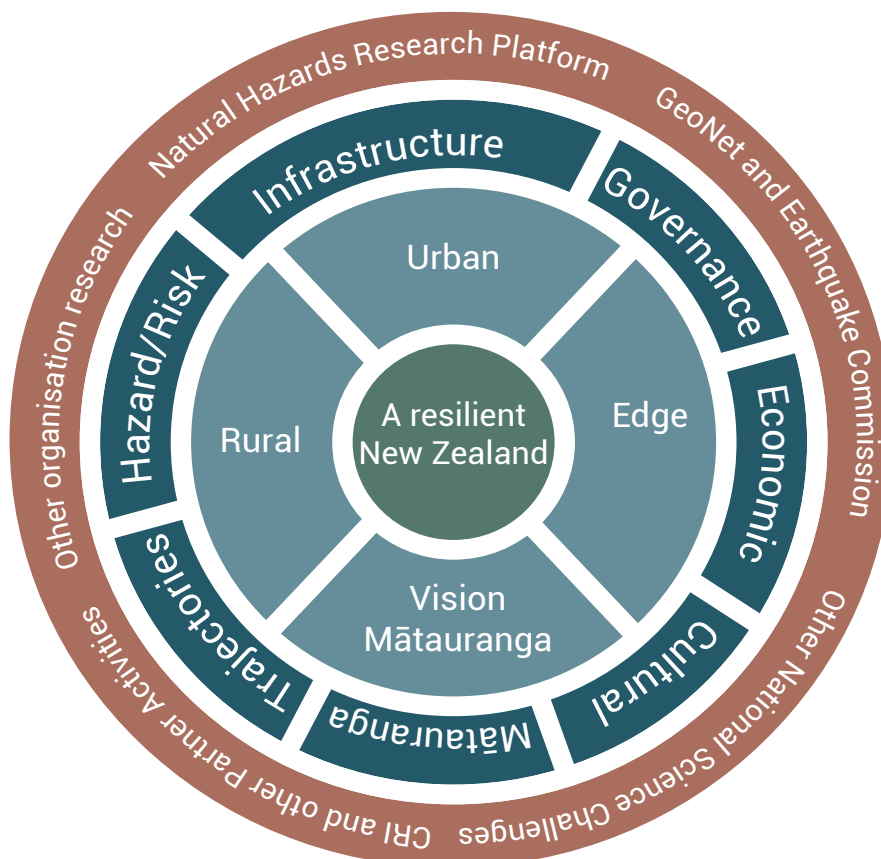


shared needs and goals among stakeholders and researchers in New Zealand. As the project evolves over the next ten years, it will be essential to preserve these existing bonds and to build new relationships between stakeholders and researchers. The 90 people who make up the initial RNC team come from 21 different organisations across New Zealand, and have a range of different backgrounds and specialties, including: geology, engineering, marine and coastal science, agriculture, forestry, fire science, statistics, modelling, psychology, communication, Mātauranga Māori, business, economics, emergency management, planning, and governance, among others. The diversity of the team is reflective of the diversity and breadth of goals that the project aims to achieve, and the stakeholders of the project will be even more diverse and widespread.

By developing enduring and meaningful partnerships with stakeholders, we will develop sustainable and fit-for-purpose research solutions to resilience to nature's challenges.

– RNC (2014) pg.4

The RNC (2014) proposal recognizes that stakeholder engagement will serve a critical role in fulfilling the project's co-creation goals. We propose that, in many ways, engagement will act as the cement which keeps the resilience pipeline together and focused on its trajectory towards transformative change. The following chapters outline typologies and characteristics of stakeholder engagement, and present options for how it might be conceptualised and integrated within the RNC in order to foster the co-creation and exchange of knowledge.



**FIGURE 1** The RNC “resilience pipeline” built of Priority Co-Creation Laboratories (light blue), Resilience Toolboxes (dark blue), and strategic cross-disciplinary partnership (brown). From RNC (2014).

# 2 Defining stakeholder engagement

## Who is a stakeholder?

Disaster risk reduction and resilience problems are multi-layered and complex. In order to achieve a holistic understanding of such issues and their potential solutions, research must extend beyond the environmental and physical sciences of natural hazards and their impacts, and also encompass sociology, economics, politics, health, the built environment, and the cultural and social fabric of at-risk communities. This broad nature of resilience research means that there are a vast number of potential stakeholders, or, people who can potentially affect, or be affected by, the research.

Many definitions for 'stakeholder' exist in the literature, due to the range of disciplines in which stakeholder theory research is grounded (e.g., business management, policy-making, natural resource management, climate change research) (Donaldson and Preston 1995, Stoney and Winstanley 2001, Freidman and Miles 2006, Carney et al. 2009, Reed et al. 2009, Orr 2014). These definitions vary in scope, with more narrow typologies focused on what constitutes a legitimate 'stake' (e.g., shareholders, property rights, capital investment), and broader ones more focused on the notion of who affects, and who is affected by, the corporation, organisation, or project (Freeman 1984; Grimble and Wellard 1997; Freidman and Miles 2002, 2006; Reed et al. 2009).

The latter, broader definition of 'stakeholder' is commonly traced back to the work of Freeman (1984). Three decades later, it remains one of the most widely used definitions (Freidman and Miles 2006, Schiller et al. 2013). This broad classification of 'stakeholder' is compatible with the inherent complexity of environmental research, which must encompass and consider a wide range of both natural and human factors. Accordingly, nuanced variations of this definition have been adopted in a number of environmental research programmes over recent years, including climate change (van de Kerkhof 2006, Carney et al. 2009, IPCC 2014), biodiversity (Durham et al. 2014), environmental modelling (Allen et al. 2013, Fulton et al. 2015), environmental policymaking (Orr 2014), biosecurity (Reed and Curzon 2015), conservation (Kainer et al. 2009), natural resource management (Reed et al. 2009), and water and flood management (Green and Penning-Rowsell 2010, Stanghellini 2010). A generalised summary of the diversity of stakeholders in environmental research is shown in Table 1.

**TABLE 1** List of environmental stakeholders by interest (Orr 2014)

Private industry	Businesses
Tribal organisations	Trade unions
Government agencies	Academics
Elected officials	Scientists
Bureaucrats	General public
Tourists/recreationists	Youth
NGOs/interest groups	Individual private actors
Trade associations	Grantors
Local communities	

The balanced and inclusive definition of a stakeholder by Freeman (1984) is similarly well-suited to the transdisciplinary and collaborative mission of the Resilience to Nature's Challenges (RNC) project, as put forth in the RNC Proposal and research strategy:

#### RNC Mission



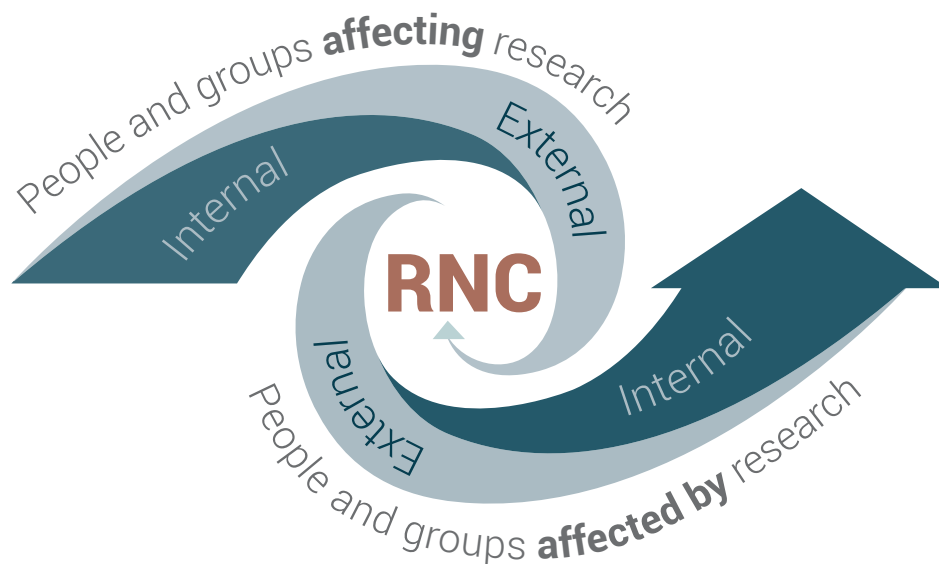
We will partner with multiple stakeholders to generate new co-created research solutions to inform "how" New Zealand builds a transformative pathway toward resilience to nature's challenges. Through an agile research and engagement team, priority-driven transdisciplinary co-creation laboratories, and high-quality, targeted underpinning research, we will tackle the "wicked" problems facing our rapidly changing cultural, economic, built and natural environments. – RNC (2014), pg. 3

Accordingly, throughout this work, we use the definition that an RNC stakeholder is one who can affect, or can be affected by RNC research (Figure 2). As the RNC team is broad and diverse itself, made up of researchers and practitioners at organisations across New Zealand, we highlight that this definition includes people both internal to the RNC, i.e., people who are part of the RNC research team, and external to the RNC, i.e., people who are not formally part of the RNC team. It is important to note that this definition includes stakeholders who are both directly and indirectly influenced by the research and its outcomes (Durham et al. 2014).

For example, although a resident may not be directly involved in flood-based research, or be directly impacted by the revision of flood risk management and regulation based on the research, if their neighbourhood is located adjacent to or within a flood-prone area, they would be considered a stakeholder – as would the government officials handling the revision, the construction companies who may have to adhere to new regulation, and many others.

## What is stakeholder engagement?

In its most basic sense, stakeholder engagement refers to the interaction of an organisation, project, or company with its stakeholders. Generally, engagement is conceptualised as a spectrum representing different degrees of interaction – with undeveloped, one-way, top-down communication of information at one end, and evolved, multi-directional collaboration and empowerment of stakeholders at the other end (e.g., Arnstein 1969, IFC 2007, AccountAbility 2008, Durham 2014, IAP2 2014) (Figure 3). An individual's perceptions of 'stakeholder engagement', and its role, timing, and value in a research project, may lie anywhere across this spectrum, depending on his or her background, training, and experience (Allen et al. 2013).



**FIGURE 2** Conceptual diagram illustrating the two general types of RNC stakeholders: people affecting RNC research, or affected by RNC research. Internal stakeholders are people and groups within the RNC project. External stakeholders are people and groups not formally part of the RNC. Stakeholders will evolve, grow, and change over time.

The engagement spectrum and its many variations can be attributed back to the work of Arnstein (1969), who recognised that there are many different levels of interaction that fall under the umbrella term of engagement, or participation, and that these approaches do not all engage stakeholders equally. Interactions at the left side of the spectrum (Figure 3) are characterised by the act of “informing” or “consulting” stakeholders, and examples include fact sheets, newsletters, reports, public talks, and meetings (Rowe and Frewer 2000, Luyet et al. 2012, IAP2 2014). Arnstein (1969) and other scholars (e.g., Selin et al. 2000, Kothari 2001, Dawkins 2014, Thaler and Levin-Keitel 2015) have argued that in order for an organisation or project to truly engage with its stakeholders in a meaningful way, efforts must go beyond informing or consulting, and towards shared decision-making power (right side of the spectrum). Examples of this “collaboration” and “empowerment” of stakeholders include advisory committees, participatory decision-making, and the delegation of decisions to stakeholders (Rowe and Frewer 2000, Luyet et al. 2012, IAP2 2014).

In scientific research, the left-hand side of the spectrum, characterised by one-way ‘informing’ of research results, has typically dominated, due to the competitive nature of scientific research, which emphasises peer-reviewed manuscripts, high-stakes grants, and internal validity over external relevancy to practice (Green et al. 2009, Allen et al. 2013). In environmental science and natural hazard and risk research, this prevailing approach has resulted in the development of a “usability gap”, in which there exists both a lack of new knowledge being *used* in practice, and the development of knowledge which is not very *useful* to practice (Figure 4) (Alexander 2007, Ray et al. 2007, Lemos and Rood 2010, Gaillard and Mercer 2013, Lemos et al. 2012, Davies et al. 2015, Scolobig and Pelling 2015).

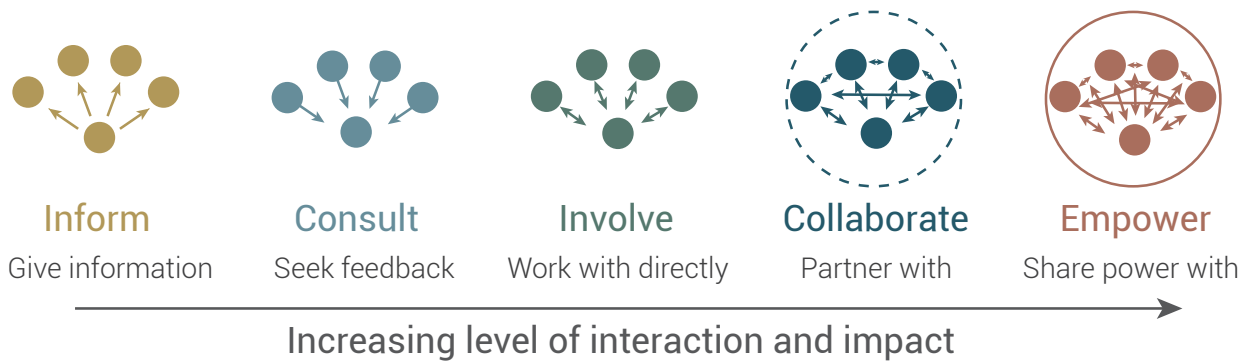
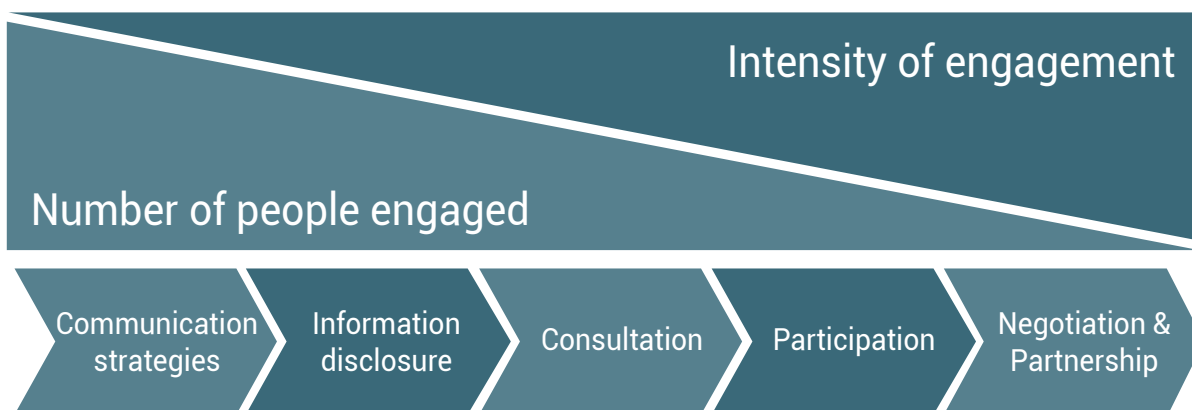
One implication of this gap is that if we want more evidence-based practice, we need more practice-based evidence.

– Green et al. (2009) pg.187

Recognition of this “usability gap” and coinciding calls for accountability and the need for scientific research on complex environmental problems to have societal relevance and saliency for practice, have led to increased

**A**

## ENGAGEMENT SPECTRUM

**B**

**FIGURE 3 A** A variation of the frequently used IAP2 engagement spectrum (IAP2 2014) (modified from CHIB 2000). **B** Stakeholder engagement spectrum from the IFC stakeholder engagement guide (IFC 2007).

acknowledgement of the importance of engaging with stakeholders throughout the research process (Kates et al. 2001, Bäckstrand 2003, Reed 2008, Lemos et al. 2012, Allen et al. 2013, Durham et al. 2014, Orr 2014). This growing conversation, which advocates transdisciplinary, multi-directional dialogue and participatory interaction to expand the potential for knowledge exchange with stakeholders (green arrows, Figure 4C), illustrates a paradigm shift in environmental research towards the right end of the stakeholder engagement spectrum (Figure 3) (Reed et al. 2008, Green et al. 2009, Lemos et al. 2012).

This shift, and corresponding efforts to strengthen the linkages between researchers and stakeholders in the knowledge production process, is reflected in the growing number of research programmes and practices which have explicitly adopted a co-produced or co-created approach to environmental science and resilience research worldwide (e.g., Steyart and Jiggins 2007, Regeer and Bunders 2009, Mauser et al. 2013, Nevens et al. 2013, Durham et al. 2014, Briley and Kalafatis 2015, Paschen and Beilin 2015, Scolobig and Pelling 2015). The RNC also openly aims to embrace an ethos of co-creation, where stakeholders are integrated throughout the research process to co-create solutions and outcomes (RNC 2014).

### Advantages and challenges of engaging with stakeholders

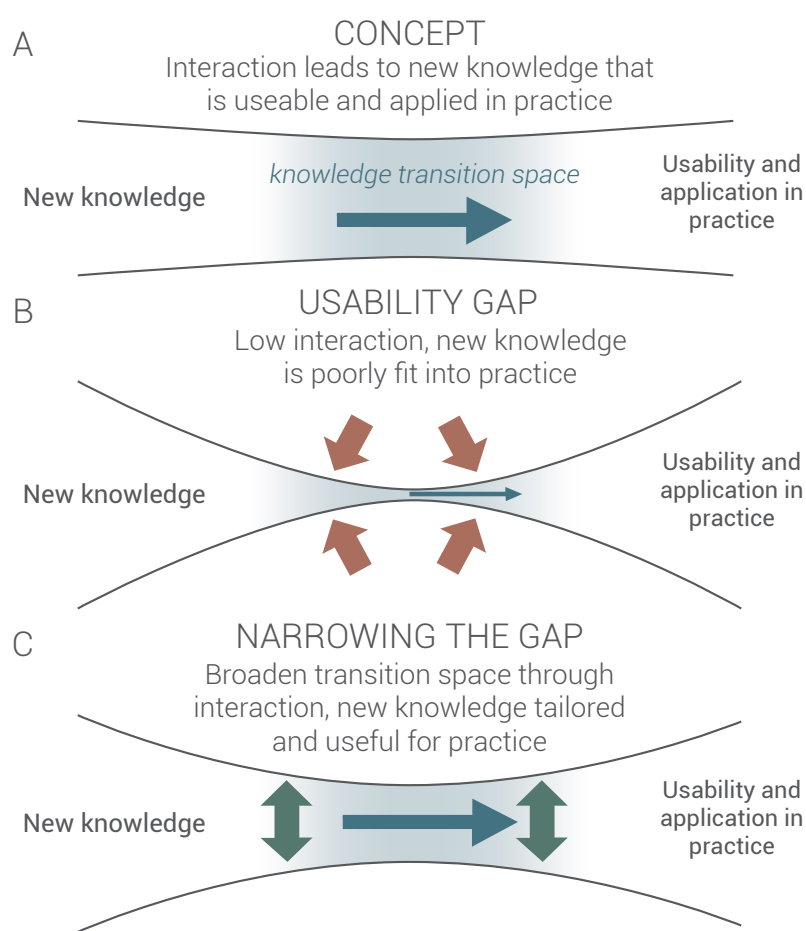
Stakeholder engagement introduces many advantages for increasing the impact and relevancy of environmental research. Engagement can lead to better innovation by drawing on experience, expertise, and tacit knowledge of people from a diverse range of backgrounds (Olden 2003, Kainer et al. 2009); promoting higher levels of trust

and fostering buy-in and support from stakeholders (Selin et al. 2000, Krick et al. 2006 Carney et al. 2009); opening pathways for informing policy and planning (Cronin et al. 2004, Orr 2014, Paschen et al. 2015); and developing a broader mutual understanding of issues (Blackstock et al. 2007, Steyaert and Jiggins 2007, Luyet et al. 2012, Davies et al. 2015).

Many typologies, or classifications, of stakeholder engagement and participation have been proposed, with each outlining a number of different reasons for engaging. Generally, the reasons, or advantages, which are emphasised by these typologies are reflective of either a normative or instrumental paradigm (Stoney and Winstanley 2001, Friedman and Miles 2006, Reed 2008, Parmar et al. 2010). Normative approaches regard stakeholder engagement as an “end in itself”, viewing the key advantage as promoting the fundamental moral values of equality, democracy, and justice (Donaldson and Preston 1995, Bishop 2000, Hendry 2001). That is, by giving a voice to the people who are affected by (or affect) the research, stakeholder engagement helps to fulfil an ethical responsibility to stakeholders by recognising and addressing multiple perspectives on an issue. More instrumental views regard stakeholder engagement as a “means to an end”, and highlight the pragmatic advantages, such as enhancing outcomes, achieving more relevant solutions, and facilitating the implementation of findings (Freeman 1984, Campell 1997, Beierle 2002). Instrumental perspectives emphasise the quality and durability of decisions made through stakeholder engagement.

These normative and instrumental advantages of stakeholder engagement and participation have been observed in the outcomes of a number of successful collaborative environmental research efforts (e.g., Beierle 2002, Cronin et al. 2004, Blackstock et al. 2007, Sultana and Abeyasekera 2007, Selin et al. 2000, Kainer et al. 2009, Orr 2014, Fulton et al. 2015). However, there remain many challenges associated with the stakeholder engagement and participation process, and a growing sense of “disillusionment” and criticism has resulted from occasions when these claimed benefits are not realised (Cooke 2001, Reed 2008, Tseng and Penning-Rowse 2012, Reed and Curzon 2015).

A broad definition of ‘stakeholder’ aims to be ethically inclusive of anyone impacted by the research. However, as everyone is impacted by their environment, this raises challenging philosophical and pragmatic questions in environmental research about who to engage with and how (Carney et al. 2009, Reed et al. 2009, Reed and



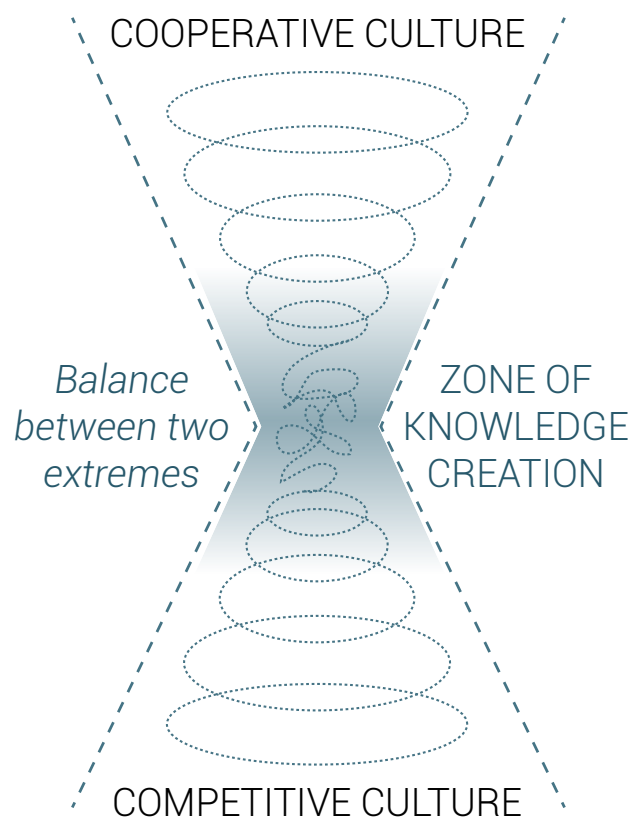
**FIGURE 4** **A** A conceptual model of research into practice, **B** the current “usability gap”, and **C** process for narrowing the “usability gap” through increased engagement between researchers and stakeholders and greater knowledge exchange. Modified from Lemos et al. (2012).

Curzon 2015). While many environmental stakeholders have interests in common, there are also discordant views, divisive ideologies, and disagreements among these stakeholders that can introduce conflict (Orr 2014). Stakeholder mapping and identification can help with the categorisation of this broad composite group of stakeholders and the prioritisation of engagement efforts, yet there is “a maddening variety” (Mitchell et al. 1997, pg. 853) of ways that this can be approached, and each has its own set of limitations.

Although many typologies and methods have been put forward in stakeholder theory, many of these approaches can be difficult, expensive, or ambiguous when applied to real world projects and problems (Jepsen and Eskerod 2009). Political and institutional constraints and power imbalances can also prove a barrier to effective engagement (Tseng and Penning-Rowsell 2012, Scolobig and Pelling 2015). If a stakeholder group has a low capacity to engage, based on factors such as limited time, resources, and interest, it can be difficult to facilitate meaningful participation (Collins et al. 2005, Jonsson 2005, Thaler and Levin-Keitel 2015). As stakeholders are increasingly asked to participate in engagement efforts, fatigue and disillusionment may develop if they do not perceive that they are gaining a reward or having an influence on outcomes (Reed 2008, Gramberger et al. 2015). In the context of decision-making, Gray et al. (2012) argue that by integrating diverse knowledge, participatory approaches increase the amount of complexity in a system, leading to a decrease in the ability to understand the system, reducing precision of decisions and outcomes.

Scholars have also highlighted certain ethical challenges which arise from engagement and participatory processes. The priorities and needs of local communities may not always align with the goals of scientific researchers, and it can be challenging to strike a balance between scientific research rigour and empowerment of the people who it intends to benefit (Chambers 1994, Beazley and Ennew 2006, Gaillard and Mercer 2013, Le De 2014). Potential for such dissonance emphasises the need to develop and consider stakeholder engagement strategies within the specific geographic, cultural, and topical context of each research project.

Despite these challenges, the potential advantages of stakeholder engagement – for improving the integration of science into practice, increasing the saliency of research, and involving and empowering people in research and decision-making – are generally perceived to outweigh these risks. Further, these challenges can help foster a productive dialectic, or balanced tension, between different perspectives regarding contentious and complex environmental issues. Critical discussion of alternative views, iterative deliberation, and acknowledgement of plural perspectives can help a project achieve a certain level of balance and robustness (Jashapara 2004, van de Kerkhof 2006). Jashapara (2003, 2004) explains that a dialectical presence of both cooperative and competitive cultures can nurture a productive knowledge creation environment (Figure 5), suggesting that traditionally competitive scientific research can successfully blend with a cooperative, collaborative project culture to co-create valuable new knowledge.



**FIGURE 5** Schematic illustrating the productive balance that can arise from a dialectic between cooperative and competitive organisational/project culture. Modified from Jashapara (2004).

# 3 Developing stakeholder engagement

The nature and shape of stakeholder engagement in practice has evolved over time (Krick et al. 2006, Partridge et al. 2006). Earliest efforts were characterised by ad-hoc engagement, driven by a response to external pressures and conflict resolution. This eventually led to recognition of the need to develop a more proactive approach, spurring the development of a second generation of engagement, which focused on parallel systematic approaches aimed at increasing understanding of stakeholder needs and improving saliency of outcomes. Today, in many cases, stakeholder engagement in practice aspires to be a sustainable, strategic, and collaborative process, embedded within the heart of projects and businesses, and focused on the exchange of knowledge and progress towards shared goals and values (Krick et al. 2006, Partridge et al. 2006).

Here, we focus on this third generation of stakeholder engagement, as embraced by the shift towards transdisciplinary, co-created approaches to knowledge exchange in modern environmental research and the RNC. In this chapter, we present a summary of reviews and methodological studies on best practice approaches to stakeholder engagement and knowledge exchange in environmental research from the academic literature. Chapter 4 then presents the results of surveys and focus groups with RNC stakeholders and researchers which aim to bring the concept into context for the RNC.

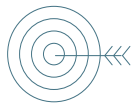
## Features of best practice

Reed's (2008) literature review of stakeholder engagement in environmental research provides a comprehensive overview of published work on the topic. As part of this review, Reed (2008) identified eight emergent features of best practice stakeholder engagement in this area (Table 2). These best practice principles have generally been well-received in the environmental research community, with over 1,000 citations in the past seven years (cited 1,001 times, Google Scholar, August 2015).

In general, the best practice guidelines (1 through 8) outlined by Reed (2008) emphasise the importance of: a culture of empowerment and co-creation that sits at the right end of the engagement spectrum (Figure 3) (1); early and iterative stakeholder engagement (2); organised stakeholder analysis (3); structured and agreed



upon objectives for engagement (4); appropriate engagement methods for the nature of the research or issue (5); skilled and experienced facilitators (6); transdisciplinary integration of multiple types of knowledge (7); and formal integration and embedding of stakeholder engagement processes into the project (8) (Table 2).



**TABLE 2** Features of best practice stakeholder engagement in environmental research. From Reed (2008)

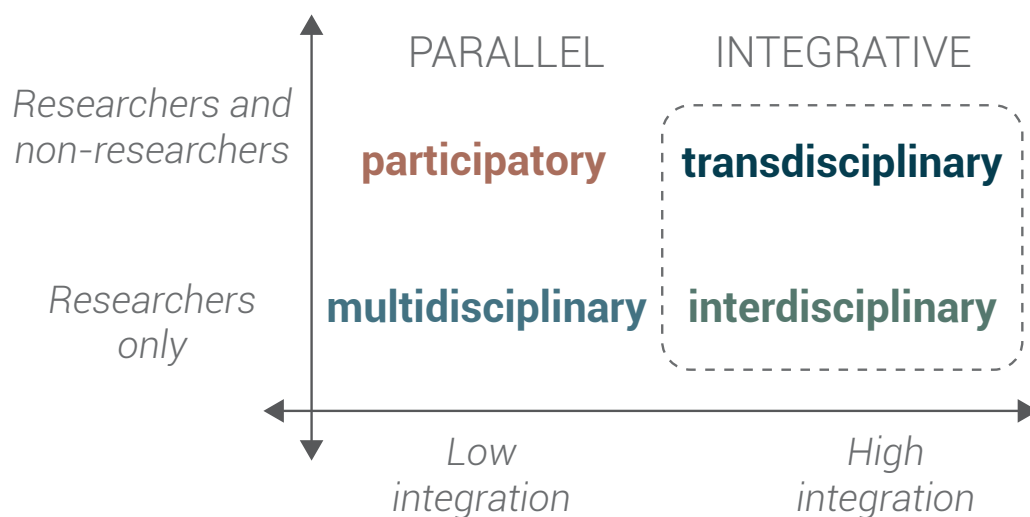
- 1 Stakeholder participation needs to be underpinned by a philosophy that emphasises empowerment, equity, trust, and learning
- 2 Where relevant, stakeholder participation should be considered as early as possible and throughout the process
- 3 Relevant stakeholders need to be analysed and represented systematically
- 4 Clear objectives for the participatory process need to be agreed among stakeholders at the outset
- 5 Methods should be selected and tailored to the decision-making context, considering the objectives, type of participants and appropriate level of engagement.
- 6 Highly skilled facilitation is essential
- 7 Local and scientific knowledge should be integrated
- 8 Participation needs to be institutionalised

Overall, these guidelines resonate with the collaborative approach proposed by the RNC (RNC 2014). The structure of the project explicitly aims to cultivate an ethos of transdisciplinarity and co-creation (1) through mandatory engagement with stakeholders (8), to engage with stakeholders early on at the first stages of the RNC to define the problem and research approach together (2, 3), to work towards shared goals (4), to integrate skilled social scientist research teams in the research process (5, 6), and to integrate diverse forms of knowledge, including indigenous world views (7).

While it is promising that the RNC goals and structure align with these best practice principles, a challenge remains in that there is little consensus on how large-scale transdisciplinary research programmes can effectively integrate stakeholders into research programmes to achieve these best practice aims, and few programmes have succeeded to reach these aims in their fullest sense (Kates 2001, Cash 2003, Carney et al. 2009, Mauser 2013). In the following sections, we present proposed frameworks for co-creation and transdisciplinary research programmes which have saliency and relevancy for the RNC project. Then, in Chapter 4, we outline results of original research which aims to help define and refine a context-relevant framework for the RNC.

## Conceptual frameworks for transdisciplinary research

Collaborative and integrative approaches to environmental research have been intensely discussed and proposed in the literature. However, the terminology used to communicate and conceptualise these ideas has been relatively inconsistent (e.g., participatory, multidisciplinary, interdisciplinary, transdisciplinary). Using an extensive review of the literature, Tress et al. (2004) presents a classification of these terms based on the degree of integration of stakeholders and researchers (Figure 6). Transdisciplinarity, based on this collective classification, is a research approach which involves high integration of both researchers and stakeholders from different backgrounds and disciplines in creating new knowledge and research on a common question. Mittelstrass (2011) and Mauser et al. (2013) emphasise that transdisciplinary work does not compromise the integrity or identity of the different disciplines involved, it merely overcomes the boundaries between them.



**FIGURE 6** Classification of research approaches based on degree of integration and stakeholder involvement. The RNC aims to be 'transdisciplinary'. Modified from Tress et al. (2004).

“Co-created” or “co-produced” knowledge is fostered through a transdisciplinary approach, in which research is developed collaboratively in the context of application, usability, and partnership (Regeer and Bunders 2009, Mauser et al. 2013, Nevens et al. 2013, Powell et al. 2013, Reed et al. 2014). Co-created research programmes aim to develop solutions through exchange of multiple and diverse types of knowledge. However, because large, united, transdisciplinary efforts in environmental research have only recently begun to emerge and develop, few well-defined and structured frameworks exist for guiding how research programmes can be successfully carried out in a co-created way.

Mauser et al. (2013) present one such framework (Figure 7) based on several years of planning for the Future Earth Project by members of the ‘Science and Technology Alliance for Global Sustainability’, which includes leading global organisations such as the ICSU (International Council for Science), ISSC (the International Social Science Council), UNESCO (United Nations Educational, Science and Cultural Organization), UNU (The United Nations University), UNEP (The United Nations Environment Programme), and the WMO (World Meteorological Organisation), among others.

Future Earth, similar to the RNC, is a 10-year initiative (2012 – 2022) which aims to take an innovative collaborative approach to finding solutions to complex environmental issues. The project, which focuses on global sustainability challenges, aims to integrate stakeholders, or ‘non-academics’ into research to achieve better, relevant, and long-lasting solutions for society. Based on the outcomes of many workshops and other activities undertaken by the Alliance over several years, Mauser et al. (2013) propose a conceptual framework for co-creating knowledge with project stakeholders through integration over three different dimensions of the research: co-designing the research plan, co-producing research, and co-disseminating the research results (Figure 7). Both researchers and stakeholders work together in each dimension, and the cycle is iterative and repeating.

At the first stage of the process, co-design, stakeholders and researchers work together to jointly identify issues and then develop this into a set of valid research questions together. After research questions are defined, they are then worked into the shape of manageable research projects with an agreed upon agenda and set of goals, after which, proposals, funding, and structures can be sought. The next step, co-production of

research and knowledge, focuses primarily on an integration between researchers of different disciplines and expertise, supported by continuous exchange between this integrated group of researchers with the project stakeholders. This allows for high-quality research to be developed consistently within and among the different disciplines, while also maintaining engagement through dialogue which ensures that the work stays relevant and on-track with the needs of the stakeholders.

The last step, co-dissemination, requires all actors to translate new knowledge into their respective communities, and to share it across their networks in a usable way. Through this dissemination, discussion of results can inspire new research questions, and the cycle can begin again (Mauser et al. 2013).

Gramberger et al. (2015) also saw a need to fill a gap in this area, and proposed a conceptual framework for integrating stakeholders in complex environmental research programmes based on the experiences of the CLIMSAVE project. CLIMSAVE (Climate Change Integrated Methodology for Cross-Sectoral Adaptation and Vulnerability in Europe) was a four-year (2010 – 2013) research project funded by the European Commission which aimed to take an integrative approach to assess climate change impacts, adaptation, and vulnerability across multiple sectors (Harrison 2013). The STIR (Stakeholder Integrated Research) framework proposed by Gramberger et al. (2015) (Figure 8), is not structured as a cycle or process like that of Mauser et al. (2013), but is a descriptive framework, which outlines essential fundamental conditions that need to be present throughout, an overarching principle which should guide the approach, and 'core elements' which need to be included.

The fundamental conditions include stakeholder evaluation and feedback on any engagement that is carried out, and having engagement be compatible with the scientific set-up of the research project (e.g., if the research aims to look at local and regional scales – scientific case studies and engagement needs to happen at these two scales). The overarching principle is participatory integration of stakeholders throughout the process, meaning that stakeholders are intrinsic to the process, rather than adjunct. This principle is realised through an iterative dialogue and the process of co-creating knowledge. Gramberger et al. (2015) describe the co-creation

process as an exchange, where scientists are committed to research and generation of results, and "stakeholders themselves" provide input and direct focus.

Conceptualised approaches and documented methods for stakeholder engagement in these [co-creation] processes are missing.

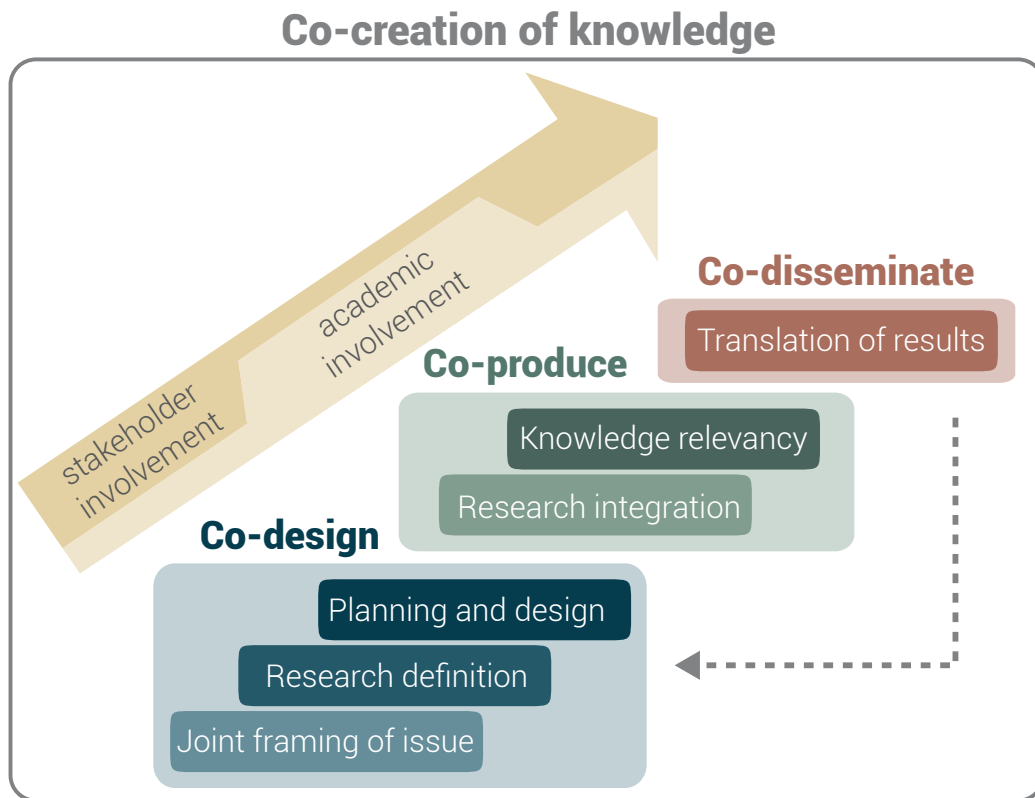
– Gramberger et al. (2015), pg. 202

setting a specific "quota" of how many stakeholders from each group should be engaged with or participate, and identifying suitable "individuals" for filling that quota (Gramberger et al. 2015). For design and facilitation, they emphasise the importance of having professional, well-planned, and thought-out engagement (workshop methods were used in CLIMSAVE). For translation of stakeholder knowledge, adoption of a specific method

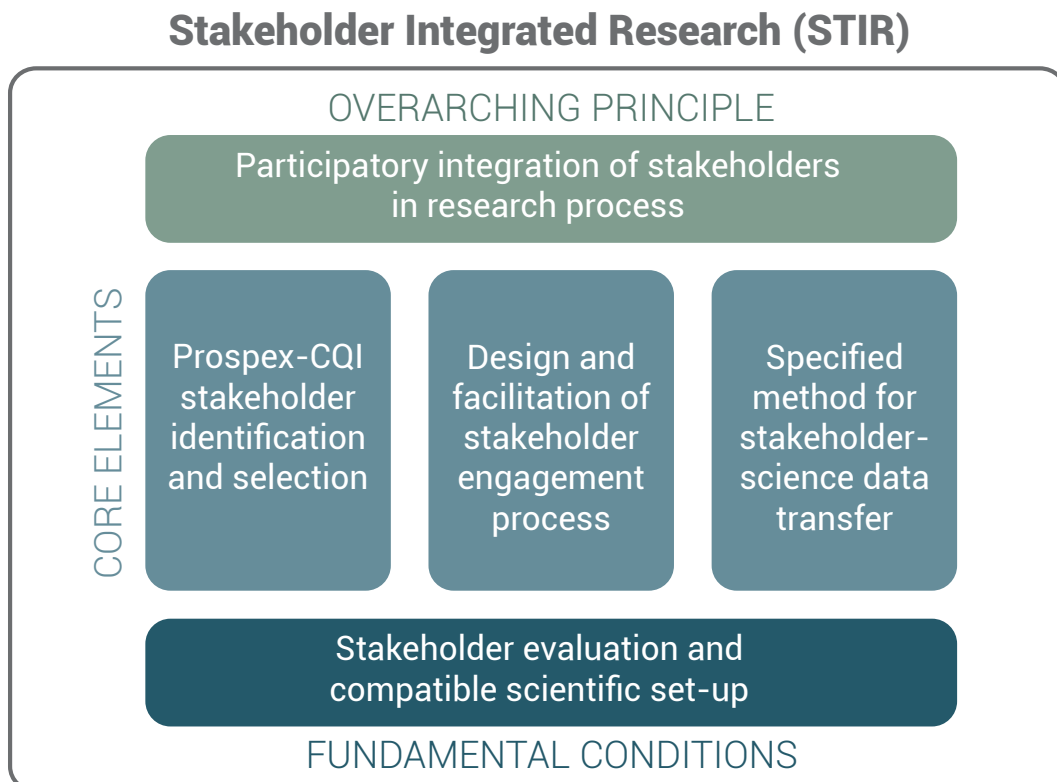
No definitive blueprint exists yet for this dimension of integration; it comprises new forms of learning and problem solving action of different parts of society and academia that have not traditionally been in close contact.

– Mauser et al. (2013), pg. 427

The three core elements comprise stakeholder identification and selection, design and facilitation of stakeholder engagement, and translation of stakeholder "data" into formats that can be applied in scientific research. They propose an instrumental "Prospex CQI" method for stakeholder identification, which is based on identifying the "criteria" and categories of stakeholders,



**FIGURE 7** 'Co-creation of knowledge' framework for the large trans-disciplinary research project Future Earth, based on a process of co-design, co-production, and co-dissemination with stakeholders and researchers. Modified from Mauser et al. (2013).

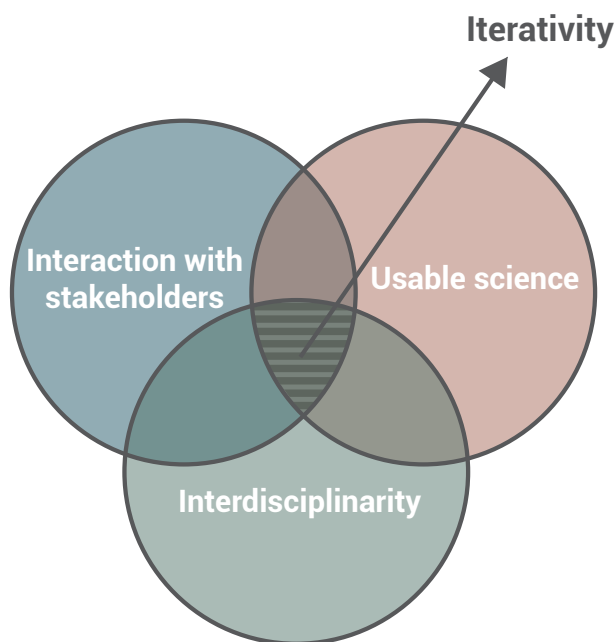


**FIGURE 8** STIR (Stakeholder Integrated Research) framework used in the CLIMSAVE project, with fundamental conditions, overarching principles, and three core elements. CQI = Criteria, Quota, Individuals. Modified from Gramberger et al. (2015).

is advocated for converting qualitative input from stakeholders into quantifiable data for research (for use in modelling in the CLIMSAVE context).

Both the Future Earth and CLIMSAVE frameworks aim to provide guidance for how to integrate stakeholders into environmental research within a co-creation paradigm. Mauser et al. (2013) propose an iterative generalised process, which hinges on continual stakeholder involvement at each stage of the research development. Gramberger et al. (2015) propose a more specific framework which describes the actions and roles which characterise this type of approach. The Mauser et al. (2013) framework derived for Future Earth has wide applicability and can help guide consideration and critical thinking about the many dimensions of stakeholder engagement that should occur over time. However, the forward-looking framework (i.e., it has not yet been tested because the project only started recently) lacks an evaluation aspect by which the process can be self-corrected or improved in practice. The Gramberger et al. (2015) framework retrospectively describes the CLIMSAVE experience. In this regard, it recognises the value gained from the evaluation and feedback process. However, its focus is narrower in other aspects. For example, in the translation of “data” as a core element, they focus primarily on the importance of quantifying the knowledge of stakeholders for modelling purposes, and do not discuss translation of research outputs into relevant formats and context for practice.

Within both frameworks, the integration of stakeholders and scientists can be described as intermingled, with both groups working together closely, but within distinct roles rather than blended ones (e.g., see divided arrow in Figure 7). This provides a pragmatic advantage to developing co-creation approaches in practice. Another pragmatic concept posed by scholars is the use of “boundary organisations” for stakeholder engagement (Cash et al. 2003, Lemos and Morehouse 2005, Hage et al. 2010, Lemos et al. 2012, Briley et al. 2015). Lemos and Morehouse (2005) put forth a conceptual model for co-producing usable science, which proposes that iterative integrative approaches, where engagement is sustained and adapted over time, can help overcome boundaries between researchers and stakeholders, and see joint objectives evolve to a more meaningful “fusion of interests”



**FIGURE 9** Model for “co-production of science and policy through integrated science”. Modified from Lemos and Morehouse (2005).

(Figure 9). The model is based on five years of experiences with the CLIMAS (Climate Assessment for the Southwest) project, a NOAA (National Oceanic and Atmospheric Administration) RISA (Regional Integrated Science Assessment) project focused on transdisciplinary research on climate systems and their impact on human and natural systems. They propose that a strong boundary relationship, built through repeated interaction, interdisciplinarity, and usable science, can actually change people’s perspectives of the project to make the science more credible, salient, and legitimate in practice.

Lemos and Morehouse (2005) explain that boundary relationships between scientists and stakeholders take time, trust, and continuous interaction in order to develop. However, they find that this investment leads to more effective

outcomes in practice and policy. Lemos et al. (2012) echo the importance of boundary relationships, and propose that “boundary organisations” can be a productive and safe environment for fostering this important linkage between knowledge and action. Boundary organisations are groups which have three key features: 1) they involve specialised roles for managing the boundary of science and practice, 2) they have clear lines of responsibility and accountability to distinct social areas on each side of the boundary, and 3) they provide a forum in which information can be co-created by actors from different sides of the boundary (Lemos et al. 2012).

In the context of climate research in the United States, Lemos et al. (2012) give the example of PEAC (Pacific ENSO Applications Climate Center) as a boundary organisation which brings together researchers and stakeholders from NOAA, the National Weather Service, university scientists, managers of water, emergency services, agriculture, and private firms. PEAC actively coordinates communication, translation, and mediation among these groups. Hage et al. (2010) explain the role of the Netherlands Environmental Assessment Agency (PBL) as a boundary organisation which serves primarily a networking function, connecting researchers and stakeholders and acting as a “knowledge broker”. Briley et al. (2015) document the success of the boundary organisation GLISA (Great Lakes Integrated Sciences and Assessments program), which helped overcome boundaries and barriers to knowledge exchange between climate researchers and stakeholders in the Great Lakes area of the United States.

Beaven et al. (2015) note the important role of the NHRP (Natural Hazards Research Platform) as a boundary organisation for coordinating research efforts before, during, and after the 2010 – 2011 Christchurch Earthquake Sequence in New Zealand. The NHRP, launched in 2009, was designed as a framework to integrate and catalyse networks among organisations, disciplines, and agencies active in or associated with the natural hazard and risk research arena in New Zealand (Beaven et al. 2015). Following the Christchurch Earthquake Sequence, the NHRP played an essential role in coordinating the research activity carried out by different groups and facilitating communication through the wider collective network.

## Stakeholder analysis

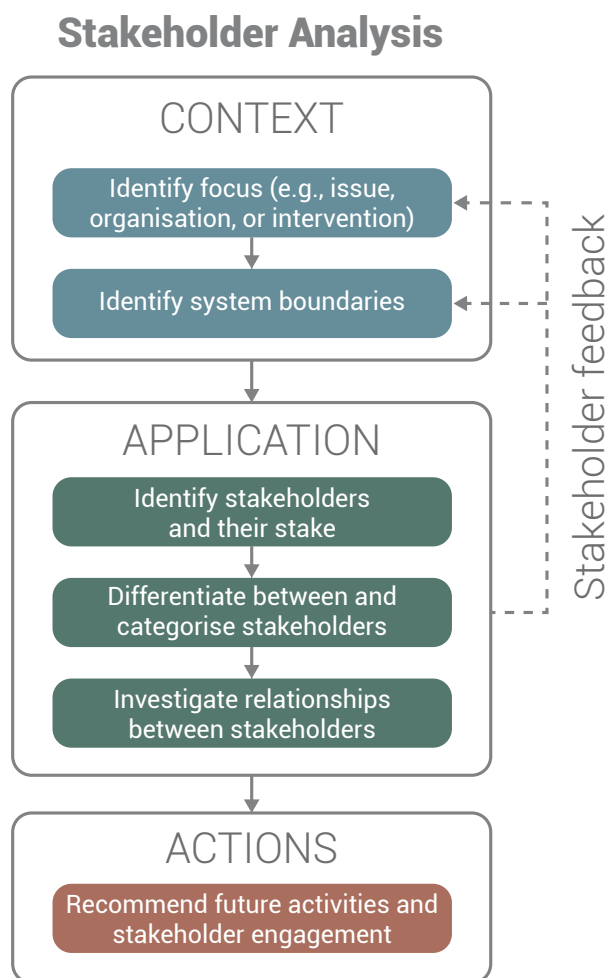
Key to all conceptual frameworks, models, and boundary structures is the identification and classification of the stakeholders who should be involved in the co-creation and knowledge exchange process. Understanding *who* the stakeholders are is an essential first step to being able to collaboratively define the research question *with* stakeholders (Bryson 2003).

A wide variety of methods exist for identifying, classifying, and investigating the relationships between stakeholders, and these vary greatly in scope and scale (Grimble and Wellard 1997, Bryson 2004, Reed 2008, Reed et al. 2009, Stanghellini 2010). The method of analysis chosen for use will depend highly on the project context, project phase, and available resources (Carney et al. 2009, Reed et al. 2009, Luyet et al. 2012). For these reasons, we do not prescribe or propose a method herein, but instead provide a brief summary of these methods and review some of the most common approaches. A number of resources and reviews exist on the topic (e.g., Grimble and Wellard 1997, Mitchell et al. 1997, Bryson 2003, Reed et al. 2009, Stanghellini 2010), and we refer the reader to these works for a fuller discussion on stakeholder analysis approaches.

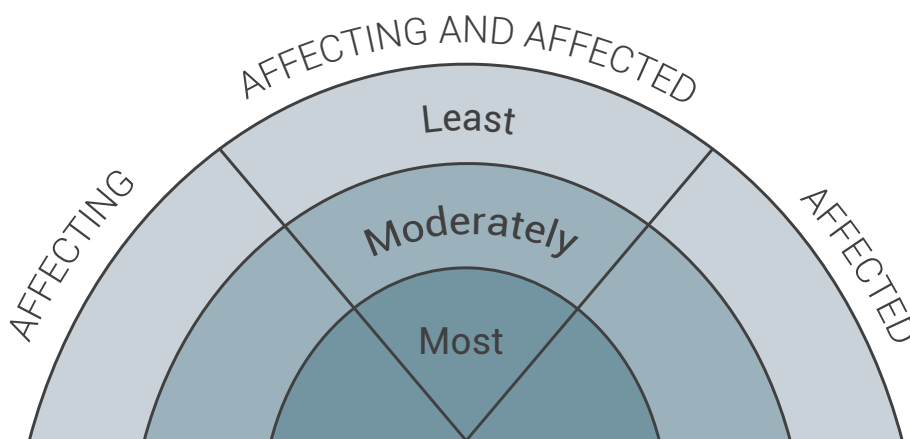
Grimble and Wellard (1997) define stakeholder analysis as “a holistic approach or procedure for gaining an understanding of a system, and assessing the impact of changes to that system, by means of identifying the key actors or stakeholders and assessing their respective interests in the system” (p. 175). This definition highlights the fundamental role of stakeholder analysis in setting the overall context and outlook for a project,

as well as the multiple dimensions and stages of the analysis process. Reed et al. (2009) present a comprehensive review of stakeholder analysis in environmental research. They summarise their findings in a schematic, which illustrates six recommended methodological steps for performing a systematic stakeholder analysis (Figure 10). The first two steps involves setting the context by defining the scope and focus of the project and its boundaries. The next three steps comprise identifying, categorising, and exploring the relationships between stakeholders through application of a number of existing methodologies (summarised in Table 3).

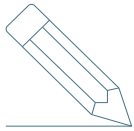
Matrices are the most basic, simplified, and common method used to identify and classify stakeholders. Figure 11 shows a rainbow matrix proposed by Spakota et al. (2008) which can be used to identify stakeholders based on the degree to which they can affect or be affected by the project. They found it was a successful method for identifying the stakeholders of the non-governmental organisation (NGO) Practical Action (PA), which carries out disaster relief and risk reduction work in Nepal. Figure 12 shows an interest-influence matrix, proposed by Gimble and Wellard (1997) for identifying and classifying stakeholders. The matrix, based on ODA (1995), categorises stakeholders according to their relative importance or interest in the project and their power to influence the project. Eden and Ackerman (1998) present a similar and widely-cited version of this matrix, which classes these four groups (A – D) into “subjects”, “players”, “context-setters”, and the “crowd”. (Figure 12). Mitchell et al. (1997) presents yet another matrix classification, in which stakeholders may fall into



**FIGURE 10** A schematic showing the six recommended steps of stakeholder analysis in environmental research. Modified from Reed et al. (2009).



**FIGURE 11** Rainbow diagram for identifying and mapping stakeholders. Modified from Spakota et al. (2008).

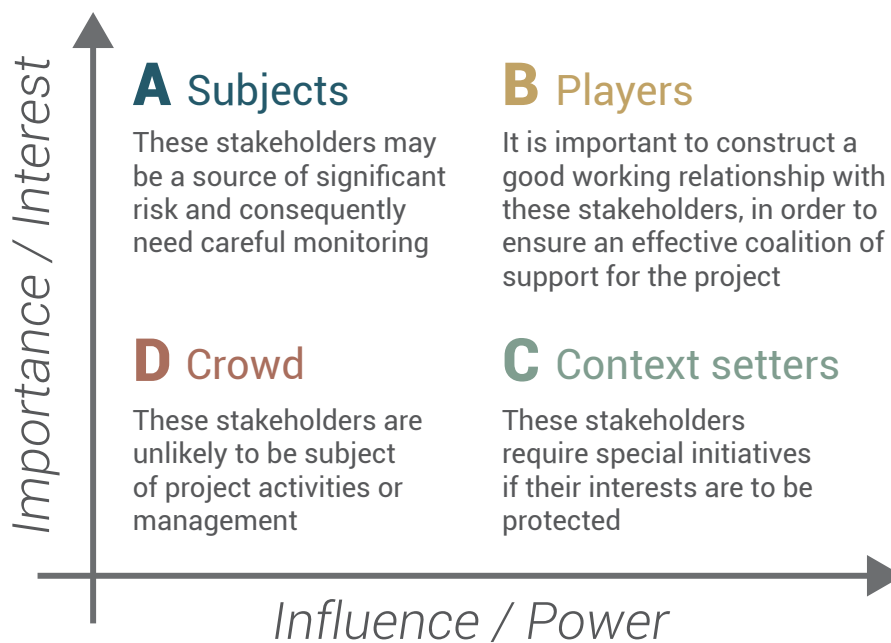


**TABLE 3** Methods for stakeholder analysis. Modified from Reed et al. (2009).

Method	Description	Strengths	Weaknesses
Focus groups	A small group brainstorms stakeholders, their interests, influence, and other attributes, and categorise them	Rapid and cost-effective; adaptable; possible reach consensus on categories; good for complex issues which require discussion	Less structured so requires good facilitation for good results
Semi-structured interviews	Interviews with a cross-section of stakeholders to check/supplement focus group data	Useful for in-depth insights into stakeholder relationships and to triangulate data collected in focus groups	Time-consuming and costly; difficult to reach consensus over stakeholder categories
Snow-ball sampling	Individuals from initial stakeholder categories are interviewed to identify new categories and contacts	Easy to secure interviews	Sample may be biased by the social network of the first individual in the snow-ball sample
Interest-influence matrix	Stakeholders are placed on a matrix according to their relative interest and influence	Possible to prioritise stakeholders for inclusion; makes power dynamics explicit	Prioritisation may marginalise certain groups; assumes relevancy of categories based on interest and influence
Stakeholder-led categorisation	Stakeholders themselves categorise stakeholders into categories they create	Stakeholder categories are based on perceptions of stakeholders	Different stakeholders may be placed in different categories by different people
Q methodology	Stakeholders sort statements drawn from a discourse according to how much they agree with them, analysis allows social discourses to be identified	Different social discourses surrounding an issue can be identified and individuals can be categorised according to their 'fit' within these	Does not identify all possible discourses, only the ones exhibited by the interviewed stakeholders
Actor-linkage matrix	Stakeholders are tabulated in a two-dimensional matrix and their relationships described using codes	Relatively easy, requiring few resources	Can become confusing and difficult to use if many linkages are described
Social Network Analysis (SNA)	Used to identify the network of stakeholders and measuring relational ties between stakeholders through use of structured interview/questionnaire	Gain insight into the boundary and structure of stakeholder network; identifies influential and peripheral stakeholders	Time-consuming; questionnaire is a bit tedious for respondents; need specialist in the method
Knowledge mapping	Used in conjunction with SNA; involves semi-structured interviews to identify interactions and knowledges	Identifies stakeholders that would work well together as well as those with power balances	Knowledge needs may still not be met due to differences in the types of knowledge held and needed by different stakeholders.
Radical transactiveness	Snow-ball sampling to identify fringe stakeholders; development of strategies to address their concerns	Identifies stakeholders and issues that might otherwise be missed and minimizes risks to future of project	Time-consuming and hence costly

*For a more in-depth review of these methods and to read more about how to conduct them, the reader is referred to Reed et al. (2009) and references therein.*



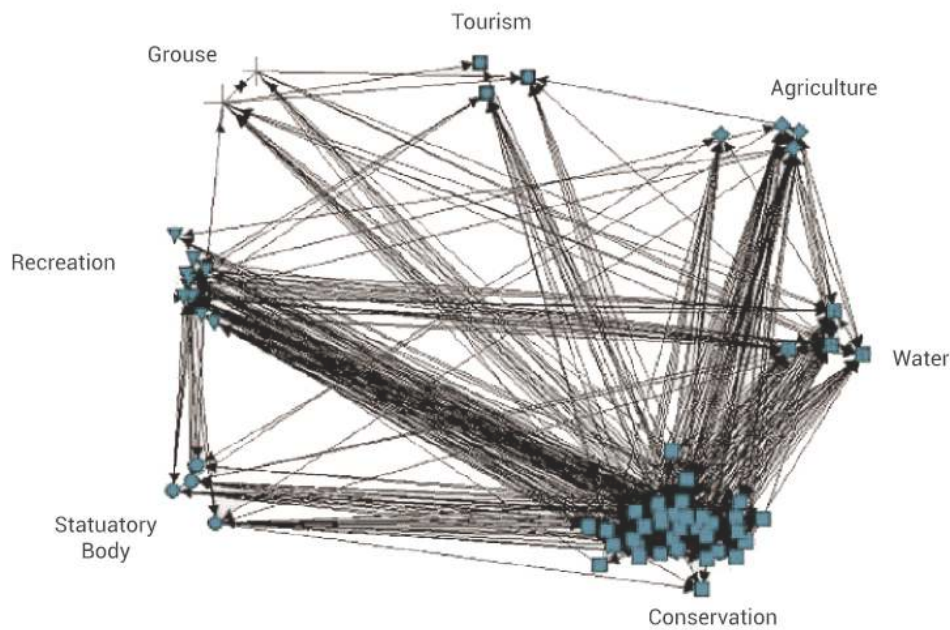


**FIGURE 12** An influence-interest matrix for classifying stakeholders based on influence and importance (Group A – D). Modified from Stangellini (2010), based on Grimble and Wellard (1997) and Eden and Ackerman (1998).

“latent”, “expectant” or “definitive” groups. These categories are based on ranking of stakeholder legitimacy and urgency in addition to their interest and influence. Stangellini (2010) argues that proximity is also an important attribute to consider in stakeholder analysis in environmental issues (e.g., for a water-catchment project, the community within that catchment would rank higher than a community further away).

While these analytical matrix approaches are popular for their simplicity, they are often conducted in a top-down way, in that the researchers perform the analysis about the stakeholders, with little to no interaction with the stakeholders. This can lead to exclusion or under-representation of some groups, particularly those who are marginalised, isolated, or who have little power (MacArthur 1997, Hart and Sharma 2004, Reed et al. 2009). Reconstructive approaches aim to conduct stakeholder analyses from a more bottom-up approach, in which the stakeholders drive the ranking and categorisation efforts rather than the researchers (e.g., Q-method, Barry and Proops 1999; card-sorting, Hare and Pahl-Wostl 2002). While these methods aim to reduce bias and exclusion, there is a risk that the stakeholders participating in the analysis may not be representative, and that they may prioritise their individual concerns, which could bias or divert the focus of the project (Reed et al. 2009).

After the identification and categorisation of stakeholders, Reed et al. (2009) recommend investigation of interrelationships among stakeholders, in order to better understand the social learning landscape and spread of information. Actor-linkage matrices are one method for assessing these relationships, in which stakeholders are listed in intersecting columns and rows to form a grid. The relationships between the two stakeholder categories are then described in each cell of the grid using key words such as “conflict”, “complementary”, or “cooperation” (ODA 1995, Biggs and Matsuert 1999). Social Network Analysis (SNA) is a related method, in which the interrelationships are instead described as a “tie”. The tie can be present (there is a relationship) or absent (there is no relationship), and the tie can have varying degrees of strength (a stronger tie represents a stronger relationship). SNA can give insight into the nature of the flow of knowledge in the stakeholder network, and can be useful for recognising optimal pathways, critical gaps, key persons, or conflicts. Recent work suggests that SNA can be a valuable method for assessing and improving networks in environmental



**FIGURE 13** Social network analysis (SNA) for 60 members of a boundary organisation related to a national park in the UK. Modified from Prell et al. (2008).

research programmes (Tompkins and Adger 2004, Newman and Dale 2005, Crona and Bodin 2006, Prell et al. 2008, 2009).

For example, in order to investigate how information was spreading within and outwards from a boundary organisation called Moors for the Future (MFF) to its wider network of Peak District National Park (PDNP) stakeholders in England, Prell et al. (2008) asked all 60 MFF members how often they communicated with the other individual MFF members. Their categorised results, shown in Figure 13, show that there is an uneven representation of stakeholders in the boundary organisation, and that the category with the most representatives is conservation. The conservation stakeholders also have a high centrality (or number of ties). This analysis helped Prell et al. (2008) identify well-connected individuals with high influence, as well as key gaps between stakeholders in order to inform future stakeholder participation in MFF and PDNP initiatives.

Reed et al. (2009) note that in some cases, where the researchers have a thorough knowledge of the local phenomenon and its network, it may not be necessary to take a participatory or reconstructive approach to stakeholder analysis. However, they do emphasise that regardless of the analytical or reconstructive approach taken, the results of a stakeholder analysis should be shared with stakeholders for feedback before moving towards the last step where engagement is put into action (Figure 10). Over the course of the long-term collaborative development of the RNC proposal, a vast array of RNC stakeholders have already been identified (RNC 2014). These are summarised in Table 4. A natural next step would include performing a more systematic stakeholder analysis within the context of the different projects which make up the RNC (i.e., Resilient Rural Backbone, Resilient Cities, Living at the Edge, and Vision Mātauranga) using these different steps.

## Engagement methods and examples

A wide range of methods exist for engaging with stakeholders in research projects. Techniques which sit at the left end of the engagement spectrum (Figure 3) tend to be characterised by a one-way flow of information from researchers to stakeholders, such as newsletters, publications, research papers, and fact sheets. More integrative methods aiming to consult, involve, or collaborate with stakeholders include workshops, focus groups, surveys, polling, and public meetings. These types of engagement create a two-way dialogue, which



**TABLE 4** RNC stakeholders identified in the RNC proposal (RNC 2014)

**Government Organisations**

Councils (local, district, regional)  
 Departments (e.g., DoC, DPMC)  
 Ministries (e.g., MBIE, MCDEM, MFE, MPI)  
 Policy makers and elected officials

**Businesses**

Corporations  
 Land-based industries  
 Local and international businesses  
 Insurers  
 Trade organisations

**Academic/Research community**

Crown Research Institutes (e.g., GNS Science, NIWA)  
 Schools  
 Tertiary institutes / universities

**Tangata whenua**

Whānau, hapū, iwi  
 Māori trusts and organisations

**Engineering, infrastructure, and planning**

Designers  
 Engineers  
 Planners  
 Infrastructure and lifeline providers

**Communities**

International communities  
 Local communities (urban and rural)  
 Marginalised communities (e.g., new migrants, refugees)

**RNC partnering organisations**

(e.g., Deep South NSC, NHRP)

gives stakeholders a way to voice their concerns, needs, aspirations, feedback, and opinion. More empowering methods of engagement enable a two-way dialogue, but also transfer decision-making power to stakeholders, through methods such as advisory committees, steering groups, citizen juries, and participatory decision-making (IAP2 2014) (Figure 3). A combination of stakeholder engagement methods are likely to be used in any one project, as different audiences and stages of the project will be characterised by different needs.

A number of comprehensive resources, which provide summaries, advice, and guidelines for choosing and conducting these different engagement methods, are available. For example, Durham et al. (2014), Queensland Government (2011), Partridge et al. (2006) and Krick et al. (2006) provide detailed summaries of different stakeholder engagement techniques and provide templates and checklists to assist in carrying out different methods. More information about these resources, including where they can be found, is outlined in the **Recommended Resources** section of this report (pg. 51).

Many different stakeholder engagement methods have been, and are currently being, carried out in research projects in New Zealand. This culture of researcher-stakeholder collaboration can be recognised in integrated responses to recent natural hazard crises in New Zealand, such as the Canterbury Earthquake Sequence in 2010-2011 (Johnston et al. 2012, Beaven et al. 2015, Kenney and Phibbs 2015) and the Tongariro eruption in 2012 (Leonard et al. 2014). Here, we outline just a few examples of transdisciplinary work and stakeholder engagement activity in New Zealand to inspire creative thinking about different ways to engage with stakeholders in RNC research. Each unique project within the RNC will require special consideration and planning, based on the project scope and identified stakeholders.

The *DEVORA* programme (Determining Volcanic Risk in Auckland) is a long-term transdisciplinary research project aimed at understanding the hazard and risks associated with a volcanic eruption in Auckland, New Zealand's largest and most populated city (Deligne et al. 2015). Auckland sits atop the potentially active Auckland Volcanic Field (AVF), which has experienced more than 55 eruptions in the past 250,000 years, including an eruption as recently as 550 years ago. Since its launch in 2008, *DEVORA* research has greatly expanded our understanding of the volcanic hazards, risks, and potential societal impacts associated with an AVF eruption (Deligne et al. 2015). *DEVORA* actively engages with stakeholders to design research trajectories, discuss implications of results, and inform local communities. Members of a steering committee, comprised of key government and organisational stakeholders, share deliberative decision-making power regarding future research needs and directions. Ongoing outreach, media, and public engagement efforts are coordinated and

encouraged, and consistent messaging across the research team is promoted by a central communications plan (Smid and Lindsay 2015). These collaborative efforts have fostered a fruitful and long-term relationship with the local governing body, the Auckland Council. *DEVORA* research directly informs Council planning (e.g., volcanic eruption contingency plans) and new learning and research opportunities are fostered through the Council (e.g., table-top student exercises at the local emergency management emergency coordination centre) (Deligne et al. 2015). Earthquake hazard and risk in Wellington is the focus of a similar transdisciplinary project entitled *It's Our Fault* (Van Dissen et al. 2010).

The *Wellington Blue Lines project* (WREMO 2015) and the *Alpine Fault Talk Tour* (GNS Science 2015) are also examples of successful stakeholder engagement in natural hazard and risk research in New Zealand. New Zealand's capital city, Wellington, lies on a large active fault system, which could generate a catastrophic tsunami. In 2010, the Wellington City Council's Emergency Management group teamed up with the national scientific research institute GNS Science to facilitate a community-driven public education campaign aimed at raising tsunami awareness (WREMO 2015). The award-winning project involved partnering with local communities to paint blue lines on the street which indicate maximum possible tsunami wave run-up heights, and illustrated an innovative way to empower at-risk communities to use and apply the results of natural hazard research.

The *Alpine Fault project* (GNS Science 2015) was a geological study focused on improving estimates of frequency and forecasting of large earthquakes on New Zealand's largest fault, the Alpine Fault in the South Island. The research discovered that large, surface-rupturing earthquakes tend to occur on the Alpine Fault at relatively regular intervals of about 310 years (GNS Science 2015). Such an event could have devastating impacts for communities in areas such as Hokitika, Franz Josef, and Christchurch. Following these findings, the project supported an *Alpine Fault Talk Tour* in which scientists visited potentially affected communities to discuss the implications of the research and answer questions from the community.

The *TANK group* (acronym for the Tūtaekuri, Ahuriri, Ngaruroro, and Karamu river catchments) in Hawke's Bay also stands as a positive example of stakeholder engagement in environmental research in New Zealand. The *TANK group* comprises approximately 30 individuals who strategically represent agricultural sectors, environmental interest groups, community groups, tangata whenua, and other stakeholders who are affected by research and decision-making regarding these water catchments (Cradock-Henry 2013, Cradock-Henry et al. 2013). Since 2012, the *TANK group* has actively collaborated with the Hawke's Bay Regional Council and Landcare Research to make shared decisions regarding freshwater management, such as setting water quality and quantity limits. *TANK* participants help evaluate and give feedback on the process through longitudinal surveys (Cradock-Henry 2013). The *TANK group* illustrates a structured way to empower and partner with many diverse stakeholders concerning important environmental issues.

The *Watershed Talk* programme was part of a 10-year transdisciplinary research project focused on developing integrative and participatory approaches to management of the Motueka water catchment in the South Island of New Zealand. *Watershed Talk* was an action-based platform for social learning which implemented creative ways of bringing together researchers and diverse groups of stakeholders to raise dialogue about care and responsibility for the catchment (Kilvington et al. 2011b).

Stakeholder engagement in scientific research outside of the realm of environmental issues can also provide relevant lessons and examples for the RNC. For example, the *Bioethics Council - toi te taiao* engaged extensively with stakeholders and local communities to better understand contentious cultural, ethical, and spiritual aspects of biotechnology research (Bioethics Council 2005). All of these projects illustrate different degrees, approaches, and purposes of stakeholder engagement. We emphasise that regardless of the method or approach adopted in various projects in the RNC, thoughtful and thorough planning is essential.

# 4 Stakeholder engagement and co-creation in the RNC

## Co-creation in the RNC

The theme of “co-creation” features strongly in the principles, vision, aspirations, pathway, and structure of the RNC project (RNC 2014, pg. 3 – 5). The four research themes which make up the core of the RNC resilience pipeline (Figure 1) are designed as “co-creation laboratories”. This central focus on co-creation aligns with the ongoing paradigm shift in environmental research worldwide (e.g., Future Earth, Mauser et al. 2013, Chapter 3). Following the contention that an inclusive, open, transdisciplinary approach to research can lead to more fitting, usable, and enduring solutions to complex challenges in coupled human-natural systems, adopting an ethos of co-creation could help the RNC better achieve its goal of a more resilient New Zealand. However, a key challenge to this emergent approach is that it remains relatively untested and poorly-defined in theory and research practice (Bundlers and Regeer 2009, Lemos et al. 2012, Mauser et al. 2013, Gramberger et al. 2015). One reason for this, is that the geography, social setting, political context, and scientific nature of a specific research project will greatly influence and shape the evolution of its co-creation process.

To bring relevancy to the concept of co-creation for the RNC, we conducted a survey of RNC stakeholders and researchers in order to better understand how a “co-created approach” fits within the context of natural hazard and risk research in New Zealand. The goal of this research was to enable RNC stakeholders and researchers to 1) share their visions about what they think a “co-created” approach should look like, what features should characterise it, and what advantages and challenges it might hold; and 2) voice their views on adopting and participating in such an approach. The aim was to use this information to build on existing frameworks and develop a meaningful and context-relevant conceptual framework for a co-creation approach to RNC research that is rooted in the views, values, and expectations of the people affecting, or affected by the research. We propose that the resulting framework can be used to help responsibly frame and guide RNC research in a shared, grounded, and relevant way.

The anonymous survey consisted primarily of open-ended questions, to encourage participants to express their views in an unconstrained and safe environment. To complement this work, and to develop a two-way

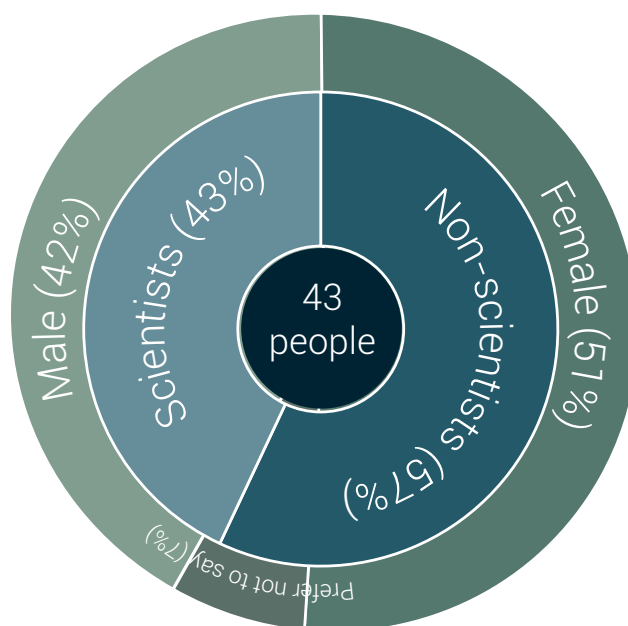
dialogue about stakeholder perspectives on engagement and co-creation, we also held two small focus groups with stakeholders in the South Island (Christchurch) and the North Island (Auckland) of New Zealand. At least 30 scoping discussions with physical and social science researchers and stakeholders across New Zealand took place before conducting this research in order to guide development of the questions. The methods, results, and findings of the survey and focus groups are summarised in the following sections. In Chapter 5, we then present a synthesis of these findings and the existing literature outlined in Chapter 3 in the form of a RNC co-creation framework.

## Online survey

The online survey consisted of 10 questions. The first pages of the survey briefly introduced the concept of co-creation and the RNC project, and then explained that the purpose of the survey was for participants to “help us get a better understanding of what knowledge “co-creation” in science should look like and how it might actually be achieved.” Five of the questions were open-ended questions which aimed to encourage participants to think critically about what they think a co-creation approach to natural hazard and risk research would look like in New Zealand. Participants were encouraged to think about what co-creation is (Q1), what defining features make it different from traditional approaches (Q2), what might incline them to participate and engage in such an approach (Q3), what challenges might arise (Q4), and whether or not the language or terminology used in such an approach was important (Q5). The remaining questions centred on demographic information, a space to provide additional thoughts, and a multiple choice question asking participants to rank how much they agreed or disagreed with the notion of working towards a co-creation approach in natural hazard and risk research (10-point Likert scale).

After the online survey was approved by the University of Auckland Human Participant Ethics Committee, a snowball sampling methodology was used to recruit participants. E-mail invitations with a link to the survey were distributed to all of the RNC Priority Co-creation Laboratory and Resilience Toolbox leaders, with a request for them to distribute the invitation amongst their research team and stakeholders. Many teams had already identified and collaborated with a number of stakeholders regarding the RNC during the proposal writing stages (RNC 2014). Invitations were also sent to existing groups affiliated with natural hazard and risk research and disaster management throughout the country (e.g., lifelines groups, research groups, environmental groups, CRI and university departments), as well as to stakeholders who participated in the workshops in the development stage of the RNC. The e-mail encouraged people to share the invitation with anyone who they thought might be interested in the research.

Although members of the wider community are all considered stakeholders in hazard and risk research, given the strict time limitations of this short-term study we were unable to thoroughly and reliably sample this



**10** survey questions  
**22** minutes on average  
**15,000** words of text

**FIGURE 14** Information about the online survey and participant demographics. Survey questions were mostly open-ended. The survey was open for approximately one month to both researchers and stakeholders.

population. We acknowledge that the purposive snowball sampling methodology adopted here has limitations. In particular, we acknowledge that the sample is affected by the network of relationships that exist, and that more well-connected populations are more likely to be included in the sample and peripheral or marginalised groups are likely to be under-represented (Patton 2002).

The survey was open for approximately one month, during which 43 people participated (Figure 14). Approximately 43% of the participants identified themselves as “scientists” and 57% in other categories (e.g., government, business, transportation). Just over half of participants were female (51%), 42% identified as male, and 7% preferred not to say (Figure 14). Participants spent an average of 22 minutes completing the survey, and their collective responses generated over 15,000 words of text for analysis.

Overall, participants provided thorough, contemplative, and engaging responses to the questions. Figure 15 is a word cloud, which shows some of the key words used by participants in response to the question about what co-creation is (the larger a word is, the more frequently it appeared in responses). Key words include: community, people, process, involved, outcomes, local, priorities, goals, think, discuss, engagement, opportunity, plan, sharing, understands, and different. These key words and descriptions align well with the literature on transdisciplinarity and the co-creation of knowledge (Chapter 2, 3). Responses suggest that participants see co-creation in natural hazard and risk research in New Zealand as a process, which involves local communities, stakeholders, and scientists planning, engaging, sharing, developing, discussing, thinking, and identifying needs and issues together to work towards usable outcomes.

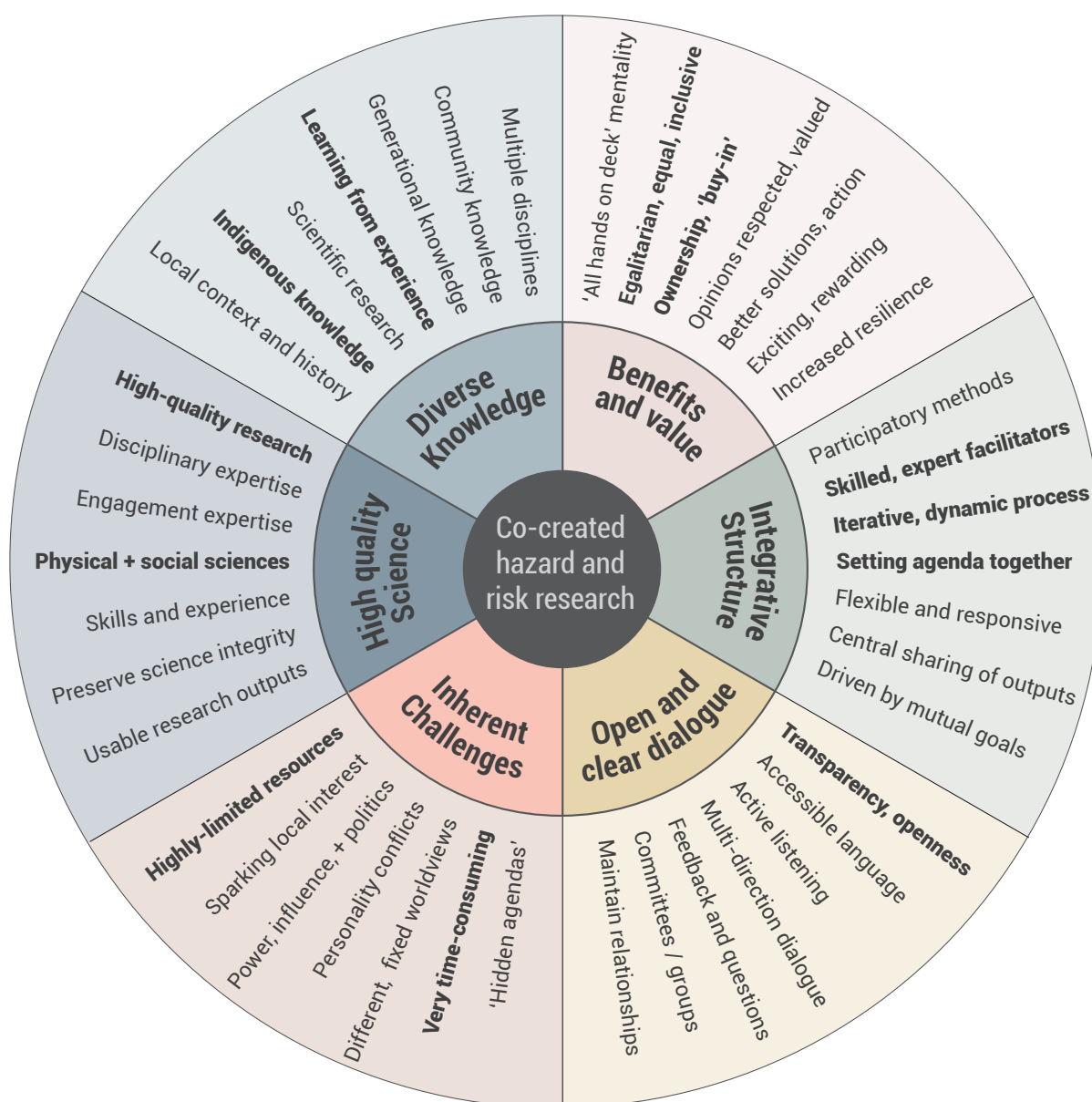
Inductive thematic analysis (Braun and Clarke 2006) was used to analyse the collective responses and identify key themes which characterised the way that participants think about and view the co-creation concept. Thematic



**FIGURE 15** Word cloud showing the 100 most frequent words used when participants were asked to describe their views and perspectives on what a co-creation process to natural hazard and risk research in New Zealand would look like. The size of the word reflects its frequency. Important thematic words include: community, people, process, involved, outcomes, local, priorities, goals, think, discuss, engagement, opportunity, sharing, understands, and different. (Note: 'hazard', 'risk', and 'research' were removed). Derivatives of the same word are combined (e.g., plan and planning, involved and involvement).

analysis is a qualitative method which involves critically reading large bodies of text and coding, or classifying, certain passages which are related to a particular theme. In the inductive approach used here, themes were identified by recognising emergent trends in the data at the semantic level (i.e., based on explicit or surface meanings of the text, rather than interpretative latent meanings) (Braun and Clarke 2006). Six themes arose regarding how participants discussed co-created hazard and risk research (Figure 16). Participants focused on describing 1) the potential benefits and value of a co-created approach, 2) the inherent challenges associated with it, and 3) the need for an integrative structured approach which 4) uses open and clear dialogue, 5) includes diverse knowledge types, and 6) is founded in high-quality scientific research (Figure 16).

Overwhelmingly, participants agreed with working towards a co-created approach to hazard and risk research (Figure 17). The benefit most commonly and strongly voiced in responses was that the approach would encourage ownership and “buy-in” of the research and its outcomes. That is, by including, respecting, and valuing diverse



**FIGURE 16** Emergent themes from participants' open-ended responses to the survey on co-created hazard and risk research. The inner ring shows the six themes which participants focused on and associated with the process, i.e., diverse knowledge, benefits and values, integrative structure, open and clear dialogue, inherent challenges, and a foundation in high-quality science. The outer ring shows specific examples of these themes taken from the responses. Bold examples appeared more frequently/strongly.



perspectives on an equal level, the research would encourage people to be interested, invested, and involved in the resilience-building process. Scientists also expressed that such an approach could be rewarding and exciting, by increasing the potential for their research to “address a real problem” and to develop findings that “will actually be useful to stakeholders”. Overall, participants viewed the co-creation approach as a potential pathway for developing better, and more fitting solutions to problems and accordingly lead to more action and application of research outcomes. However, participants also emphasised that co-creation was dependent on the equal involvement of “all parties at all levels”, and that it would be a challenging, but worthy endeavour. A core message that resonated throughout responses was that research should be inclusive, and done “with end users, rather than for end users”.

Participants acknowledged that the process of co-creation was going to be “complicated,” “difficult”, and “take a bit of time to get right”, and emphasised that developing an inclusive research process had to start from the very beginning, and then be “iterative” over the life of the project. While it was emphasised that the process needed to be structured, people explained that it also needed to be a flexible, responsive, and dynamic structure that was constantly evolving. Overall, responses described an integrative process which should start with setting the research agenda and deciding on the mutual goals together through a conversation guided by skilled, expert facilitators. This should be followed with a participatory process which involves the bringing together and consideration of many diverse forms of knowledge. This knowledge should then guide and be combined with high-quality scientific research. Findings, results, and new knowledge should then be shared in a central place and openly exchanged with the participants, stakeholders, and wider community. Throughout this process, open, transparent, and clear language and dialogue was viewed as essential for maintaining relationships and the integrity of the co-creation approach. Active listening and continuous feedback loops were also viewed as key components of this iterative and “cyclical” process. The value in considering diverse types of knowledge was raised by the majority of participants. The importance

Co-creation is hard work. However, it is also very rewarding – both professionally and personally.

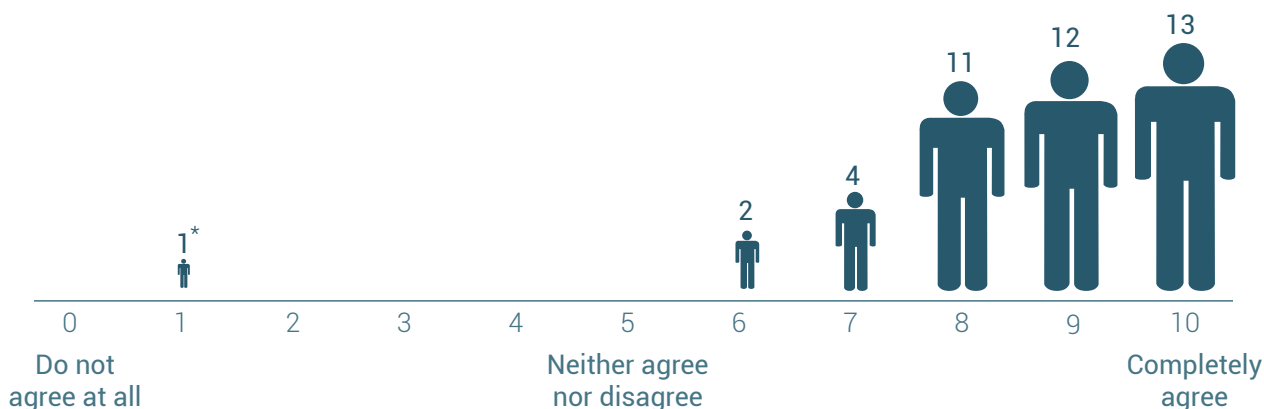
– Survey participant

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## STANDING IN AGREEMENT

How many agree with using a “co-creation” approach in natural hazards research?

\* Number of responses



**FIGURE 16** Scientists and stakeholder rankings of the importance of working towards a co-creation approach to natural hazard and risk research. A majority 98% of participants agree that it is the right approach to some degree.

of listening to and learning from people and local communities who have experienced disasters or hazardous events in the past was a particularly strong theme. Participants highlighted that local communities, indigenous peoples, and older generations have valuable and highly-relevant knowledge regarding how different hazards impact and affect a region, and that these sources of knowledge should be respected and included in a co-created process. Stories from experience were seen as an “opportunity for hands on learning” for researchers, but also as a way to make the affected communities feel valued, listened to, and motivated to participate in resilience-building initiatives. Integration of indigenous knowledge, tangata whenua, and Māori world views were also viewed as an essential part of a co-created research process. Participants noted that the time donated by these diverse groups also needs to be appropriately recognised and appreciated.

Those who have experienced the hazard have innate knowledge of what happens and can offer solutions.

– Survey participant

All participants recognised inherent challenges associated with adopting and exercising a co-creation approach. The most widely identified challenge was the time-consuming nature of a co-created process coupled with the limited resources for undertaking it. Other challenges noted were the need to break down existing power structures, political play, and hidden agendas; mediating different or fixed world views; and dealing with personality conflicts. A co-created process aims to bring together many different types of people and organisations, and will have to overcome traditional hierarchical structures and institutional divisiveness. In the context of natural hazard and risk, a number of participants noted the difficulty of sparking and maintaining interest in long-term, low-probability, complex problems such as resilience amongst the competition of more pressing day-to-day challenges in local communities. A complicated dialectic was also expressed by a number of participants, for which a co-creation process will need to work to achieve balance. For example, participants

appreciate that co-creation requires a significant amount of time, patience, and costs, but also acknowledge that those resources are often very limited: “So give it time, but be efficient”. Similarly, the process needs to be organic and self-organising, but also structured: “a little anarchic (but not without a structure to it)”.

Do not think of us [non-researchers] as a group on which knowledge is imparted. There’s a lot of knowledge in here to start with. – Survey participant

Participants named a wide range of potential people who should be given a voice in a co-created process. Listing everyone from “boaties”, rental tenants, and transient campers to government officials, CRIs (crown research institutes), and private consultants. A variety of terms are

used interchangeably in the literature to describe the actors and players in collaborative research processes (e.g., academics and non-academics; scientists and non-scientists, researchers and stakeholders; detached specialists and engaged problem solvers (Pohl 2015); end-users; publics). In order to investigate whether or not the terminology played an important role or influenced the way people viewed the co-creation process, one survey question asked participants to share their views on this topic.

Generally, participants stated that it was important to be cognizant and careful of the general language and labels used in a co-created process, but that it should not be “dwelled upon”. Many participants recognised the restrictions and limitations which can be incidentally imposed by labels, but also acknowledged the need for labels in order for a structure to take form and facilitate the flow of knowledge between groups. The

greatest risk participants recognised, was the possibility for a label to place someone in the context of a passive or receiving role – which would be against the goals of a co-creation process. Although a variety of responses and examples of possible labels and terms were proposed, a few trends emerged. The term “end-user” was used as an example of an unfavourable label, because it placed people in a non-participatory role. The label “researcher” was described as more fitting than “scientist” for the general term for the people conducting research because it better represents the range of disciplines involved in a transdisciplinary research project. While some participants felt the word “stakeholder” was “not very conducive to a collaborative, active approach”, most responses accepted the term as good broad category which captured the “full range of people who have a vested interest in the research programme”. Some participants expressed that researchers are in fact stakeholders themselves, and a number of participants explained that in a truly co-created process, there would be no divisive labelling of roles, and that everyone would be considered as equally respected “partners” or “participants”.

## Focus groups

Two short (two-hour) focus groups were carried out parallel to the online survey. Following University of Auckland Human Participant Ethics Committee approval, a snowball sampling methodology was used to recruit participants for the focus group, similar to the online survey. E-mail invitations to the focus group were distributed to all of the RNC Priority Co-creation Laboratory leaders, with a request for them to distribute the invitation amongst the stakeholders of their respective research streams. The invitation was also sent to past participants of RNC development stage workshops. One small focus group was hosted with five stakeholders from different stakeholder organisations in Christchurch (Environment Canterbury, Canterbury Civil Defence and Emergency Management Group, Christchurch City Council, and Canterbury District Health Board) and one small focus group was held with two organisational stakeholders in Auckland (Auckland Council). The small size of the focus groups allowed for in-depth discussion among an intimate group, in a safe and comfortable environment. The same facilitator was present at both groups, and went through a semi-structured list of questions which were designed to create a two-way dialogue about views, goals, and expectations for stakeholder engagement in the RNC. It is important to note that all of the stakeholders who participated in these focus groups were representatives from government organisations, and that the insight gained is limited to the experiences and views of these stakeholders. The focus groups were audio-recorded and notes were taken throughout.

Three key themes emerged from the two focus groups, which were the importance of:

- 1 utilising existing stakeholder networks in creative ways,
- 2 seeing the multi-layered “bigger picture” of resilience, and
- 3 evaluating and monitoring engagement activity over the course of the project.

The stakeholders felt strongly that in order to achieve effective engagement and prevent stakeholder fatigue, the RNC needs to “hook in” with existing stakeholder networks. Many organisations already have ongoing initiatives for managing natural hazard, risk, and resilience. Participants felt that the new RNC work should align with these existing activities, and coordinate with their objectives. This view particularly prevailed among the Christchurch stakeholder participants, who have been actively involved in managing the city’s rebuild since the 2010 – 2011 Canterbury Earthquake Sequence. Participants explained that lack of awareness and consideration of existing efforts and networks could affront stakeholders who may perceive their work as not being valued. Participants explained that many meetings, activities, and groups are already focused on and dedicated to discussing these sorts of issues. They cited examples such as the 2014 think piece commissioned by LGNZ (Local Government New Zealand) on “Managing natural hazard and risk in New Zealand – towards more

resilient communities” (Willis 2014), and the biannual meetings of the Regional Planning Managers Group. They explained that the RNC would best become integrated and get “buy-in” with government stakeholder groups if they “piggy-backed” on this type of ongoing activity.

Similarly, participants stressed that they have strong existing networks, connections, and relationships which should be built upon. For example, in both Christchurch and Auckland, they have established groups for engaging with local iwi, and committees and panels for interacting with the local communities and public. Some of these relationships have a long and strong collaborative history, and in many cases can serve as a fruitful pathway for the RNC to reach an already active and engaged community. For example, participants explained that if the RNC wants to co-create with the local community, rather than start a relationship from scratch, the RNC team could join forces with local stakeholder organisations who have an active, invested, and interested group of public representatives already unified. They explained that combining efforts would be an effective use of resources in a resource-limited situation, and that it would encourage a positive, mutually-beneficial, and consistent exchange with stakeholders. Participants noted that each region of New Zealand is uniquely complex, with different social structures and different hazards, and that local stakeholders hold a vast and valuable body of tacit knowledge regarding the perceived risks, historical impacts, and local capacities of an area. Participants expressed that appreciation and respect of stakeholder knowledge is essential for co-creating RNC research. Further, there are many existing partnerships and ongoing collaborations between scientists and stakeholders across the New Zealand hazardscape (e.g., Leonard et al. 2008, Collins et al. 2011, Kilvington et al. 2011a, Potter et al. 2014, Saunders et al. 2015). These partnerships need to be recognised and respected. Being aware and informed about such efforts can help ensure future work is carried out in a productive and supportive way.

Every region is distinctly different, for distinctly good reasons, often. So, it's understanding what's already set up in each region or location that you [the RNC] can then piggy-back on. And if you don't do that, then you will fall foul of lots and lots of people and organisations because there's just so much going on...

– Focus group participant

Stakeholder participants also emphasised the need to keep in mind the “bigger picture” of resilience and the importance of taking a “whole-systems” approach. They highlighted that there are many different levels and dimensions comprising resilience, from scientific research, to public awareness, social behaviour, economic stability, and government policy. Participants explained that in order to create an embedded culture of resilience, collaboration and coordination across all dimensions is essential – all of the different levels need to be in-sync in order to achieve success. At a government organisation level, participants noted that a two-way dialogue regarding legislation and policy would be an important part of engagement. For example, they said CDEM teams need to recognise the importance of good research for informing disaster management policy, and equally, research teams should be aware of the CDEM Group Plans and the way these impact application of the research. Some participants proposed that a steering group or committee, which brought together different stakeholders, could facilitate this type of dialogue and sharing across boundaries. Auckland participants noted the success of this approach for keeping everyone informed in the Determining Volcanic Risk in Auckland (DEVORA) Project. Participants recognised that this type of exchange could serve as an opportunity for building capacity and for developing a consistent and more comprehensive picture of resilience across different areas of expertise and knowledge in the RNC. Participants emphasised that representatives from organisations

of all backgrounds would need to be involved, from public health and social development to emergency management and urban planning.

Participants also voiced that it was “absolutely” essential to regularly monitor and evaluate engagement efforts over the ten-year lifetime of the RNC. Stakeholders expressed that evaluation should be done in both a formative (during the project) and summative (after the project) way. They viewed evaluation as a “reflective practice” which could help the RNC responsibly exercise adaptive management of the project. They saw such feedback loops as a way to recognise and address gaps and conflicts early on. However, they noted that the evaluation would have to be a short, easy, and feasible way to give feedback. Overall, the focus group participants expressed a keen desire for transdisciplinary engagement of a responsible, organised, broad, and outcome-driven nature.

## Vision Mātauranga

Tangata whenua, or the indigenous people of Aotearoa (New Zealand), have a sacred and meaningful relationship with the natural environment, and they are regarded as key partners in all environmental projects in New Zealand. Māori acknowledge that the environment holds important physical, spiritual, and metaphysical values, and they trace their genealogical connection back to the land, forests, seas, and waterways. Accordingly, Mātauranga Māori, or Māori world views, offer a special and unique perspective on the environment, based on Māori values, traditions, and experiences. Māori have rich intergenerational knowledge about New Zealand’s ecosystems and environments, and how to sustain and preserve their mauri (life force). Mātauranga Māori can therefore offer valuable insight into modern environment challenges, and in many ways, can help foster a more holistic understanding of these issues and their possible solutions (King et al. 2007, Harmsworth 2005).

It is essential to integrate the visions and principles of Mātauranga Māori into dialogue surrounding environmental challenges and efforts to work towards sustainable solutions (Harmsworth 2005, Majurey et al. 2010). In the context of stakeholder engagement, tangata whenua

are regarded as a key partner in environmental projects in Aotearoa, rather than simply another stakeholder. As indigenous peoples, Māori have legal rights to participate in any project which affects them – under international law, Tiriti O Waitangi (the Treaty of Waitangi), the Resource Management Act (RMA), and the Local Government Act (LGA). Harmsworth (2005) provides a comprehensive summary of relevant clauses and provisions of these documents which pertain to engagement with Māori, and Majurey et al. (2010) provide an in-depth look at Māori values and concepts in the context of the RMA. These resources provide further detail about legislation surrounding consultation, collaboration, and engagement with Māori.

In accordance with these responsibilities, and with respect and appreciation of the Māori world view, Vision Mātauranga is an overarching and core principle of the RNC co-creation research strategy. In addition to the Vision Mātauranga priority co-creation laboratory, which aims to build research capacity in Māori communities and to empower iwi, hapū, and whānau, the RNC aims to integrate Māori world views and engage with tangata

Māori bring to the table a unique set of skills and expertise based on over 1,000 years of knowledge, and offer an important perspective in all decision-making. They are an integral part of any collaborative effort to achieve sustainable environmental management.

– Harmsworth (2005), pg. 46

whenua in all dimensions and research streams of the project (RNC 2014). A number of participants of the online survey and focus groups echoed the importance of engaging with tangata whenua in a co-created approach to natural hazard and risk research.

Mātauranga Māori offers perspectives on hazards and disasters in the New Zealand which differ greatly, both in content and context, from Eurocentric western world views (King et al. 2003, Harmsworth 2005). Both types of knowledge should be integrated, respected, and valued in a co-created approach. King et al. (2003) give a number of examples of how Māori oral histories and traditions both record details and share valuable lessons about hazardous events of the past. For example, the mōteatea (traditional Māori song) for Te Heuheu (II) Tūkinono (Ngāti Tūwharetoa) and his people tells the story of how they perished from a landslide in Te Rapa after a landslide on the shores of Lake Taupo in 1846. A village named Waihi was established near the buried site of Te Rapa, and it too was impacted by a devastating landslide in 1910. Combined knowledge of these two experiences suggests that the area is prone to recurring landslides, and today, a warning sign has been installed in the area and potential landslide risk is actively assessed (King et al. 2007, Massey et al. 2009). Similar oral histories exist for storms, tsunamis, volcanic eruptions, and seismic events.

In addition to holding knowledge of past events, such oral histories can provide a means for understanding, conceptualising, and recovering from the impacts of catastrophic natural disasters (Cashman and Cronin 2008). For example, oral histories about the eruption of Tarawera in 1886 served as an important community education tool for translating knowledge about the dangers associated with volcanic areas, and also for coming to terms with the devastating event. Cashman and Cronin (2008) draw comparisons between these Māori oral traditions and modern community histories of the volcanically-active Pacific Northwest, USA. They conclude that storytelling can be an important mechanism for enhancing the resiliency of communities in hazard-exposed areas, and they propose that these traditional methods could be integrated into modern emergency planning. Kenney and Phibbs (2015) draw similar conclusions about the value of integrating traditional Māori technologies in modern practice. Their work outlines the experiences of the local tribe Te Rūnanga o Ngāi Tahu in the disaster management response to the Christchurch Earthquake Sequence in 2010-2011, and illustrates how Māori kaupapa (cultural values) helped give rise to a united and successful community-led response to the disaster. They propose that integrating a kaupapa-based approach into formal response planning and strategies could enhance New Zealand's resilience to natural disasters.

These works, and others, recognise the valuable contribution of Mātauranga Māori and tangata whenua to understanding New Zealand's natural hazards and enhancing the resiliency of communities. It is important to note, however, that successful engagement with Māori needs to be driven by a genuine interest in developing a long-term relationship, rather than using engagement as an instrumental means to an end. Engagement with Māori needs to be underpinned by mutual trust, respect, and understanding of each other's cultural beliefs and world views (Harmsworth 2005). It is very important to be aware and observant of tikanga Māori (cultural customs and values) and to acknowledge that building such a relationship requires the time, resources, and commitment of both parties.

To better understand factors that lead to positive engagement experiences with tangata whenua, Harmsworth (2005) carried out a review of case studies and resources on Māori engagement. He identifies 12 key barriers to effective engagement and participation, which are summarised in Table 5. Harmsworth (2005) also provides a summary of best practice for engaging with Māori, as documented and evaluated by the experiences of many different sectors, communities, and government agencies. Overall, he notes that the most significant feature of best practice is that a project seeks to genuinely understand and respect iwi/hapū environmental values and to exercise kaitiakitanga (guardianship of the environment) in a way that is complementary to their own work. In this way, Māori culture is embedded into the project, rather than approached or viewed as a conflicting issue.



**TABLE 5** Some barriers to effective Māori engagement. From Harmsworth (2005).

### Barrier

- Lack of recognition of rights and status of iwi and hapū as Treaty partners
- Lack of Treaty knowledge and provision for the Treaty of Waitangi
- Being at a disadvantage for effectively managing their natural resources and tāonga (treasured property)
- Process and time frames that do not take into account iwi/hapū consultation processes
- Lack of, or difficult systems in place for allowing iwi/hapū participation
- Actions that impinge on iwi/hapū rights, e.g., lands subject to Treaty claims, adverse effects on cultural sites
- Under-resourcing of iwi/hapū to effectively participate
- Lack of knowledge of Māori issues
- Consultation with the wrong parties

In order to form a solid partnership with Māori, it is essential to engage in good practice from the beginning of the project. However, it is important that these first steps are well-informed and conducted in a way that respects Māori customs and protocols. For example, Harmsworth (2005) highlights that the initial meeting should take place between researchers and iwi/hapū at the senior level, in a venue that gives mana (status, prestige, authority). Such customs and protocols, or tikanga, need to be observed for successful engagement, and there are many established groups which can provide expert guidance for this. For example, many regional and district councils will have groups dedicated to Māori engagement and affairs, which can provide advice and help direct and facilitate contact. Figure 18 shows a version of the stakeholder engagement spectrum (Figure 3) in te reo Māori (Māori language), from the “Engaging with Māori” handbook prepared by the Bay of Plenty Regional Council Māori Policy Unit (BOPRC 2011). Table 6 lists relevant Māori consultation principles used by the Auckland Regional Council (ARC 2004). Although these are presented as “consultation” principles, they reflect an effort to empower and partner with tangata whenua and Māori organisations in a way that respects and integrates Mātauranga Māori.

Currently, there is no unified strategy or central set of guidelines for engaging with Māori in the RNC. It is advised, however, that engagement efforts should be coordinated and conducted in a collaborative and harmonious way that respects the time, roles, and resources of both the Māori and the RNC researchers involved. Engagement with Māori needs special consideration and dedication, and should aim to empower Māori organisations and tangata whenua in all dimensions of RNC research.



**FIGURE 18** The engagement spectrum in te reo Māori. Modified from BOPRC (2011). Many organisations have existing networks and relationship with the local iwi, and knowledge and experience in tikanga Māori. These can be good starting places from which to begin reaching out to tangata whenua in RNC projects.



**TABLE 6** Māori consultation principles. From ARC (2004), as presented in Harmsworth (2005).

<b>Principle</b>	<b>Why it matters</b>	<b>Putting into practice</b>
Kanohi ki te kanohi <i>Face-to-face</i>	It's a cultural preference of Māori to meet face-to-face This reflects the oral tradition Trust is built out of personal contact	Meet in person, wherever possible. Discuss and agree on where to meet Be prepared to go out to Māori communities
Rangatira ki te rangatira <i>Chief-to-chief</i>	Māori have confidence that the people consulting with them have the mana (status) to do so	Involve the right people Involve people at an equal level Involve those who can answer questions
Nā te kakano <i>From the seed</i>	Reflects the Māori life cycle Early involvement shapes the final result Māori may have different priorities & timelines Issue may be new to Māori, who need time to absorb the issue, and develop their position	Involve Māori from the start Be prepared for a slow process based on consensus Māori representatives are likely to need time to consult with their communities
Kei mou mou taima <i>Open and meaningful</i>	Phrase literally means 'waste of time' It's important not to waste people's time – Māori are seeking meaningful engagement and response to consultation	Consult with a clear purpose Explain why you are consulting Don't have a predetermined outcome Ask about engagement interest
Ki tai wiwi, ki tai wawa <i>Flexible</i>	Phrase refers to moving from side to side to change direction in your waka Be open to different pathways and objectives Māori community have their own processes and structures to take into account	Be prepared to consult several times, at different levels Allow for organic processes to emerge Need for balance and a two-way relationship Seek Māori agreement on key consultation decisions
Tikanga Māori <i>Correct way of doing things</i>	Māori have their own protocols, customs and ways of doing things Recognising these is a sign of respect and a two-way relationship	Recognise, respect and use Māori protocols, customs and ways of doing things Seek guidance in tikanga Māori
Ko te tūmanako <i>Transparent</i>	Phrase means 'good faith', 'good will' Important for Māori to know who is involved and that they have been invited in good faith They will know who else can represent their views if they are unable to	Be open and honest (and ask for feedback) about: participants, audience, purpose, the process, how information will be used, who's making the decision, and with what authority Don't have a hidden agenda – be upfront
Mahia te whare <i>Foster capacity</i>	Phrase means 'build the house' Foster Māori capacity and capability, rather than building from scratch every time	Ensure Māori have capacity to participate Cover costs (e.g. venue, food, key individuals) and include a koha Many Māori organisations don't have paid staff Budget for Māori engagement
Whakatika te he <i>Accountability</i>	Phrase means 'right the wrongs', or 'find the right way through the confusion' Māori believe we should learn from the past and look to the future Don't continue past mistakes and injustices Keep promises, listen to and value Māori views	Be accountable and take responsibility Feedback on previous Māori engagement Do some research – you may be able to get a sense of Māori views of an issue from their iwi/hapū management plans and other documents
Kia tika te reo <i>Use appropriate language</i>	Use clear and appropriate communication and language to ensure understanding	Change language depending on audience and situation Learn correct te reo Māori pronunciation



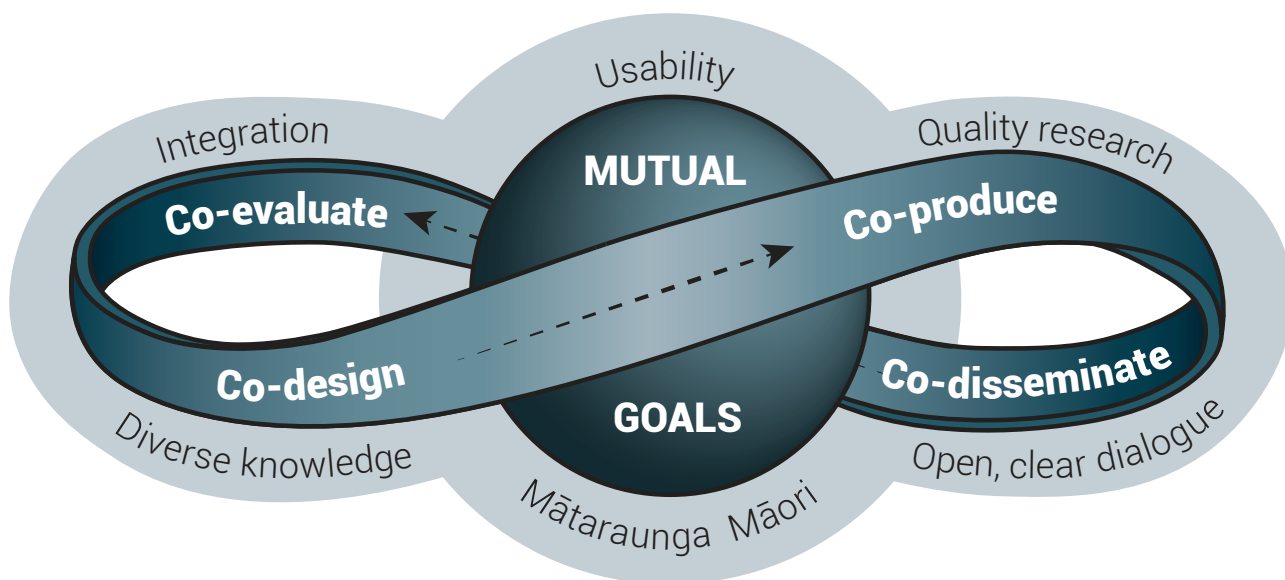
# 5 Proposed RNC co-creation framework

## A conceptual co-creation framework

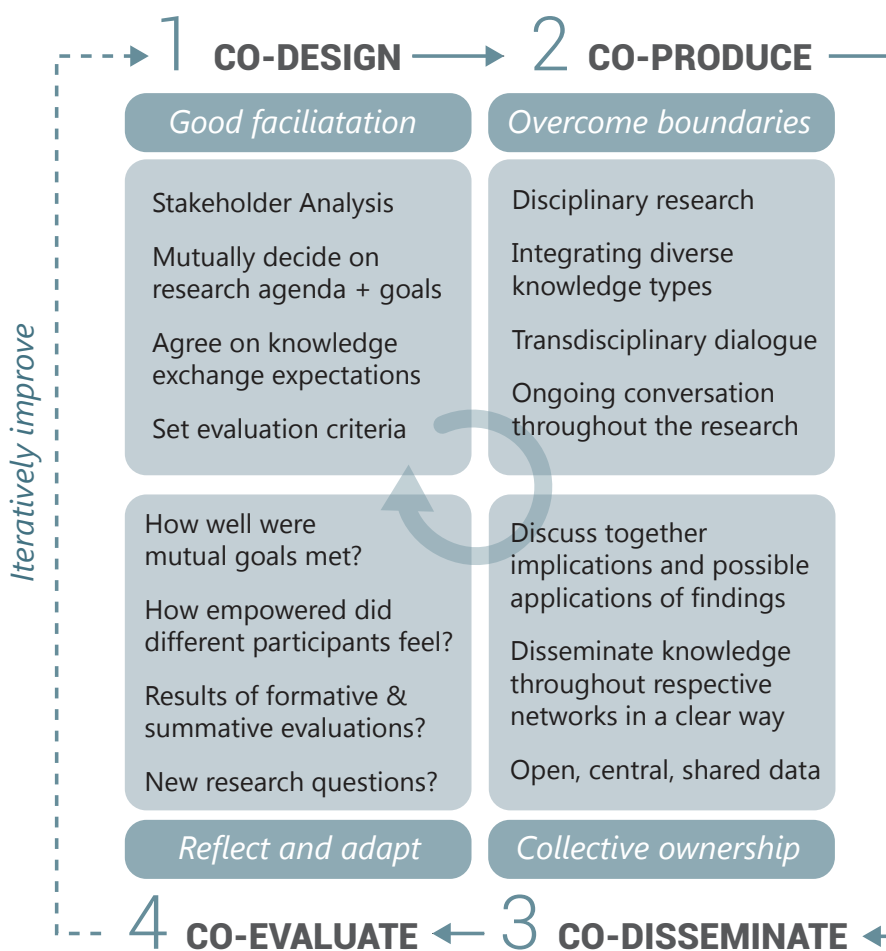
The online survey revealed some of the key features, qualities, and components which characterise a co-created approach to research in the mind of New Zealand researchers and stakeholders. These include: the integration of diverse forms of knowledge, well-facilitated and widespread engagement in the early agenda-setting stages of the project, a foundation in high-quality research, and ongoing communication and feedback through an iterative process. The stakeholder focus groups gave further, more specific insight into pragmatic pathways for achieving these goals, namely: building on existing stakeholder relationships, keeping a broad perspective and an inclusive approach, and factoring in feedback loops and evaluation processes.

Many of these themes align with the literature on co-created approaches to integrative environmental research (Chapter 3). However, there are important nuances in this collective information, which do not fit well within existing conceptual frameworks (e.g., Figures 7, 8, 9). Tacit knowledge and experience related to hazard, risk, and disaster in New Zealand means that people have developed a unique understanding and perspective of what co-created research should look like in this domain. Here, we propose a framework for co-creation of research specific to the RNC, which is based on the results of this short-term study and how these findings fit within the literature and existing frameworks. Figure 19 shows a schematic of this conceptual RNC co-creation framework. Figure 20 presents a more specific breakdown of the conceptual components and what they mean.

Stakeholders and researchers who participated in the study felt strongly about the importance of engagement early on in the project, when mutual goals are decided and the research agenda is being set. This aligns well with the “co-design” stage of the Mauser et al. (2013) co-creation framework, and also comprises the first phase of co-creation in the RNC conceptual framework. The important overarching principle associated with this stage, is the need for good expert facilitation. During this stage, stakeholder analysis should be performed, mutual goals should be defined and the agenda set together. Attempts should be made to collaboratively identify existing networks and pathways for aligning the RNC engagement efforts with other ongoing or parallel



**FIGURE 19** A conceptual framework for co-creation in the RNC. Four phases of co-creation (co-design, co-produce, co-disseminate, and co-evaluate) - make up an iterative cycle which is centred around shared mutual goals. Key features which feed into and characterise this process are: diverse knowledge types, quality research, open and clear dialogue, integration, Mātarauanga Māori, and usability.



**FIGURE 20** A proposed four step process for co-creation in the RNC, based on the conceptual framework presented in Figure 19 (above). Light blue boxes are tasks and actions to be conducted with all partners and dark blue boxes highlight the key challenging principle to be addressed in that phase.

initiatives. Participants of the co-creation process should agree on knowledge exchange and engagement expectations for the following phases of research, and the team should collaboratively agree on criteria which should be used to evaluate the process.

Similar to both the Mauser et al. (2013) framework and the Gramberger et al. (2015) STIR framework, participants voiced the importance of high-quality discipline-specific research in the co-creation process. Overall, they described a co-production phase of research which hinges on the breaking down of boundaries between diverse knowledge types and expertise (e.g., local, indigenous, generational, physical sciences, and social sciences). With these improved boundary relationships, each knowledge type is valued equally and is used to guide and inform inquiry across different knowledge sources, but disciplines are not blended or diluted. In essence, this means that researchers practice within their area of skills and expertise, and that stories still belong to and are preserved within communities. However, local stories can be used to guide research practice, and research can be used to help create new local stories. During this fruitful co-production phase, the overarching principle is aiming to overcome traditional boundaries and traditional hierarchical divisions through ongoing transdisciplinary conversation and dialogue.

The third phase of the co-creation research cycle is co-dissemination. This phase is also included in the Mauser et al. (2013) framework, but here we additionally emphasise the importance of creating a culture of collective ownership and the need for open, central sharing of data, as voiced by the participants of this study. During the co-dissemination phase, new knowledge is shared among the RNC participants and partners in a clear, open, way and each group shares and disseminates this knowledge throughout their network in appropriate ways. This phase is an important time for raising discussion about implications and applications of findings in order to catalyse integration of the research into policy, practice, and social activity. Findings and data should be shared openly, and collective ownership should be encouraged.

The fourth phase introduced in this framework is co-evaluation. Participants expressed that an iterative process of evaluation, reflective practice, and adaptive management was very important. The literature acknowledges that many co-creation goals can fall short due to feelings of inequality, lack of appreciation, fatigue, or not being listened to (Cooke 2001, Reed 2008, Tseng and Penning-Rowsell 2012). Through formative evaluations during different stages of the project, the RNC team can recognise and address problems before they develop into a critical or compromising issue. Through summative evaluations at the end of a research project, lessons learned can be adopted and taken into account to improve the next research project.

Unlike the "castle"-shaped framework for Future Earth proposed by Mauser et al. (2013), the RNC co-creation framework is not designed as a hierarchical series of separate steps. Instead, co-creation is shaped as a process, with transitional phases that repeat iteratively in a cycle, with the gravitational force of mutual goals keeping the process together and focused (Figure 19). Similar to the Gramberger et al. (2015) approach, the process has a number of overarching principles guiding and feeding into it. We propose that formation of a boundary organisation, comprised of representatives from stakeholder categories for each co-creation laboratory, could serve as structure to help support the co-creation process.

Based on the wide definition of "stakeholder" adopted in this report, theoretically everyone involved in the co-creation process can be considered a stakeholder. However, for structural and pragmatic reasons, we propose that "researcher" is used to describe the members of the RNC research team conducting research (both social and physical sciences) and "stakeholder" is used to describe non-researchers. Everyone involved in the process should be regarded as a "partner", and there will be different types of partnerships involved (e.g., those with government organisations, with iwi, local communities, etc.). We note that rhetoric is important to be aware of in a co-creation process. Stakeholder participants voiced that although terminology and labels were not of

utmost significance, it did influence the degree to which they felt valued in the co-creation process: "If a title empowers someone to feel like their view is important and worth listening to it is useful. If it pigeonholes them into feeling like they are not wanted in some parts of the process then it isn't" (online survey participant).

We note that inherent in this conceptual framework, is the need for a strong and collaborative relationship among the researchers making up the RNC team. In a survey of researchers involved in BioEarth, a five-year transdisciplinary research project focused on modeling climate impacts on water, nitrogen, and carbon cycling in the Columbia River Basin (USA), Allen et al. (2013) found that close communication among the researchers was a critical factor for successful engagement. The researchers involved in transdisciplinary projects have a wide range of backgrounds, experience, and expertise, and they found that this can result in a range of expectations about how and when to engage with stakeholders. They conclude that these differences can be addressed through open communication and peer-learning among the research team (i.e., those more experienced in engagement work together with those who are less experienced).

In the RNC project, each of the four Priority Co-creation Laboratories (Resilient Rural Backbone, Resilient Cities New Zealand, Living at the Edge, and Vision Mātauranga) will have a distinctly different research focus. Accordingly, much of the

co-creation cycle will be done within the context of each individual co-creation laboratory, as the goals, agenda, and stakeholders will vary for each geographical, social, and research context. However, it will be critical to maintain good communication and linkages within and across the laboratories. Good internal communication will be particularly important during early stakeholder analysis stages. If joint stakeholders are recognised, discussions need to be held around how this relationship can be built in a productive and streamlined way that prevents development of stakeholder fatigue. If boundary structures are organised, it will be important to understand the flow of information in and out of these structures and the networks which they integrate.

Effective stakeholder engagement is dependent on effective transdisciplinary communication among the research team

– Allen et al. 2013, pg. 354

# 6 Sustaining engagement and co-creation over time

Nurturing a culture of collaboration, equality, inclusiveness, and co-creation takes time, patience, and commitment. While the importance of well-facilitated, cross-boundary engagement early on in the project is a key factor of success in transdisciplinary environmental research programmes (Phillipson et al. 2012), sustained engagement over time will be key to building the enduring relationships which can lead to transformative change and a more resilient New Zealand. Participants of the focus groups and online surveys felt strongly that documentation, strong feedback loops and formative evaluation strategies needed to be in place for adaptively managing the project in an ongoing way so that it can best meet its long-term co-creation goals over time. In addition to ongoing monitoring and evaluation, we propose that this NSC project presents a valuable opportunity for documenting and recording the evolution of a co-created environmental research project, which will be of interest internationally.

A number of scholars have noted the lack of documentation and reporting on large-scale, long-term, transdisciplinary projects (e.g., Reed 2008, Mauser et al. 2013, Allen et al. 2013, Gramberger et al. 2015). By actively recording and documenting the evolution of a co-creation research approach, the RNC can help take one of the first steps towards filling this gap, and through doing so, contribute valuable new knowledge about this emergent

approach. Social network analysis (SNA), which describe the linkages and flow of information between people in a group, can be a successful tool for understanding the nature of relationships in a transdisciplinary project involving both researchers and stakeholders (Tompkins and Adger 2004, Newman and Dale 2005, Crona and Bondin 2006, Bodin et al. 2006, Prell et al. 2008, Prell et al. 2009). For example, Crona and Bodin (2006) used SNA to identify key communication gaps contributing to unsustainable fishing practices in Kenya. Prell et al. (2008) and (2009) present a case study where SNA was used to identify key stakeholders and pathways for participatory activities within a large-scale environmental research project in England (also see Chapter 3).

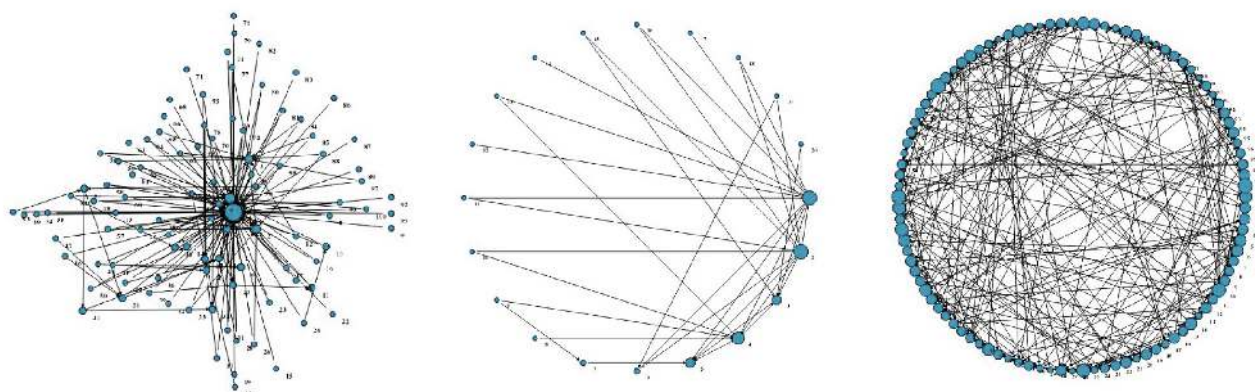
It was possible to use SNA in an innovative and sensitive way to better meet the needs of stakeholders and the research project. – Prell et al. 2008 pg. 459

Lienert et al. (2013) used SNA to identify areas of social fragmentation within the water sector network in Switzerland. We propose that SNA could be applied in a more overarching, long-term context to monitor the RNC network over time. We suggest that tracing the flow, shape, and cohesiveness of the network at regular intervals could help the RNC responsibly track its involvement with co-creation partners.

## Social Network Analysis in the RNC

Social network analysis (SNA) has a long history in research literature. Sociometry, one of the first techniques proposed for quantitatively analysing the structure of social groups was put forth more than eight decades ago by Moreno and Jennings (1934), and scholars can trace further roots back to the late 19th century (Prell et al. 2012). The modern field of SNA is vast, with three individual journals focused on the topic – *Connections*, *Journal of Social Structure*, and *Social Networks*. However, Prell et al. (2008) explain that, “environmental applications of social networks are just beginning to emerge” (pg. 444). This emergence aligns with the paradigm shift of thinking about ‘wicked’ environmental problems in a new transdisciplinary way, which recognises the role of social factors in contributing to the issue, and in helping reach its solution. SNA provides a way to visualise and identify how knowledge spreads throughout a group of people and can help map the reach of co-management and engagement efforts (Crona and Bodin 2006, Davidson and Hunt 2006, Prell et al. 2008).

Social networks are formed as a series of nodes with connecting lines. Each node represents an actor, which has certain qualities and attributes, and each line represents a tie, or relationship to another actor. Ties are characterised using attributes (e.g., type of relationship, frequency of relationship) and strengths (e.g., weak, strong) (Granovetter 1973). Quantitative mapping of actors and ties through SNA can be a useful way to identify social patterns in a group, namely: centrality and homophily. Degree centrality refers to how many ties are connected to an individual actor or group of actors. A high number of ties means a high degree centrality (Freeman 1979). Betweenness centrality refers to how often an actor is directly tied to two other actors who are not directly connected to each other (Freeman 1979, Wasserman and Faust 1994). Homophily refers to when actors with similar attributes tie to each other (Friedkin 1998, Skvoretz et al. 2004). Prell et al. (2009) summarise the possible effects of these patterns in natural resource management (Table 6). Their review illustrates how strong ties, weak ties, homophily, degree centrality and betweenness centrality can all have positive and negative effects on a social network. Analysis of these patterns could help the RNC recognise strengths and weakness in its researcher-stakeholder relationship network as it works to develop its co-creation approach. It would also enable a way to identify where engagement efforts are most needed.



**FIGURE 21** Random examples of the results of a social network analysis (SNA), modified from SocNetV (Kalamaras 2009). There are many different ways to display networks through use of different algorithms and attributes. Often times thicker lines can be used to display stronger relationships, clustering can be used to show categories of stakeholders, or centralisation can be used to show key players.



**TABLE 7** The effects of different network concepts in SNA. From Prell et al. (2009).

Concept	Effect	Description	
Strong ties	+	Good for communicating about and working with complex information	
	+	Hold and maintain trust between actors	
	+	Actors more likely to influence one another's thoughts, views, and behaviours	
	+	Encourage creation and maintenance of norms of trust and reciprocity	
	-	Encourage likelihood that actors sharing strong tie hold redundant information	
	-	Actors less likely to be exposed to new ideas and thus may be less innovative	
	-	Can constrain actors	
Weak ties	+	Tend to bridge across diverse actors and groups	
	+	Connect otherwise disconnected segments of the network together	
	+	Good for communicating about and working with simple tasks	
	+	New information tends to flow through these ties	
	-	Not ideal for complex tasks/information	
	-	Actors sharing weak ties are less likely to trust one another	
	-	Can break more easily	
Homophily	+	Shared attributes among social actors reduces conflict, and provide the basis for the transference of tacit, complex information	
	-	Can also result in redundant information, i.e., actors have similar backgrounds and therefore similar sources of knowledge	
Centrality	<i>Degree centrality</i>		
	+	Actors with contacts to many others can be targeted for motivating the network and diffusing information fast through the network, i.e., these are the focal actors in a centralised network	
	-	Actors do not necessarily bring together diverse segments of the network	
	-	Because of their many ties, these ties are often weak ones, thus decreasing influence over others	
	<i>Betweenness centrality</i>		
	+	Actors that link across disconnected segments of the network have the most holistic view of the problem	
	+	As with degree centrality, they can mobilize and diffuse information to the larger network	
	-	They can feel constrained or torn between two (or more) positions	
	Centralisation	+	As only a few actors hold the majority of ties linking the network together, only need reach these well-connected few to reach entire network
		-	Reliance on only a few is not the optimal structure for purposes of resilience and long-term problem-solving

*For a more in-depth review of these network effects, the reader is referred to Prell et al. (2009) and references therein. + = positive effect, - = negative effect*

The importance of knowledge flow and exchange in a co-created research project is paramount. Recent literature has called for the need for more research on social network analysis and its applications to understanding knowledge exchange and transdisciplinary boundary relationships in scientific research (e.g., Prell et al. 2008, 2009; Crona and Bodin 2006; Crona and Parker 2012). The RNC presents an opportunity to answer these calls, and take a critical and innovative look at how a co-creation approach to knowledge shapes a research project's social network.

Social networks can be built through performing focus groups, interviews, or surveys with a specific group of people or actors. For the RNC, this group would need to be a defined through a systematic stakeholder

analysis or the formation of boundary organisation structure (e.g., Prell et al. 2008, 2009). In order to maintain a consistent long-term effort, we propose that well-planned and well-organised surveys at regular intervals (e.g., twice or thrice annually) would be a good balance for a robust assessment over 10 years without burdening participants. A number of free statistical software packages exists for conducting social network analysis (e.g., UCINET, Borgatti et al. 2002; SocNetV, Kalamaras 2009), and could be used for this analysis. As with most social analysis methods, this approach will be unable to fully capture and represent every individual related to the network. It is therefore important that participants represent the full scope and extent of the co-created process, but are also within feasible and relevant boundaries. Similarly, it will also be important to collaboratively consider the ethical and strategic implications of any method adopted (Borgatti and Molina 2003). For example, issues such as participant anonymity will need to be discussed, as well as concerns as to how the results will be used to inform adaptive management of the RNC.

## Longitudinal evaluation

Although Reed (2008) does not include evaluation as one of the eight features of best practice stakeholder engagement in environmental research, evaluation is considered a best practice standard in a number of other key stakeholder engagement resources (e.g., Krick 2006, AccountAbility 2008, Durham et al. 2014). Evaluation of engagement efforts can introduce a way to recognise important gaps, recognise emerging relationships, and give participants of engagement a voice for providing feedback – a key theme recognised in the research done in this study. In addition to the quantitative structural insight provided by SNA, we propose that ongoing qualitative evaluation would be a valuable tool for monitoring the co-creation process and developing strong feedback loops.

In the collaborative New Zealand water catchment project TANK (Tutaekuri, Ahuriri, Ngaruroro, and Karamu river catchments), Cradock-Henry (2013) used longitudinal surveys to evaluate the ongoing collaborative process. They performed multi-criteria surveys of a boundary group, comprised of 30 individuals from the agricultural and horticultural sectors, environmental and community interest groups, and tangata whenua, over the course of TANK meetings (also see Chapter 3). Cradock-Henry (2013) remarks that formative evaluations, i.e., evaluations of the collaborative process, are less common than summative evaluations, i.e., evaluations of the outcomes of a collaborative project. However, he finds that formative, longitudinal evaluations are a valuable tool for facilitating continuous feedback and adaptive management of a project and that surveys were a pragmatic way to do this at low-cost and with minimal resources.

A combination of qualitative and quantitative approaches provides the best insight into stakeholder processes

– Lienert et al. (2013) pg. 146

We propose that longitudinal surveys which collect feedback on ongoing co-creation research and engagement efforts could be conducted in tandem with the surveys used to collect SNA data. Cradock-Henry (2013) employed quantitative 5-point Likert-scale questions which measured participants' agreement with how well the project was meeting different "success" criteria. We suggest that inclusion of open-ended questions for qualitative data collection would allow enhanced opportunity for feedback. Lienert et al. (2012) found that qualitative data about participatory relationships can add "fine-grained" insight into the project's social network, collaboration, and knowledge exchange.



# 7 Conclusions

## Conceptual and pragmatic implications for RNC co-creation and engagement

Co-created research requires taking an innovative approach to stakeholder engagement, which immerses and embeds stakeholders in the heart of the research decision-making process. Co-creation approaches depart from traditional one-way, top-down research approaches, and embrace a multi-directional flow of knowledge that empowers and enables all people affecting or affected by a research project to have a voice. Co-creation requires considerable time and effort, but carries with it a great potential for enduring and long-lasting solutions which will be useful, usable, and used by the people who need them. Through building long-term partnerships, integrating different disciplines and knowledge sources, and respecting multiple world views, co-created research offers an inclusive way to identify, frame, and resolve the complex and unstructured issues which face transformative resilience.

Adopting a co-created approach to natural hazard and risk research aligns with the national and international literature, and is supported by the New Zealanders sampled in this study. It offers exciting potential to expand the frontiers of environmental research, and to see New Zealand lead the way in this timely and relatively undocumented project paradigm. A number of challenges face large transdisciplinary environmental research projects, and it is important to be aware of the potential issues participants are likely to encounter, as well as the good practice measures which can help prevent such conflicts and difficulties. This report provides an overview of such considerations through a review of stakeholder engagement concepts in the transdisciplinary co-creation research literature, and through a primary study which investigates perspectives on a co-created approach to natural hazard and risk research in New Zealand.

Based on the literature review, scoping discussions, online surveys, and focus groups presented in this report, we draw a number of conclusions regarding conceptual and pragmatic considerations for fostering co-creation and stakeholder engagement in the RNC. These are presented throughout the report and are summarised in Table 8. We propose that these considerations, and the frameworks presented in Chapter 5, should be consulted to help guide and develop a thoughtful, informed, systematic, and successful co-created research process.



**TABLE 8** Conceptual and pragmatic considerations for engagement and co-creation in the RNC

Category	Points for consideration
<p>CONCEPTUAL</p> <p>Points related to principles, concepts, and framing of co-creation and stakeholder engagement</p>	<p>In a co-creation process, all participants should feel empowered, and be respected and valued equally.</p> <p>A transdisciplinary project should aim to break down barriers between groups of different disciplines and backgrounds by facilitating exchange and integration of different types of knowledge. The unique identity of each group and its knowledge should remain distinct.</p> <p>Diverse knowledge types (e.g., indigenous, experiential, generational, physical and social sciences) need to be valued, integrated, and respected.</p> <p>Tangata whenua are more than just another category of stakeholder, as outlined by a number of important pieces of legislation (e.g., Tiriti o Waitangi, RMA, LGA). Special consideration should be given to Māori world views and values throughout the project.</p> <p>Co-creation is a time-intensive process and limited resources will be a key challenge.</p> <p>Co-creation can be envisioned as an iterative cycle of co-designing, co-producing, co-disseminating, and co-evaluating.</p> <p>Participants should be careful about rhetoric, phrases, and language used, as labels and word choice can have both constructive and destructive impacts on a participant's perceived importance and value in the co-creation process.</p>
<p>PRAGMATIC</p> <p>Points related to carrying out engagement and co-creation in practice</p>	<p>A systematic and structured stakeholder analysis should be performed for each priority co-creation laboratory.</p> <p>It is paramount to engage with stakeholders early-on in the co-design phase of a research project. Setting the agenda and mutual goals together is a key feature of a co-created process.</p> <p>An experienced, skilled facilitator will be essential for many stakeholder analysis methods and stakeholder engagement exercises.</p> <p>Formation of a boundary organisation which includes representatives from all stakeholder categories may serve as a streamlined way to facilitate knowledge exchange among a wider network, and create a familiar and safe forum for discussion.</p> <p>Where appropriate, research teams should endeavour to align research objectives and engagement efforts with ongoing stakeholder activities and existing networks in order to make the best use of resources and to prevent redundancies and stakeholder fatigue.</p> <p>A central hub with open sharing of data and results can help encourage collective ownership of and accessibility to the new knowledge created.</p> <p>Learning from stories and experience of past hazard events in a research area is key, and this knowledge should be integrated into the research.</p> <p>Feedback loops are important for adapting the project to meet the changing needs of stakeholders over time, and researchers and stakeholders should agree upon how two-way communication and feedback will be built into each project.</p> <p>Longitudinal evaluation and monitoring of engagement can be a helpful tool for assessing the progress and evolution of a co-created project, and serve as a pathway for maintaining accountability and adapting project to address important gaps and issues.</p> <p>Clear, frequent communication between researchers needs to be maintained. This can offer transdisciplinary peer learning opportunities and prevent inconsistencies and miscommunication in regards to stakeholder engagement.</p>

*Based on the literature review, scoping discussion, online survey, focus groups, and stories presented in this report*

# Recommended Resources

## From Words to Action

Relevant resources on stakeholder engagement from a corporate background by AccountAbility and UNEP (Krick et al. 2006, Partridge et al. 2006)

[www.accountability.org/about-us/publications/the-stakeholder.html](http://www.accountability.org/about-us/publications/the-stakeholder.html)

- Stakeholder Engagement handbook (2 volumes)
- Templates for stakeholder engagement planning (8 templates)

## BiodivERsA Stakeholder Engagement Handbook

Comprehensive resources from a large-scale European transdisciplinary research project (Durham et al. 2014)

[www.biodiversa.org/577](http://www.biodiversa.org/577)

- Stakeholder Engagement handbook (1 volume)
- Practical method notes (12 2-3 page summaries of relevant techniques)
- Templates for stakeholder engagement planning (8 templates)

## Engaging Queenslanders

Handbook providing summaries, advice, and examples of engagement methods

[www.qld.gov.au/web/community-engagement/guides-factsheets/methods-techniques/](http://www.qld.gov.au/web/community-engagement/guides-factsheets/methods-techniques/)

- Community Engagement handbook (1 volume)

## Managing Natural Hazard Risk in New Zealand - Towards More Resilient Communities

Overview of law, policy, roles, responsibilities, and regulation in management of natural hazard risk in NZ (Willis et al. 2014)

[www.lgnz.co.nz/home/our-work/publications/managing-natural-hazard-risk-in-new-zealand-towards-more-resilient-communities/](http://www.lgnz.co.nz/home/our-work/publications/managing-natural-hazard-risk-in-new-zealand-towards-more-resilient-communities/)

- Future directions and goals for natural hazard and risk are outlined

## Good practice guidelines for working with tangata whenua and Māori organisations

Review of legislation, tikanga, and other special considerations for engaging with tangata whenua (Harmsworth 2005)

[www.landcareresearch.co.nz/publications/researchpubs/harmsworth\\_good\\_practice\\_tanagata\\_whenua.pdf](http://www.landcareresearch.co.nz/publications/researchpubs/harmsworth_good_practice_tanagata_whenua.pdf)

- Checklist/summary of best practice considerations
- Templates for evaluating principles of engagement with tangata whenua

## Māori Values Supplement - Making Good Decisions Workbook (RMA)

Summary of Māori environmental concepts, advice for incorporating matauranga Māori into decisions (Majurey et al. 2010)

<https://www.mfe.govt.nz/sites/default/files/maori-values-supplement.PDF>

- Glossary of key Māori environmental concepts and values
- Explains responsibilities for integrating Māori in environmental decisions based on the Resource Management Act

## Knowledge co-creation: Interaction between science and society

A review of co-creation as an approach to transdisciplinary research

(Regeer and Bunders 2009)

[www.managingforimpact.org/resource/knowledge-co-creation-interaction-between-science-and-society](http://www.managingforimpact.org/resource/knowledge-co-creation-interaction-between-science-and-society)

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National  
**SCIENCE**  
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Kia manawaroa –  
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