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- KOSTENWAHRHEIT IN DER KLIMAPOLITIK
- REFLECTING ON TRANSDISCIPLINARITY WITH *I2S*

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Designing transdisciplinary projects for collaborative policy-making

The *Integration and Implementation Sciences* framework as a tool for reflection

Collaborative policy-making has increased in New Zealand, and with it has brought new demands for supporting research. As a tool for reflection of projects where both research and societal outcomes of policy and practice change are pursued and multiple knowledges are recognised, we use the Integration and Implementation Sciences *framework. We present insights for the design and implementation of transdisciplinary research from the* Selwyn Waihora Project, *which aimed to produce socially robust information to support land and water policy-making in New Zealand's South Island.*

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Abstract

The *Selwyn Waihora Project* was a research project supporting a collaborative policy-making process to set environmental limits in the Selwyn Waihora catchment in New Zealand's South Island. In this *Design Report* we reflect on this project based on data collected from a range of project participants approximately two years after project completion. The data collection was guided by the *Integration and Implementation Sciences* framework *(i2S)*. On the basis of participant responses, and the authors' first-hand experiences working on the project, we present insights for transdisciplinary research. Through the questions asked by the *i2S* framework insights emerged on: what it means to honour community values; the importance of context but that projects can pay too much attention to it; boundary objects to foster integration across multiple knowledge systems; the value of intra-team narratives for translation; the importance of considering the losers of the research; and sharing the burden of uncertainty.

Keywords

boundary object, collaborative policy-making, intra-team narratives, New Zealand, Selwyn Waihora catchment, transdisciplinary research, uncertainty

The popularity of collaborative environmental decision-making in New Zealand has increased in recent years (Cradock-Henry et al. 2017). The first attempt to use this approach for setting environmental limits in New Zealand was in the Selwyn Waihora catchment[1] (figure 1). Environment Canterbury (ECan), the largest regional government in the South Island, ran a collaborative policy-making process between 2011 and 2015 in the Selwyn Waihora. This process was supported by a research project, the *Selwyn Waihora Project (SWP)* (Robson 2014). The *SWP* team aimed to produce socially robust information (Polk 2014) to support land and water policy-making and implementation, as well as building understanding of the potential environmental, economic, social and cultural consequences of future land management decisions. Given the recent shift towards collaboration and the existing conflict around water resources within the catchment, the *SWP* set out to include not just the relevant scientific disciplines, but also sources of local, stakeholder and Māori (indigenous) knowledge *(mātauranga Māori)* to increase the research's relevance, credibility and legitimacy to all of the parties involved and affected (Cash et al. 2003). Although the *SWP* team did not use the term transdisciplinary to describe their work at the time, the parallel working across both science and societal issues (Bergmann et al. 2012), bringing not only disciplinary knowledge together but also recognising the importance of local and indigenous knowledge (e. g., Hirsch Hadorn et al. 2006), and the participation of stakeholders in the research (Pohl 2011) justifies the term.

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We collected data on the *SWP* as part of a separate research programme to evaluate Bammer's 2013 *Integration and Implementation Sciences (i2S)* framework. *i2S* provides a systematic way to describe and assess the methods used in complex real-world research, but is relevant for drawing out lessons for transdisciplinary research as it focusses on projects where both research and societal outcomes of policy and practice change are pursued and multiple knowledges are recognised. The data collection comprised interviews and workshops with the *SWP* team and end users. These end users were the Selwyn Zone Committee (ZC), a group established by ECan to recommend environmental limits, and ECan staff. The reflections we report in this paper are therefore derived both from the authors' first-hand experiences of the *SWP*, contemporaneous project notes and reports, and the insights gained through the interviews and workshops. We do not reflect here on the *i2S* framework per se, only the insights revealed through describing the *SWP* using the *i2S* framework. We structure the insights into three research stages: *design*, *implementation* and *dissemination*.

The *Selwyn Waihora Project*

The purpose of the *SWP* was to inform the environmental limit-setting process in the Selwyn Waihora catchment, where many waterbodies are highly valued culturally, economically and for recreation. The population in the areas is growing rapidly and is approximately 60,000, with approximately seven percent Māori. The catchment is also home to a large area of irrigated agriculture (CMF 2009). At the start of the *SWP*, the deleterious environmental and cultural impacts of land-use intensification, made possible through irrigation, were already apparent (e. g., Stevenson et al. 2010, Tipa 2013 a). The key local and national factors that influenced the design of the *SWP* were:

- conflicts between cultural, environmental, economic and recreational uses of water (CMF 2009);
- an acrimonious local history of water management characterised by battles of science and exploiting uncertainty (Duncan 2017, Weber et al. 2011);
- uncertainty in biophysical information;
- the non-statutory *Canterbury Water Management Strategy*, with aspirational targets for all aspects of water management (CMF 2009);
- increased Māori engagement in environmental management, and co-management of lake Te Waihora;
- a temporary *Act of Parliament*[2] (2010–2016) which replaced elected with appointed officials, gave special weight to the *Canterbury Water Management Strategy*, and took away the right to appeal decisions to a higher court;
- historic marginalization of Māori in water governance (LAWF 2010, p. 3);
- concurrent establishment of national policy guidelines for freshwater management (MfE 2011, 2013).

The *SWP* team worked with a range of stakeholders at different stages in the research process (figure 2, p. 173), however the ZC were their main audience. The Selwyn ZC is one of ten committees in the region instituted as part of the *Canterbury Water Management Strategy*. The Selwyn ZC is made up of six mandated Māori representatives, two appointed local and regional council members, and five selected community representatives (who applied for a position on the committee). Ngāi Tahu (the local Māori tribe) is comprised of multiple groups called *rūnanga*. The number of Māori representatives on a committee is determined by the num- >

1 Catchment: an area of land, typically defined by the natural landscape, where water drains to a common river, lake or aquifer.

2 *Environment Canterbury [Temporary Commissioners and Improved Water Management] Act* 2010.

DESIGN REPORTS

GAIA regularly publishes the results of transdisciplinary projects. Yet, reporting results leaves little room for discussing the project *design* and the processes shaping it. *GAIA* thus offers a unique opportunity: the ***Design Report***. This format is aimed at researchers working in interdisciplinary teams and/or with stakeholders from outside academia.

Design Reports analyze the decisions that determine the design of the research and communication of a project, offering a critical explanation and discussion of them, paying special attention to the question of how partners from scientific and non-scientific cultures communicate, what kind of communication architectures they have, and how they handle the results.

Design Reports contribute to raising the level of experience in the setting-up and implementation of inter- and transdisciplinary projects with a focus on research and communication. They include recommendations or lessons learnt. ***Design Reports*** are subject to double blind peer review and should present original research.[a]

a For more details see *https://ojs.oekom.de/downloads/GAIA_author_guidelines_design_reports-OTH.pdf*.

FIGURE 1: The Selwyn Waihora catchment with lake Te Waihora.

TABLE 1: Assessment matrix for a range of scenarios and their predicted consequences for the Selwyn Zone Committee's priority outcomes. Adapted following a feedback of the Zone Committee and and other stakeholders, finalized. a *Wāhi Tapu* means sacred place, *mahinga kai* means food or resource

PRIORITY OUTCOMES	CURRENT	PERMITTED BASELINE SCENARIO
Are the Zone Committee's priority outcomes supported in the scenario?		
thriving communities and sustainable economies	possibly supported currently	as current
high quality and secure supplies of drinking water	possibly supported currently	unlikely
***Wāhi Tapu* and *mahinga kai* are respected, understood, protected and enhanced**[a]	unlikely/is not supported currently	highly unlikely/no
healthy lowland streams	unlikely to be supported currently	highly unlikely/no
lake Te Waihora is a healthy ecosystem	unlikely to be supported currently	unlikely
hill-fed waterways support aquatic life and recreation	possibly supported currently	possibly
enhanced indigenous biodiversity across the Zone	unlikely to be supported currently	unlikely

ber of *rūnanga* in the committee's geographic area, with many committees having one or two Māori representatives. The high number in the Selwyn Waihora signifies the cultural importance of the area, especially lake Te Waihora. This made the Selwyn ZC and the policy-making process in the area unique as Māori have a particular relationship with water. In the Māori world view water is imbued with its own life force, its *mauri,* and people are connected by lineage to their waterways. This is a very different framing to one characterised by resource management (Wilson and Inkster 2018). In relation to aspirations for water there was a high degree of agreement between all six *rūnanga*. Although the tensions between these framings were mainly grappled with within the decision-making processes of the ZC, it did require sensitivity from the *SWP* team in terms of the methods employed in researching cultural wellbeing and approaches to integration.

Insights for research design

Honouring community values

Differing views on what is considered relevant is a common transdisciplinary challenge with researchers and planners traditionally having a privileged role in defining environmental problems (Wesselink et al. 2013). The *SWP* team felt they needed to produce knowledge that was relevant to the ZC and community as well as scientists and policy-makers (after Cash et al. 2003). However, instead of a joint problem framing exercise between the ZC, ECan and researchers to establish the scope for the research, the *SWP* team resolved to directly use the priority outcomes to guide the scope by determining what was considered relevant (Robson 2014). Priority outcomes are a set of social, environmental, economic and cultural aspirations for the catchment that were established through a broad community process run by the ZC (SWZC 2012) prior to the *SWP* starting (for priority outcomes see table 1). There were some consequences to this decision in terms of credibility discussed in later sections however, in the context of the previous conflict around water management, the use of priority outcomes in this way was considered by both the *SWP* team and end users as an effective means to recognise and embed multiple local and indigenous values in the research, and an important factor in building the relevance of the research.

Context matters, but you can pay too much attention to it

Transdisciplinary research is, by its nature, highly contextual, needing strategies that are sensitive to the demands of the circumstance (O'Rourke 2017). The *i2S* framework specifically asks what circumstances might influence the research from individuals who might be barriers or facilitators, through to the big picture context (Bammer 2013). The *SWP* team were highly aware of, and responsive to, the context that affected their research. An example of this attention to context was the development of the research purpose. The move away from the linear science-into-policy "decide and defend" policy-making by ECan to collaborative freshwater policy-making (Robson-Williams et al. 2018, Weber et al. 2011), signalled a recognition that these resource use decisions were not purely technical affairs, they required value judgements (LAWF 2010, p. 5). In response, the *SWP* team developed a clear research purpose: not to try and give a "right" science answer, but instead to make clear the likely consequences of future options to support informed value judgements. An approach that was considered successful by the end users.

However, in another part of the project, the *SWP* team were, perhaps, too influenced by context (Robson-Williams et al. forthcoming). The ZC were asked to describe, in a series of narrative statements, what the catchment would look like if each of the priority outcomes were realised. Based on these descriptions, the *SWP* team chose indicators that they would use throughout the project. However, being acutely aware of the history of water management conflicts, traditional privileging of western science perspectives, and the current era of collaboration, the *SWP* team took the narrative statements and hence the indicators uncritically. The *SWP* team did not create an opportunity to bring forward relevant scientific knowledge that perhaps contradicted or tested parts of the narrative statements and indicators thereby exploring with the ZC what constituted acceptable. When it came to testing future scenarios against the indicators, and determining the extent to which

from the executive summary of the planning report (Robson 2014, p. 24). On the basis of the scenarios a package of solution measures was drafted and, or food gathering place.

AGRICULTURAL INTENSIFICATION SCENARIO	AGRICULTURAL INTENSIFICATION WITH MITIGATION SCENARIO	MEETING ENVIRONMENTAL ASPIRATIONS SCENARIO	DRAFT SOLUTIONS PACKAGE	FINAL SOLUTIONS PACKAGE
Are the Zone Committee's priority outcomes supported in the scenario?				
probably improved	probably improved	unlikely to improve across whole catchment	probably improved	probably improved
unlikely	possibly	possibly	unlikely	unlikely
highly unlikely/no	possibly	possibly	possibly	possibly
highly unlikely/no	unlikely	possibly	probably	probably
unlikely	possibly	probably	probably	probably
probably	probably	possibly	probably	probably
unlikely	possibly	possibly	probably	probably

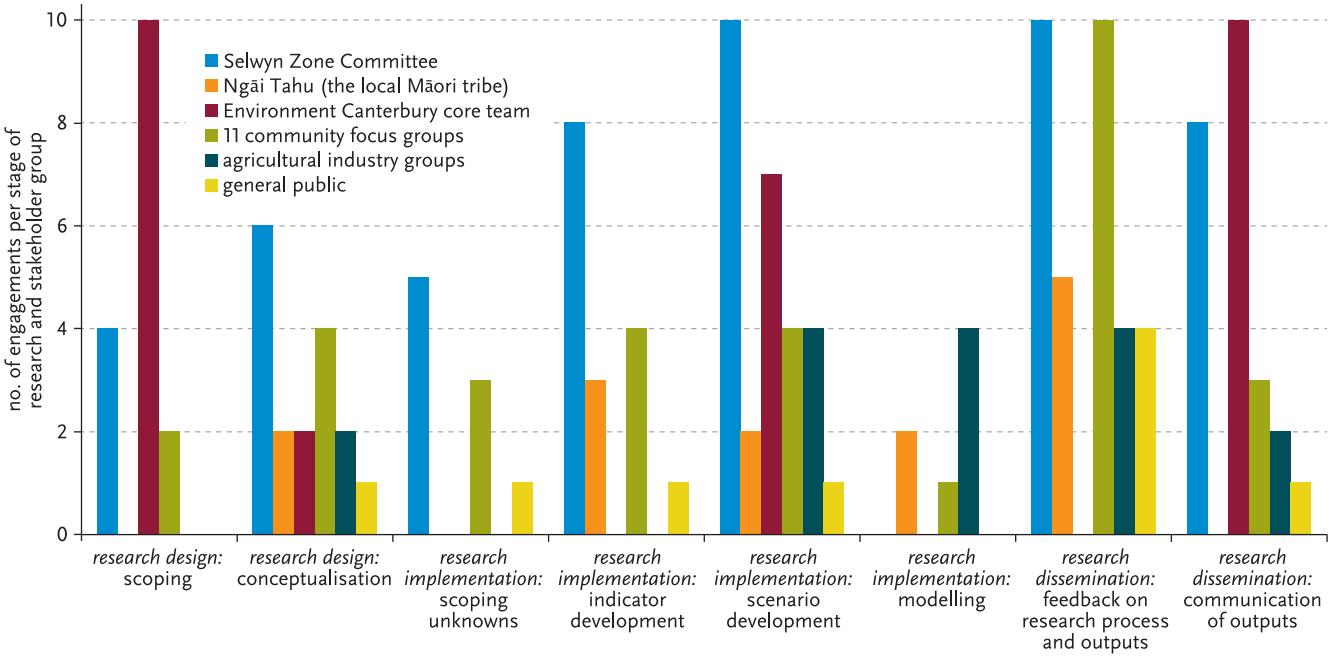
community aspirations were met by these future scenarios, there were some indicators that were difficult to use and the *SWP* team were faced with the need to make their own value judgements about when these indicators reached acceptable standards. Had the technical team engaged more critically with the ZC on the narratives, it is likely that there would have been more robust and appropriate indicators and understanding of acceptability.

Consider the losers

Bammer (2013, p. 21) notes the importance of the research team understanding who will benefit from the research, to help target research efforts most effectively. Data from the *SWP* workshop showed that the potential beneficiaries of the research were considered by the *SWP* team. The main intended beneficiaries were ECan (the project sponsors) and the ZC. The benefits envisaged were richer, more agreed information to make better-informed decisions, and greater likelihood of implementation (e. g., Krueger et al. 2012, Voinov et al. 2016). The *SWP* team reflected that as well as knowing the beneficiaries, they would have been well served by explicitly considering the potential losers as well.

Although ECan was identified as a beneficiary, it was only considered at an organizational level. During the project the *SWP* team encountered different views on the project's benefits from different organizational groups in ECan. The shift in research purpose to an "inform, not lead" model meant a shift away from planning decisions based on scientific defensibility to planning decisions based on ZC consensus. At the time, the *SWP* team did not recognise that for some in ECan this approach meant a perceived loss >

FIGURE 2: Number of engagements (e. g., workshops, public meetings) between the *Selwyn Waihora Project (SWP)* team and stakeholders for different research stages: *design*, *implementation* and *dissemination*.



of defensibility and credibility, despite aligning with the broader organizational objectives. In the latter stages of the process, the *SWP* felt considerable pressure from some within ECan to "just give an [science] answer" and noted that there was frustration when this was not done. In the early stage of the project the *SWP* team had identified a project champion within ECan who was asked to help guide the project. Earlier identification of the potential losers and the consideration of beneficiaries at the individual, team and organizational level may have helped the project team to be better prepared, and better able to benefit from the intervention of the project champion.

Insights for research implementation

Boundary objects for integration

Integration is a key component and challenge in transdisciplinary research (Gaziulusoy et al. 2016, Konig et al. 2013). In New Zealand, notions of integration can be problematic with indigenous knowledge systems, and related research methods, at risk of being subsumed into the western science knowledge system through an attempt to achieve "integration" (Wilson and Inkster 2018). The *SWP* team decided that some of the assessments needed to be done separately, akin to multidisciplinary research, to preserve the distinctness of the knowledge systems. As such a year-long project was conducted by local *rūnanga* to determine and assess cultural health in the area (Tipa 2013 b), that ran in parallel to more traditional hydrological, ecological, social and economic modelling and assessments. However, the *SWP* team needed to provide integrated and digestible information to the ZC, and avoid the multi-disciplinary problem of appraising options in isolation (Krueger et al. 2016). So they made the priority outcomes the focus of integration. The breadth of each outcome was such that no indicator could directly predict the impact of future scenarios; there were multiple indicators and they needed interpretation. This required the *SWP* team to agree what the results from each scenario meant vis-à-vis the outcomes. That the priority outcomes covered social, cultural, economic and environmental aspects helped reduce the dominance of any one perspective in these discussions. The assessment matrix (table 1) was created and populated to capture the results. Through combining the priority outcomes with *SWP* interpretations, the matrix became an important boundary object (Star and Griesemer 1989) both within the *SWP* team and the ZC.

Sharing the burden of unknowns

Explicit management of unknowns is an underappreciated element of transdisciplinary research (O'Rourke 2017), but ignoring them can lead to adverse unintended consequences and nasty surprises (Bammer 2013). Bammer notes that acceptable levels of uncertainty and ways of managing unknowns may vary widely in a research project. The use of priority outcomes to scope the research expanded the number and types of unknowns, and the uncertainties in the modelling by posing previously unasked questions. There were varying levels of anxiety with the *SWP* at the range and magnitude of uncertainty within the modelling. At times this caused delays with some scientists wanting to do further analysis or data collection to better calibrate or justify model assumptions. To try and manage these concerns while still continuing with the research, a modelling decision logbook was created and maintained by the lead scientist in the *SWP* team. The joint discussion, the recording of the consequences, and the decision meant that the "burden" of the uncertainty was shared between scientists and the lead scientist. It allowed a wider set of considerations to be taken into account in the decision that is how important was this modelling decision in the overall project, or compared with other parts of the research.

Insights for research dissemination

Intra-team stories

Communication is at the heart of transdisciplinary research (O' Rourke 2017) and is a continual challenge in transdisciplinary projects (Pohl and Hirsch Hadorn 2008). The analysis conducted by the *SWP* team involved a chain of 13 steps covering biophysical, economic, social and cultural assessments, each using different models and approaches as well as different disciplinary languages. In addition to passing on data and analysis along the chain, each member wrote a narrative description in non-technical language of what the results were, and described the direction, magnitude and significance of the results as a change from the current state. This enabled others in the technical team to understand the meaning and significance of all the analyses and proved highly useful for translating and disseminating the results for the ZC.

Lessons

As with many projects, the *SWP* had both successes and failures, but overall can be considered successful in its objective of producing socially robust information to support policy-making as the ZC's recommendations and the underpinning science were largely accepted in the hearings, despite one early challenge that proposed an alternative catchment conceptual model. After many years of stalemate with water management in the area, the policies and regulations governing land and water management in the area are now operative.

We suggest six insights for transdisciplinary research:

Research design

- Pay attention to the trade-offs between relevance and credibility. Uncritically embedding community values in the research helps build a sense of relevance of the work with some, but reduces the credibility for others.
- Pay attention to the context that can influence the research from champions and detractors to historic and current circumstances. But be aware of how the research team is responding to context, to ensure they are not disproportionately influenced by it.

- Conduct a thorough and explicit consideration of the intended beneficiaries and the probable losers of the research, not just at an organizational scale but considering groups and even individuals within an organization and the project team.

Research implementation

- Where you have multiple knowledge systems, consider the use of boundary objects as a point of integration.
- As a way of sharing the burden of uncertainty in projects where there are multiple models and assessments, maintain a modelling decision logbook documenting research challenges, assumptions, considerations and decisions.

Research dissemination

- In a research team with multiple disciplines and knowledge systems, use intra-team narratives to facilitate not only data exchange but understanding of the meaning and interpretation of the data across the research team.

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