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Shifting knowledge practices for sustainable land use: Insights from producers of Aotearoa New Zealand

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Governments have been introducing regulations alongside sustainability-focused incentives, programs, and policies to help address environmental issues associated with agriculture. In this new ecological and policy context, where the socio-economic consequences of environmental limits are beginning to be experienced, old questions are being asked about how agricultural producers engage with advice and advisors and what factors might facilitate a faster transition to more sustainable land use. This paper presents research from Aotearoa New Zealand where a nationwide survey and focus groups have examined how producers are using advisory services. The research draws on the 'triggering change' cycle to explain how imperatives to shift to more sustainable land use are changing the knowledge practices of producers and their relationships with farm advisors. The research highlights the importance of conceiving producers as curators of advice and information rather than mere recipients, which involves doing their own research to identify what role they want an advisor to play. These findings have important implications for the development of future extension programs to help producers adopt, adapt and/or co-design more sustainable land use practices.

KEYWORDS

sustainability transition, extension, farmer knowledge, farm advisors, triggering change cycle

1 Introduction

Industries such as agriculture, horticulture, and forestry contribute to economic, social, and cultural development and prosperity globally (Radetzki and Wärell, 2020). However, these industries also generate externalities that can degrade ecosystem services (Green et al., 2005; Balmford et al., 2018). One nation experiencing these tensions is Aotearoa New Zealand (NZ). In 2017 the Organization for Economic Co-operation and

Development (OECD) reported that NZ's economic growth model, which is based on the exploitation of natural resources, is beginning to exceed its environmental limits (OECD, 2017). This is evident in NZ's agricultural land use contributing 49% of the nation's greenhouse gas emissions, the highest share for agriculture in the OECD (OECD, 2017; Chandrakumar et al., 2019). Furthermore, the environmental effects of intensive agriculture on freshwater quality have become a social justice issue for the nation's indigenous Māori population. This issue is politically and administratively challenging to solve with local governments struggling to impose enforceable limits on nutrient losses from agricultural land (Duncan, 2014; Foote et al., 2015; Duncan, 2016; Duncan, 2017; Duncan et al., 2018; Hughey et al., 2019; Kirk et al., 2020; Phiri et al., 2020; Ministry for Primary Industries (MPI) 2021c).

Nevertheless, over the past decade, as NZ's central government has introduced policies and regulations to address issues such as water quality, a range of sustainability-focused incentives and programs have also been developed to encourage change in farm systems and practices (Duncan & Kirk, 2020). While change has been occurring, it has been slow and many land, marine, and freshwater species remain threatened (Ministry for the Environment (MfE) and Statistics New Zealand (StatsNZ), 2022: 18). Hence, central government has sought to hasten the pace of change in farm systems. In 2019, it allocated \$229 million over four years to the Productive and Sustainable Land Use package to promote "farm land use practices that deliver more value and improve environmental outcomes" (Ministry for Primary Industries (MPI) 2021a). The package includes:

- On the ground help to support on-farm changes
- Information about other land use options
- Advice and support from professional farm advisors
- Help with the development of higher value food and fibre products
- Greater focus on farmer-led approaches, with farmers driving the change and sharing their knowledge with other farmers (Ministry for Primary Industries (MPI) 2021a)

Other government initiatives include the Māori Agribusiness Extension programme, which encourages clusters of Indigenous producers to connect with each other to share lessons about changing to more sustainable farm systems (Ministry for Primary Industries (MPI) 2021b). To help implement the Productive and Sustainable Land Use package, the Ministry for Primary Industries (MPI) funded this research to investigate how producers use advisory services and to gather their perspectives on how they could be improved.

At first glance, changing primary production practices to achieve more sustainable outcomes might appear straightforward given the apparent success of agricultural

extension in the past (Black, 2000; Blackstock et al., 2010; Mills et al., 2019; Cofré-Bravo et al., 2019). Broadly, extension research has conceptualized four different ways in which producers engage with scientists and advisors: linear 'top-down' transfer of knowledge, participatory 'bottom-up' approaches, one-to-one knowledge exchange, and formal education and training (Black, 2000).

The linear top-down approach involves new knowledge and technologies being developed by scientists and researchers who then transfer this knowledge to producers directly, *via* publications or extension activities. This mode of extension typically relies on 'early adopters' to encourage neighbors or colleagues to follow their example (Rogers, 2003; Brown et al., 2016; Small et al., 2016). However, this does not always occur as a range of factors influence adoption (Russell et al., 1989; Dunn 1997, as quoted in Black, 2000: 494). As a result, some farmers have begun to lose faith in linear technology transfer schemes (Wood et al., 2014; Dolinska and D'Aquino, 2016).

Given concerns that the above approach relies substantially on one-way communication and is limited by its lack of capacity to tailor insights to particular farm contexts, alternative bottom-up and two-way engagement approaches began to be formulated (Braun and Duveskog, 2011; Knook et al., 2018). The aim of these bottom-up approaches was to empower producers and to provide opportunities for advisors to listen to producers. However, it was often the case that producers were simply delegated to passing knowledge on to researchers who then devised solutions, with Lacombe et al. (2018) noting that farmers were seldom included as equal co-designers. The bottom-up approach was also criticized for relying on "farmers' local knowledge to solve problems that were new to their experience, such as many environmental problems" (Vanclay and Lawrence, 1995: 125-6). Co-design based on human-centered design has begun to be applied in agriculture to stimulate innovation (Casey et al., 2015; Turner et al., 2017; Pigford et al., 2018) but limited research has focused on how to deliver such processes with farmers (Prost, 2021).

One-on-one provision of advice to producers remains a popular method of knowledge exchange through, for example, fee-for-service consultants. Group-based approaches to agricultural extension have also become popular due to the perception they are more efficient than targeting one producer at a time (Black, 2000; Thomas et al., 2020). Universities provide another pathway for producers to access advice and information about new practices and technologies (Black, 2000). However, it is usually those who complete high school who go down this path.

While these modes of extension appear clear-cut, and in their various forms have been successful, research on extension and practice change in the primary production sector highlights that the process through which producers receive advice and then decide to make changes on land is complex (Vanclay and Lawrence, 1994; Sutherland et al., 2013; Black, 2000; Blackstock

et al., 2010; Koutsouris, 2014; Kuehne et al., 2017; Duncan & Kirk, 2020; Klerkx, 2020; Knook et al., 2020; Thomas et al., 2020). It has also been recognized through social practice theory, for example, that individual producers are often limited in what they can change due to government policies and/or incentives, technologies and infrastructures that become embedded in farm systems and the cultures of producers (Shove, 2010; Shove et al., 2012; Strengers and Maller, 2012; Spurling et al., 2013; Delaney and Fam, 2015). Research on agricultural innovation systems and agricultural knowledge systems has, for many years, acknowledged the increasing complexity of farm decision making, and how it is influenced by networks of farmers, consultants, researchers, local and central government agencies, and other civil society actors who contribute to the production, exchange, and utilization of agricultural knowledge (Klerkx et al., 2012; Eastwood et al., 2017; Ingram, 2018; Sutherland and Marchand, 2021).

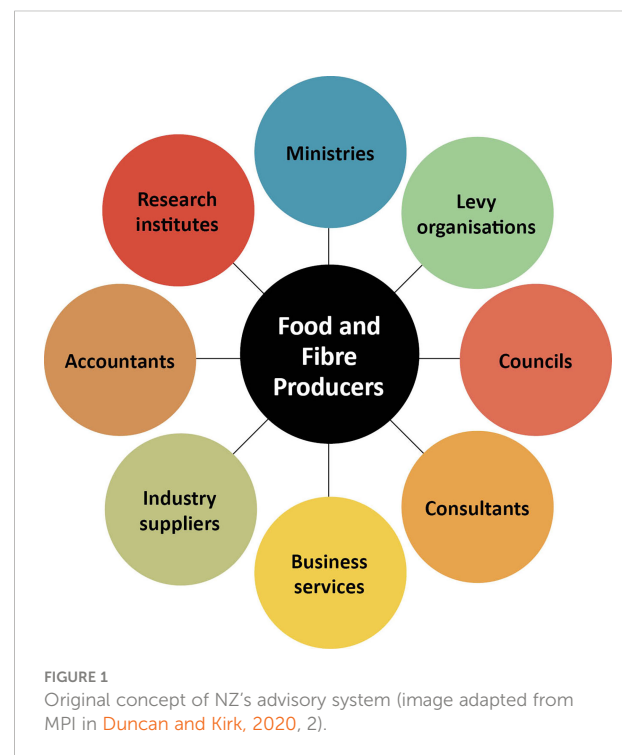
Importantly, it has also been recognized that the traditional modes of extension are based on the erroneous assumption that the reason why producers do not adopt recommended land use practices is a lack of knowledge. This knowledge-deficit behavioral model has been widely criticized for the gap-filling solutions it often invokes that are not sufficiently targeted or context specific nor appropriately communicated (Irwin and Wynne, 1996; Blackstock et al., 2010; Fleming and Vanclay, 2010; Moser, 2010; Calo, 2018; Duncan et al., 2018). However, producers cannot rely on their experiential knowledge alone to adapt to new and novel environmental and economic challenges (Vanclay and Lawrence, 1995) or to calculate the costs and benefits of new and novel sustainable land use practices. This means transitioning production to more sustainable land use will require producers to utilize the advisory system. As mentioned, the purpose of the research was to examine how producers are using the advisory system and to gather their perspectives on how it could be improved.

Similar to what has occurred internationally, NZ's agri-food advisory system changed radically in the 1980s when central government's cost-cutting measures withdrew funds from agencies that had been offering one-on-one extension services to producers. The rationale was that these services should be provided by the private sector on a fee-for-service basis (Hall and Kuiper, 1998; Botha et al., 2008; Parminter, 2011; Klerkx, 2020). These changes have resulted in fragmentation of the primary industry advisory system, making it difficult to coordinate activities and knowledge generation of different private and public entities (Black, 2000; Duncan and Kirk, 2020; Scarlatti and Geosocial Technologies, 2021). Nowadays, key actors within the advisory system are consultants who provide fee-for-service advisory services. Importantly, with the move of advisory services to the private sector, these consultants have tended to focus their advice on financially compelling topics such as improving production, productivity and efficiency on the basis this is what they believe producers want

(Duncan and Kirk, 2020). While advice on these welcome topics has been central to the success of NZ's primary production sector and terms of trade over past decades, it has meant that advice and expertise on sustainability-based topics, or what could be classed as 'optional' topics, has been limited (Duncan and Kirk, 2020). Confirming this, Scarlatti and Geosocial Technologies (2021) recently reported that there are few specialized environmental consultants in NZ, with 74% of their survey respondents reporting that consultants who could help prepare farm environmental plans in their region was low or critically low.

Given this gap, as central government has introduced environmental regulations over the last decade, government ministries, business services (e.g., organizations selling products such as fertilizer), research institutes, industry levy organizations (e.g. Dairy NZ, Beef & Lamb NZ), industry suppliers (e.g., co-operatives like Fonterra) and regional councils have been providing sustainability-focused information and advice to producers. Industry levy organizations and regional councils have been providing group-based forums and land management officers who work directly with producers. These services are funded through levies paid to industry groups by producers and council rates. Given this, we initially conceived these actors, organizations, and institutions as constituting NZ's advisory system (Figure 1).

While changes in government policy and enabling programmes have been introduced, producers have been experiencing imperatives for change also through environmental cues such as diminished water security and unpredicted weather events. In



addition, changes in information and communication technologies mean that producers now have unprecedented access to advice and information *via* the internet. In this new ecological and policy context, old questions are being asked about how producers engage with advice and advisors and what factors might facilitate a faster transition to more sustainable agricultural land use.

This paper is structured as follows. First, we present our conceptual framework, which draws on the ‘triggering change’ cycle in Sutherland et al. (2013). After outlining our methods, we present key aspects of the results of our online survey. We focus on topics producers have sought advice and information in the past and topics they say they need advice for the future. We also look at the sources producers have been using and their perspectives on the relevance and trustworthiness of the advice and information they have received from these sources. We then discuss the key themes derived from our focus groups which add depth to our survey results and our understanding of the knowledge practices of producers. We conclude by discussing the implications of our findings for current models of extension and argue that a shift in thinking is needed from conceiving producers as mere recipients of advice and information to curators whereby they weave together the advice and information they need from within and outside the advisory system to identify what role they want an advisor to play.

2 Conceptual framework

2.1 The ‘triggering change’ cycle

Sutherland et al. (2013) ‘triggering change’ cycle draws on interviews with producers in the United Kingdom who shifted

from conventional to organic farming. Sutherland et al. (2013) conclude that minor changes on-farm happen incrementally at an operational level, but major changes most often occur in response to trigger events. Sutherland et al. (2013: 144) argue that most farm trajectories are typified by path dependency (Wilson, 2008), but that certain trigger events force producers to consider if “system change is necessary to meet farm management objectives”. These trigger events could be diverse, such as natural hazard events like floods or droughts, which affect productivity, or deaths in the family, which prompt considerations about farm succession planning. Trigger events break producers out of a state of path dependency as producers conclude their current farm trajectory will be unable to achieve their goals (Thelen, 1999; Pierson, 2000; Wilson 2008, Wilson, 2008).

Sutherland et al. (2013) present a five-step process for conceptualizing major changes on farm following a trigger event (see Figure 2). The first step is a state of path dependency that is broken by the second step which is a trigger event. Following a trigger event, the third step is an active assessment phase when producers seek available information and advisory sources to identify different options, potentially testing these options through on-farm experiments. The fourth step is the implementation of changes which is followed by a consolidation stage whereby producers assess the successes and failures of the changes made. If the producer decides to retain the changes, the cycle returns once again to path dependency. If the producer decides the changes have not been successful, they will return to the active assessment phase of the cycle to consider their options.

Producers encounter advice and information during path dependency, but Sutherland et al. (2013: 147) argue producers

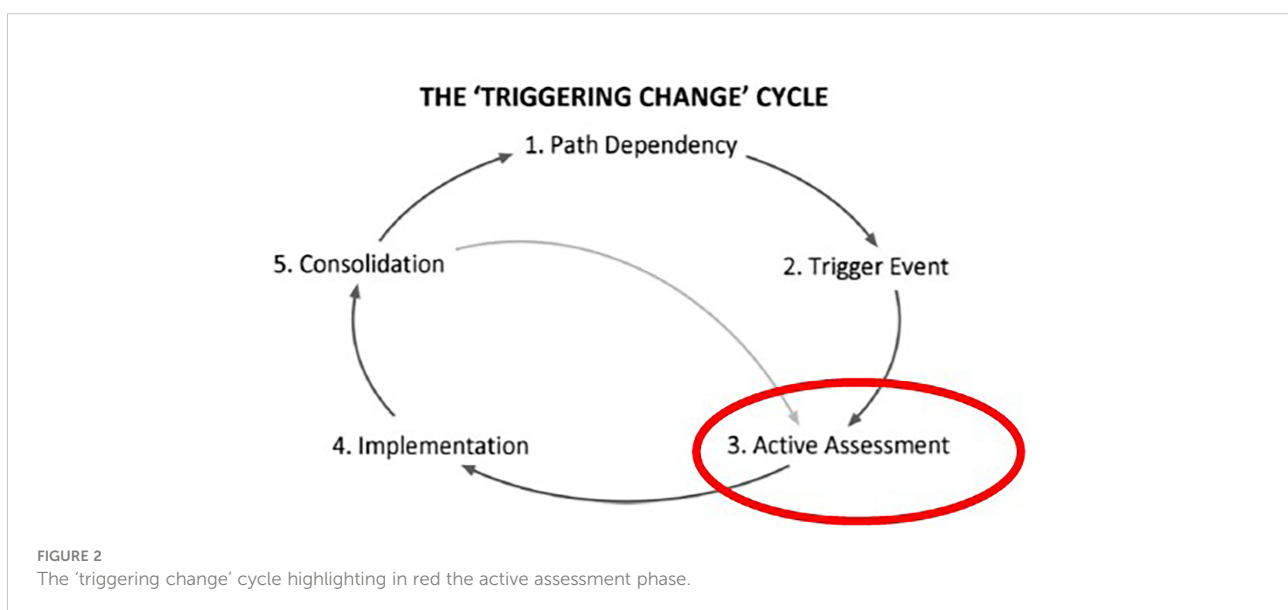


exhibit “peripheral route processing” during this step, which means they are passively receiving information and storing it in their minds for potential later use. After a trigger event, however, producers shift gears and start “central route processing” whereby they begin to overtly seek advice and information to help inform decisions moving forward (Sutherland et al., 2013: 147). Hence, following a trigger event, producers start looking for information, exploring and assessing options, talking with other producers, and seeking advice from experts.

Rose et al. (2018) argue that events like Brexit as well as calls for sustainability, have been ‘trigger events’ for the United Kingdom’s agricultural sector. Arguably, similar sustainability-based ‘trigger events’ have been occurring in NZ (van den Dungen et al., 2011). In the last ten years, policy reforms have also shifted advice topics from being seen by producers as optional to no-choice (e.g. farm environment plans, water quality and biosecurity management practices) (Duncan & Kirk, 2020).

Advisors play an important role in the active assessment phase of the triggering change cycle as this is when producers are gathering information from a range of sources about options and possibilities and exploring the economic, managerial, and social implications of making a change. Past research on producer extension and advisory services offers some clues as to what might enhance advice during the active assessment phase.

For example, producers perceive advice to be relevant if it is tailored towards boosting their productivity (Alarcon et al., 2014; Aydogdu, 2017). Producers find advice trustworthy if they respect the expertise and experience of advisors (Blackstock et al., 2010; Sutherland et al., 2013), such as advice from veterinarians (Jelinski et al., 2015; Small et al., 2016; Ritter et al., 2019). Producers perceive advice to be trustworthy if they have an established relationship with an advisor. For example, advisors from fertilizer companies, crop consultants, seed suppliers, and university extension services have been identified by producers as being trustworthy sources of advice and information in their field of expertise because they were able to establish relationships with producers over time (Russell and Bewley, 2013; Stuart et al., 2018; Houser et al., 2019; Kuehne et al., 2019). These long-term relationships build social capital between the advisor and the producer (Fisher, 2013). In Houser et al. (2019), crop consultants, seed suppliers, and fertilizer salespeople had high levels of access to producers due to their advice being focused on productivity. The same research concluded advisors focused on environmental performance did not have the same access to producers which hampered the ability of these advisors to grow long-term relationships with producers. In this paper we present further insights on how producers use advice and information during the active assessment phase.

3 Methods

To examine how producers have been using the advisory system in NZ, a range of land-based farmers, growers, and foresters from all regions of NZ were invited to participate in our research. We used two different methods: first, a survey questionnaire (n=382) and second, focus groups (n=33) with producers. Although we selected a diversity of producers – and combined qualitative and quantitative data collection methods and analysis – the results cannot be extrapolated to all producers in NZ, but rather represent the views of those we engaged with.

The survey included questions on:

- what topics producers had sought advice and information over the last five years
- the sources of this advice and information
- the relevance and trustworthiness of these sources
- topics of advice and information that producers expect they will need in the future (see Booth 2020 Appendix 1 in Duncan et al., 2021).

The survey defined advice as services provided by and/or available from fee-for-service consultants, financial advisors (e.g. accountants, bank managers, insurance providers), business services (e.g. from seed and fertilizer companies), government ministries, industry levy organizations, industry suppliers, research institutes and vets. Vets were an addition to the early conception of the advisory system presented in Figure 1.

Advice could include specific services such as producer-initiated assessments, studies and reports, fact sheets, best practice guidelines, publications, newsletters, workshops, conferences, field days, one-on-one discussions, on-line forums, industry reports and research. The internet, farming magazines, and media (e.g. TV documentaries) were not considered sources of advice, but were considered sources of information potentially used by producers. In the survey we defined advisory services broadly to include both advice and information to ensure we captured all topics in which producers might be interested in relation to productive and sustainable land use and all sources they might be using. Peers/peer support groups were not initially included as a component of the advisory system, but they were included in the survey as a potential source of advice and information.

The survey sample came from two sources: Manaaki Whenua – Landcare Research’s Survey of Rural Decision Makers (SRDM) (Stahlmann-Brown, 2019) and through promotion of the survey by advice providers, industry levy groups, and the New Zealand Institute of Primary Industry Management. The SRDM is a biennial nationally representative survey of farmers, growers and foresters. The survey was sent to 585 SRDM respondents and an unknown number through promotion from advice providers and industry levy groups.

The SRDM sample included all land uses: sheep and beef (45%), dairy and dairy support (20%), other stock (6.8%), forestry (13%), arable (4%), horticulture (11%), and other industries (i.e., tourism and beekeeping; <1%). The survey was enumerated using the computer assisted web interviewing programme Qualtrics. The survey was open for four weeks in May and June 2020. We received a total of 382 responses, including 237 recruited through the SRDM. All respondents recruited through the SRDM were self-described for-profit commercial farmers, growers, or foresters. The average response rate among those recruited through the SRDM was 41%. The average response rate among those not recruited through the SRDM is not known.

Respondents to the 2021 SRDM were 67% male, 32% female, and <1% gender diverse. The median age of respondents was 62 and the average age was 60. This aligns closely with previous versions of the SRDM, with the average age of respondents in the 2019 edition was 59 years, with 70% male, 30% female, and <1% gender diverse.

We recruited participants for the focus groups by asking survey respondents if they were willing to be contacted about follow-up research on the topic of advisors. Those who said yes were invited to join. Other participants were recruited through contact with industry levy organizations who promoted an invitation to participate in the research to their members. The focus groups were held with farmers, growers, and foresters from across NZ. Most focus groups had mixed primary sector representation however two workshops were held with specific sectors, i.e. viticulture and dairy farming. We conducted seven focus groups which comprised a total of 33 participants from across the primary industry sectors (Figure 3). Of the participants, 26 were male and 7 were female. A map showing focus group and survey responses across different regions of NZ can be found in Figure 4.

Statistics New Zealand (2019) reported that the land uses we analyzed are the most common in NZ. For example, sheep and beef production is the most common land use in NZ with 4.1

million hectares in sheep and 2.7 million hectares in beef. The dairy herd covers 2.2 million hectares of land. Forestry covers 1.6 million hectares of land. Horticultural production consisting of vegetables, flowers, fruits, and nuts covers 132,717 hectares. Different regions have different trends and land use profiles. For example, regions like Waikato, Canterbury, and Southland have seen significant growth in dairy cattle between 2002-2019, whereas horticultural land use is more prevalent in Marlborough, Hawke's Bay, and the Bay of Plenty. Forestry is more prevalent in the Bay of Plenty, Northland, and Gisborne.

As a result of the COVID-19 pandemic, the focus groups, which ran for 60 minutes, were held online rather than face-to-face. One of the benefits of an online approach was that participants did not need to travel to or from a specific location, saving time for the participants, especially as the producers in our research often lived in remote locations (Farnsworth and Boon, 2010). A related benefit was that it helped us engage with producers over a geographically dispersed area at one time (Rupert et al., 2017). To assist with focus group design, we followed Forrestal et al. (2015) best practice principles for online focus groups, such as keeping the groups smaller than a typical in-person focus group (5 to 8 participants), communicating detailed instructions about how to join the focus group to participants, and seeking verbal rather than written consent for participation (Forrestal et al., 2015). The questions that guided our focus groups can be found in Appendix 1.

The research was approved by the Manaaki Whenua – Landcare Research social ethics process and informed consent was obtained from all participants before involvement. The focus groups were digitally recorded, and relevant sections of the recordings were transcribed for coding. A thematic analysis of the focus groups data was conducted using an inductive approach (Cope, 2005; Fereday and Muir-Cochrane, 2006; Merriam and Tisdell, 2015). Descriptive codes were derived by reading and re-reading the transcripts and looking for what

Primary sector	Focus group attendees
Sheep and beef	9
Horticulture/viticulture	5
Dairy	6
Grazing livestock that is not owned (including dairy support)	3
Forestry	3
Deer	2
Vegetable/flowers	2
Kiwifruit	2
Fruit/nuts	1

FIGURE 3
Focus group attendees (by sector).

appeared important and significant to producers in terms of how they were using the advisory system and their particular knowledge practices. The qualitative data analysis software NVivo 11 was used to store, organize, and code the focus group data prior to analysis. Using NVivo, through an iterative process, the descriptive codes were progressively grouped into analytical themes (Cope, 2005), which are presented in italics in the discussion.

4 Results

4.1 Survey

We present here a small portion of the survey results. Fine-grained demographic and geographic statistical analyses were conducted and can be found in Booth (2020 Appendix 1 of Duncan et al., 2021).

4.1.1 Sources of advice and information

In terms of sources of advice and information, we found that over the past five years respondents sought or received advice or information from an average of five different sources. More than half of respondents sought information outside our conceived advisory system (see Figure 1), namely, the internet (54%), peers or peer support groups (54%), and farming magazines (53%) (Figure 5). Within our conceived advisory system, local/regional councils and levy organizations were ranked highest as sources of advice and information. Figure 5 shows that fee-for-service

consultants, central government ministries and research institutes – actors most commonly associated with extension – are being used by fewer producers (37%, 24% and 23% respectively).

4.1.2 Topics of advice and information

In respect of topics of advice and information, respondents sought or received advice or information on an average of five different topics over the past five years. Seeking information and advice to respond to government policy and regulations on water quality issues is evident in the number of producers seeking advice and information on farm environment plans and managing water quality. Overall, it can be seen that producers have been seeking advice and information on a range of topics and that changing production (i.e. increasing production, productivity and efficiency) is only one of them and not the top of the list.

Comparing panels of topics in Figure 6, producers see their advice and information needs shifting to help them adapt to future changes. Respondents still want advice on farm environment plans, managing water, on-farm biosecurity, and changing production. However, more than a third of respondents also want advice on sustainability (31%), financial management (38%), diversifying the farm system (34%), marketing opportunities (36%), and climate change resilience (39%). Again, changing production (i.e. increasing production, productivity and efficiency) is only one of several topics producers are seeking advice and information. Hence, although changing production is where advisory services have historically been directed, producers have been seeking advice on a range of

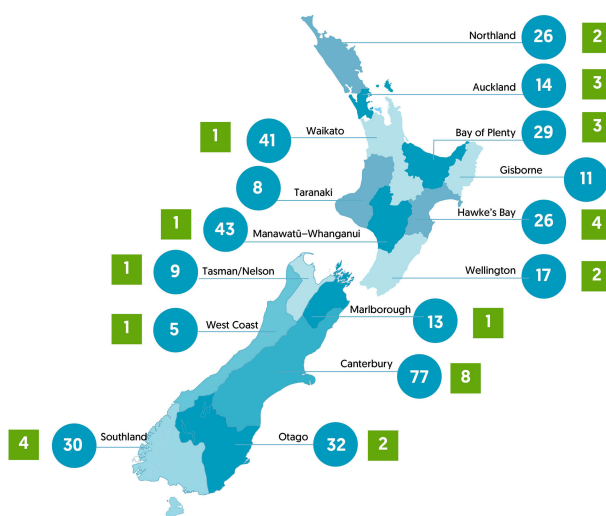


FIGURE 4
Regional differences in survey (blue circle) and focus group (green square) participation.

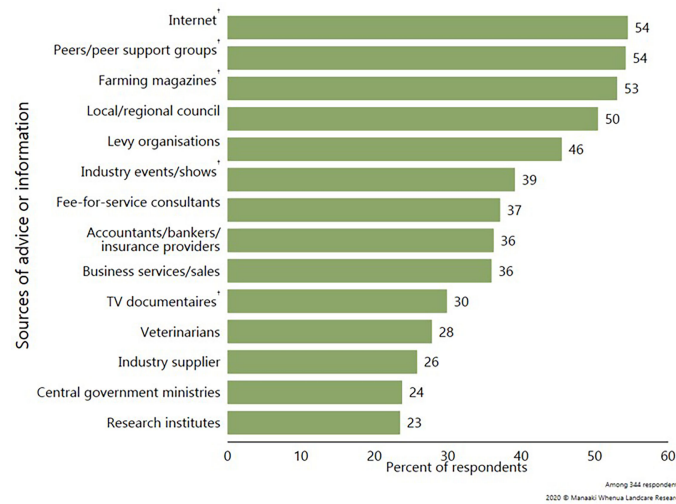


FIGURE 5 Proportion of respondents who have sought or received advice or information from these sources (Duncan et al., 2021: 71).

other topics inside and outside the advisory system and are saying they want advice and information on a broad range of sustainability-related topics to adapt to future challenges.

Notably, the survey found that younger producers (18–39 years) tended to seek advice on a broader range of topics and from more sources compared with producers older than them (40+ years). The proportion of respondents who sought information or advice on any topic decreased as they got older (Booth 2020 Appendix 1 in Duncan et al., 2021) (to be discussed in focus groups section 4.2).

Figure 7 shows that respondents who thought sources had a high degree of relevance thought the level of trustworthiness of that source was also high. This is seen most clearly in the results for research institutes and veterinarians. A similar proportion of respondents thought advice from accountants, levy organizations and fee-for-service consultants was both highly relevant and trustworthy.

It will be recalled that the internet, peers/peer support groups, and farming magazines are important advice and information sources for more than half of our respondents.

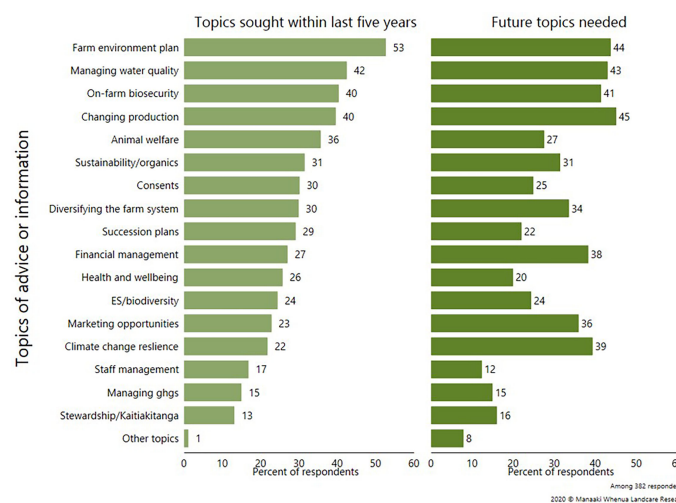


FIGURE 6 Proportion of respondents who sought or received advice or information in the past 5 years (left panel), and who said they would like advice or information on these topics to help them respond and adapt to future changes (right panel).

However, Figure 7 shows producers perceive them to have varying levels of relevance and trustworthiness. Indeed, the internet has the smallest number of respondents ranking it high for trustworthiness. This result suggests relevance and trustworthiness are not the only factors contributing to the high use of the internet. The focus groups, to which we now turn, provide further insight.

4.2 Focus Groups

In the methods section we explained that the survey defined advisory services broadly to include both advice and information. This was done to ensure we captured the broadest possible range of topics producers were interested in and all the sources they were using. In the focus groups we narrowed our investigation to producers' use (or not) of advisors, in particular of fee-for-service consultants. Our analysis identified the following themes from the focus groups.

4.2.1 Producers are experiencing a variety of trigger events

Sutherland et al. (2013) argue that trigger events catalyze the active assessment of advice for system change, and it is system change that shifts an operation's path dependency. In contrast, the producers we spoke to explained they actively seek advice and information when making incremental changes to their operations as well as system changes in response to a variety of trigger events, for example:

- disappointing soil test results
- finding no micro-fauna in the soil

- concerns about the effects of chemicals on family and pets
- being overwhelmed by the level of debt and not seeing a way through
- quality of life imperatives (e.g. needing to spend more time with family)
- compliance with regulations
- concerns about future access to water resources.

It can be seen that environmental cues and policy changes are now serving as trigger events.

4.2.2 Advice and information are different

While we were focused on advisors in the focus groups, given the high proportion of survey respondents using the internet and farming magazines (which we defined as information sources), it was important to first explore with focus group participants whether they thought information and advice were the same or different things. We discovered this was a meaningful distinction from the perspective of producers. Indeed, it provided important insight into why producers use the advisory system in the way that they do and how their relationship with advisors has changed.

We consistently heard from participants that advice and information are different. Information, we were told, is factual (e.g. numbers, technical details, science) whereas advice is opinion. A forester explained:

[Advice and information] are quite different! Information is, one hopes, factual and backed up by good evidence. Advice, to me, is opinion. That, to me, is the difference. Advice is someone's subjective judgment and so not clear-cut.

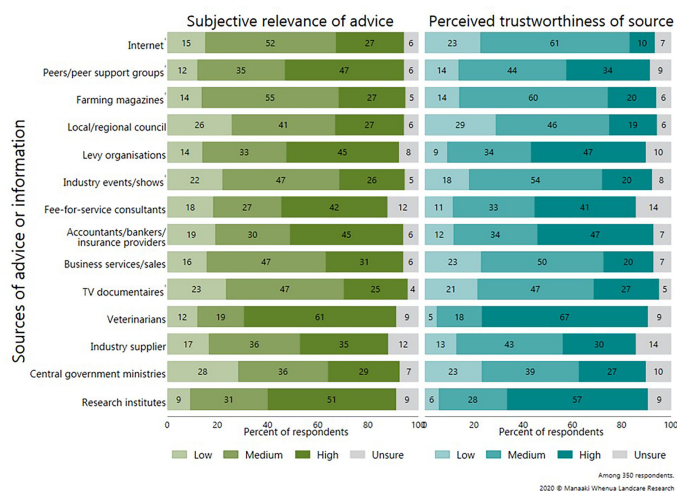


FIGURE 7 Subjective relevance and perceptions of trustworthiness of sources of advice and information.

A sheep and beef farmer described information as ‘straight from the oven’ and ‘the first place you go’ (usually *via* the internet) when you decide to do something or you find you need to do something. Another participant described it this way: ‘information is a noun. Advice is telling you to do something, more like a verb’ (beef farmer). We also heard:

"Information is what you go looking for and advice is from people that can tell you this is what I tried, it might or might not work. Advice is opinion and information is everything about all your different options". (sheep and beef farmer).

In other words, information is seen as general whereas advice is specific, and advice is seen as a subset of information. Importantly, a range of factors are involved in transforming one into the other: ‘Anyone can take information [and present it to you] but skills, maturity and experience [are] needed to turn that information into advice’ (wine grower).

How information is transformed into advice was clearly of concern to producers, as there were risks in not doing it well:

"[The conversation] reminds me of a grower we had who would ask for lots of advice about the same thing and would take a bit of advice from here and there and cobble the advice together, which were never designed to work together but work only within the context of that person who had provided it. You need to be specific about what you’re asking and how the advice you’ve been given is couched to you". (wine grower)

Another participant highlighted how information becomes advice when the producer moves from gathering information, anecdotes, and experiences, to asking targeted questions about what to do:

"[You can gather] a lot of information through those discussion groups. You’ve got ideas being thrown around and sometimes one of those ideas will gel with the problem you’ve got or something you’re considering. It becomes advice when you essentially, in your head or verbally to someone, ask what should I do or how should I go about this? That’s when you’re not just seeking information, you’re into the realm of seeking advice". (wine grower).

This contribution reflects what Sutherland et al. (2013: 147) describe as a shift from passive ‘peripheral route processing’ to active ‘central route processing’.

We were told that using information also requires skill. For example, it was recognized that information acquired *via* the internet was often not tailored to a producer’s circumstances, and sometimes not specific to NZ. Hence, judgement was needed to use it. Others discussed how there is an enormous amount of information out there and that it takes considerable effort to narrow things down. A wine grower described it in terms of a ‘smorgasbord’, which meant it was often hard to choose which direction to go in, especially if a producer was just starting out.

It was noticed that reflections on advice used terms like ‘subjective’, ‘someone’s opinion’, ‘not rock solid’ and ‘not clear-cut’. The impression we received is that producers lack confidence in advice unless it comes from a trusted source or

has been vetted by the producer or someone the producer trusts. Information, on the other hand – while recognizing there is an overwhelming amount of it ‘out there’ – was described as ‘facts’, ‘evidence’ and the ‘first place you go’.

4.2.3 A ‘telling rather than listening’ approach

Some of our focus group participants did not currently use advisors. One reason was the perception that advisors often adopt a ‘telling rather than a listening’ approach. These producers explained they would prefer advisors who are willing to learn about the producer’s local farm context, conditions, and situation before offering advice. These producers suggested the ‘telling rather than listening’ approach arises from advisors assuming producers have a knowledge deficit which needs to be filled by the advisor. A sheep and beef farmer explained, “if someone comes in with the wrong mannerisms, saying ‘you should do this, you should do that’, it does not sit too well because they do not know your farm”.

Producers were also concerned about a lack of alignment of values, which also arises from advisors not first finding out about producers and their context. For example, a kiwifruit grower had the following experience:

"[When we started out] we were wandering around with one guy and he was saying ‘what we should do is rip out this natural shelter and put in artificial shelter belts and possibly roof the whole thing; that’s where you’re going to get your best production’. I’m saying, ‘Hang on, no, no thank you. We didn’t move from the city to here [for that], we like trees’. He was smart enough to say, ‘So do I, that’s cool, let’s do it your way’, but some others perhaps wouldn’t have been quite as flexible as he was”.

These contributions highlight how producers are more likely to engage with advisors who can demonstrate not only expertise and experience but also advisors who listen to the producer and make efforts to understand their farm and situation.

4.2.4 Producers seek advice for specific purposes

We found that producers seek advice from advisors for quite specific purposes, for example:

- to have ideas, practices, proposals or new systems checked and/or assessed for pitfalls, appropriateness and/or meeting required standards
- to obtain independent, non-biased advice
- to access expertise and experience not held by producers
- to fill knowledge gaps
- to make improvements to or change their farm system
- to solve specific problems
- to help make things simpler
- to identify options
- to access up-to-date information and to help resolve conflicting advice.

What is key here is that producers are doing their own research before seeking advice from advisors:

"We're getting the factual information first and then seeking advice to find out about other pitfalls we haven't discovered. That's pretty much what we use advisors for now. It doesn't mean we'll follow their advice, but if they know of a potential pitfall that we haven't come across in the information we've sought then that is money well spent". (dairy farmer).

Hence, seeking advice is done after the issues of concern are fully researched and understood, and a clear role for an advisor has been identified by the producer. They also convey the widely held view among our participants that advisors should not be relied on to make decisions about farm businesses; rather, it was the producer's responsibility to make decisions based on their own research, knowledge, and experience.

4.2.5 Producers need a good filter

Relatedly, producers explained they need a good filter when receiving information and advice about what will and will not work in their operation. We were told they are continually bombarded with new products, technologies, systems, and practices they are told they should adopt and options to improve production. Given these circumstances, a participant maintained it was very important for producers to know what will not work in their operation:

"[W]hen you search for advice you have to apply a filter. You hear about something but you don't think it will work in your situation. Having a good filter and understanding what won't work is important". (wine grower)

Doing the research first is a risk mitigation measure for producers and part of having a good filter. Again, doing the research before consulting an advisor ensures the producers cannot solve the problem themselves, that the advice they pay for is ultimately value for money and they are 'not sold a dud', as one dairy farmer put it.

4.2.6 Producers are seeking advice and information at different times in their lives

A participant explained how experience and life stage had influenced his motivations for different actions and who he seeks advice from:

"As a young farmer, a young businessman, it's always about profitability and increasing production. But the older you get, you temper that with broader life views and start to look for advice that reflects that. You grow old together: the network changes and evolves and relationships develop. Things evolve. Family. Things become broader ... I don't use consultants per se as much as I used to. At 57, now I'm surrounded by a network of people I respect and continually draw down from". (sheep and beef farmer)

Given the evolution of life, this producer explains he no longer needs to formally engage advisors and now relies on his network, which traverses the advisory system and includes peers.

Another participant agreed that life stage influences motivation, in particular the pressure of financial commitments, which is an important reason why younger farmers are highly motivated to seek advice on production, productivity and efficiency goals. He explained:

"As you get older you certainly aren't pushing the farm as much. Not battling the bank! When you're battling the bank and you have a massive mortgage, it does get you out of bed in the morning, that's for sure, and makes you motivated. When you don't, you back off. Animals are looked after better too". (dairy farmer)

The survey found that as producers get older they seek advice on fewer topics. The focus groups suggest this is not necessarily due to producers not seeking advice, but related to gaining experience and building informal networks.

4.2.7 Getting comfortable and building confidence is important for change

We also heard that getting comfortable with ideas and the perceived commitments that flow from putting those ideas into action takes time, and what one feels comfortable with evolves as one gains knowledge, experience, and confidence:

"We started our planting programme about 5 years ago and we were talking with [an advisor] who was talking about all these new technologies, steel posts, underground irrigation, but I was too scared at that stage. I didn't have the knowledge or understanding of any of them. It all sounded good and it all made sense but I wasn't comfortable with doing it. Five years down the track we're putting in a half hectare block and putting all that in and different stuff like plastic posts, and those sorts of things. That's an evolution for me, personally, I'm comfortable. I've seen, I've heard, it makes sense, I've had time to ask the questions but I want to trial it for myself before I put it into full production". (wine grower)

For this wine grower, his thinking evolved over a lengthy period of time. With experience, gathering more information, seeking advice, seeing how things work in other locations, and asking questions this producer eventually became comfortable with what the change might involve. Nevertheless, he is still cautious and is doing a trial to make sure the change is likely to work before he puts these new ideas he first heard about five years ago into full production.

4.2.8 The internet and informal peer networks are indispensable

The survey found that the two most-used sources of advice and information were the internet and peers/peer support groups (both 54% of respondents). During the focus groups,

producers repeatedly referred to their use of these sources and how helpful they were found to be. It was acknowledged that information sourced from the internet was not always relevant or trustworthy (see Figure 5) but it was widely agreed that it was highly useful. Indeed, participants conveyed that the internet's accessibility, and the fact that producers could easily take or leave what they found, enhanced its favorability.

The survey and focus group contributions illustrate how the informal networks of peers and peer support groups have become sounding-boards for producers. Peer networks include other producers, neighbors, and contractors, who would be considered to sit outside the advisory system (Figure 1). These networks have always been, and continue to be, integral to the decision-making of producers seeking, considering and using information they gather and advice they receive from a range of sources.

4.2.9 Assessing risks and trying things out

Another consideration in the utilization of advice is the scale of the decision and the perceived risks, which influence when advice is used:

"Some things I adopt straight away. Depends on what it is. Sometimes I try it at a small level, on a paddock at a small scale, where you can afford for it to not be as you expect, you can afford to lose. You try it and gain experience to do more. Other decisions, where there is trust and it ties in with your own knowledge, you'll probably jump in and take the calculated risk based on what you believe to be good advice". (beef farmer)

For this producer too, trying things out on a small scale is an important starting point when there is uncertainty about outcomes and the risks of changing things are potentially high. A trial allows the producer to see what might happen as well as gain knowledge and experience. The producer also notes that when trust is high, uncertainty is perceived to be lower. Under these circumstances a producer is willing to take the risk.

4.2.10 Ratifying advice before making changes is crucial

Drawing on the knowledge of 'others whose opinion you trust or have helped in the past' is important in helping producers assess whether the advice they are receiving is good advice and worth considering, according to one kiwifruit grower. Another producer, a dairy grazer, described how he goes about verifying the advice he receives:

Once I've got the advice I then go and bounce it off the neighbors and various members of the discussion group and say, "what do you reckon?" I get it ratified by peers.

"We do all the research beforehand. We make sure we know exactly what the regulations are. We try to make sure we're not going to have surprises. Then we go and source people. We talk to other farmers who have used different people. We do all the research. Then we go to professionals". (dairy farmer)

We can see here that seeking advice involves several steps and requires drawing on multiple sources within and outside the advisory services system. This was a common theme:

"When I get advice from the vet, that's the first step. Then I go and check with others or do some reading before accepting that advice. Advice is not rock solid. Perhaps it's specialized information, but it's not the answer at that point". (sheep farmer)

5 Discussion

Our results support the proposition of Sutherland et al. (2013) that producers are more likely to make changes to their operations following a trigger event, and it is at these times producers are actively looking for advice and information. Our results show that a range of factors can serve as trigger events and that a range of other factors influence how producers respond to trigger events.

Notably, although fee-for-service consultants believe producers are substantially interested in advice on production, productivity, and efficiency (Duncan and Kirk, 2020), the survey showed producers have been seeking advice on a range of topics beyond production, productivity, and efficiency and this is also likely to be the case for the future. Our focus groups confirmed this to be the case. Hence, the producers we spoke to are looking for information and advice beyond production, productivity, and efficiency and they are accessing it *via* the internet and from local councils and levy organizations to a greater extent than from fee-for-service consultants.

The survey showed that the trustworthiness of a source is linked to the relevance of their advice. However, this was not the full story. We heard that producers are turned off by consultants who adopt 'telling rather than listening' no matter how relevant the advice or information. Asking producers whether there was a difference between advice and information in the focus groups provided important insights on the knowledge practices of producers, which we will discuss further below. Producers' are wary of some consultant advisors and this came through very strongly when we asked whether there was a difference between advice and information. Information, we were told, is factual, while advice is opinion – 'not rock solid' and 'not clear-cut'. Advice was seen as a subset of information, and we were told that considerable skill, maturity, and experience is needed to transform information into advice. It was clear that producers are not confident that all advisors within the advisory system these attributes. Hence, it appears it is the translation process between information and advice with which producers are most concerned.

While the focus groups indicate some producers are wary of consultant advisors, they recognize consultant advisors are useful. Hence, producers are doing their own research before engaging consultants, so they know what they need and want, what questions to ask, and to be able to assess if the consultant is

capable of providing the needed advice and assessing what is ultimately provided. This research process allows producers to identify a very clear role for a consultant advisors. Crucially, this 'pre-advice' phase relies heavily on the internet and peers or peer support groups. It is at this point that producers need a good filter, in particular to know what will not work within their system. We heard that relying on the internet is challenging as information is not always relevant. Even so, it provided producers with easy access to a lot of information and access to advice. Access was clearly an important attribute of the internet, as was being able to take or leave information that had been gathered. Having autonomy in this respect appears important and highlights a trade-off that is being made between relevance and trustworthiness for accessibility.

The focus groups also found that producers are seeking advice and information at different times in their lives, getting comfortable and building confidence is important for change, assessing risks and trying things out is crucial and getting advice ratified before making changes is also key to advancing through the active assessment phase of the 'triggering change' cycle into the implementation phase. Figures 8–10 use the hypothetical example of a primary producer seeking advice after running out of water to finish a crop to highlight the factors that can influence both an incremental and systemic response to this trigger event. These figures highlight how the active assessment phase of the 'triggering change' cycle involves multiple steps and actors. In particular, it involves producers doing their own research, inside and outside the advisory services system, before they seek advice from advisors within the advisory services system.

Figures 8 and 9 reflect how a primary producer's age, life stage, experience, existing knowledge, skills and practices, network, financial situation, vision, and comfort levels

influence whether they respond to a trigger event with an incremental or systemic change. Risks will always be high when contemplating a systemic operational change, which requires greater levels of assessment and ratification.

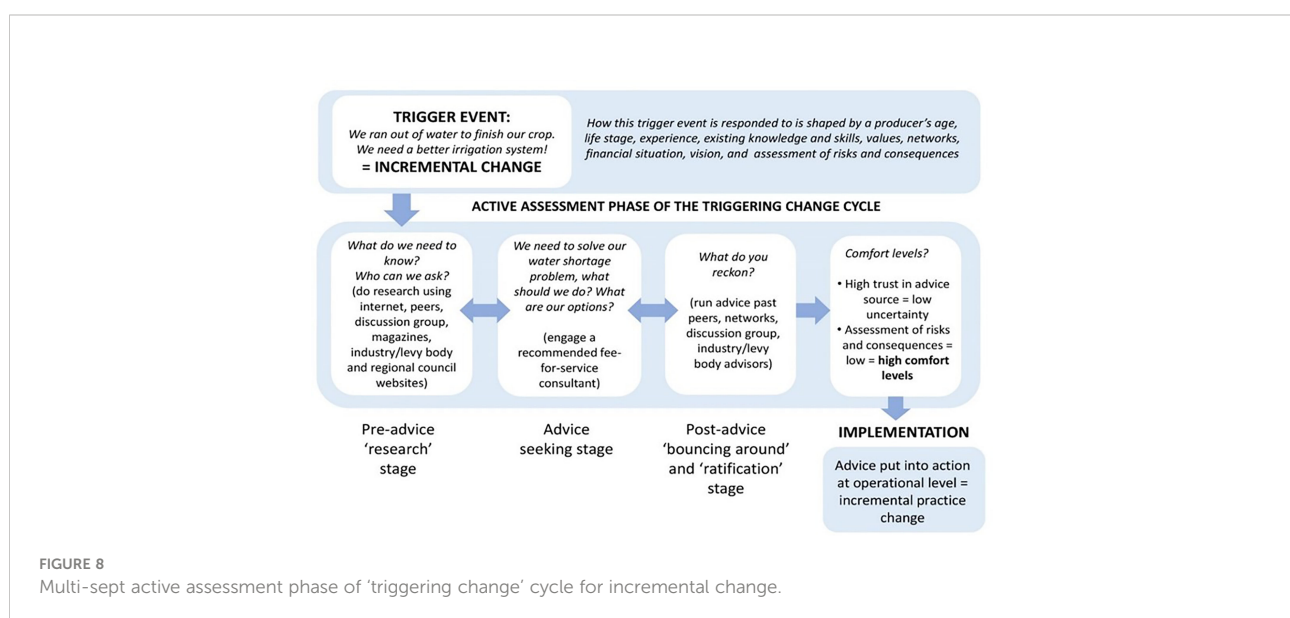
Figure 10 shows how a producer's comfort levels when making a change are affected by trust, ratification from peers, and personal assessment of risks. If the producer needs further evidence to be convinced to change, they might trial different interventions, and if their expectations are met, they could choose to further adopt these interventions.

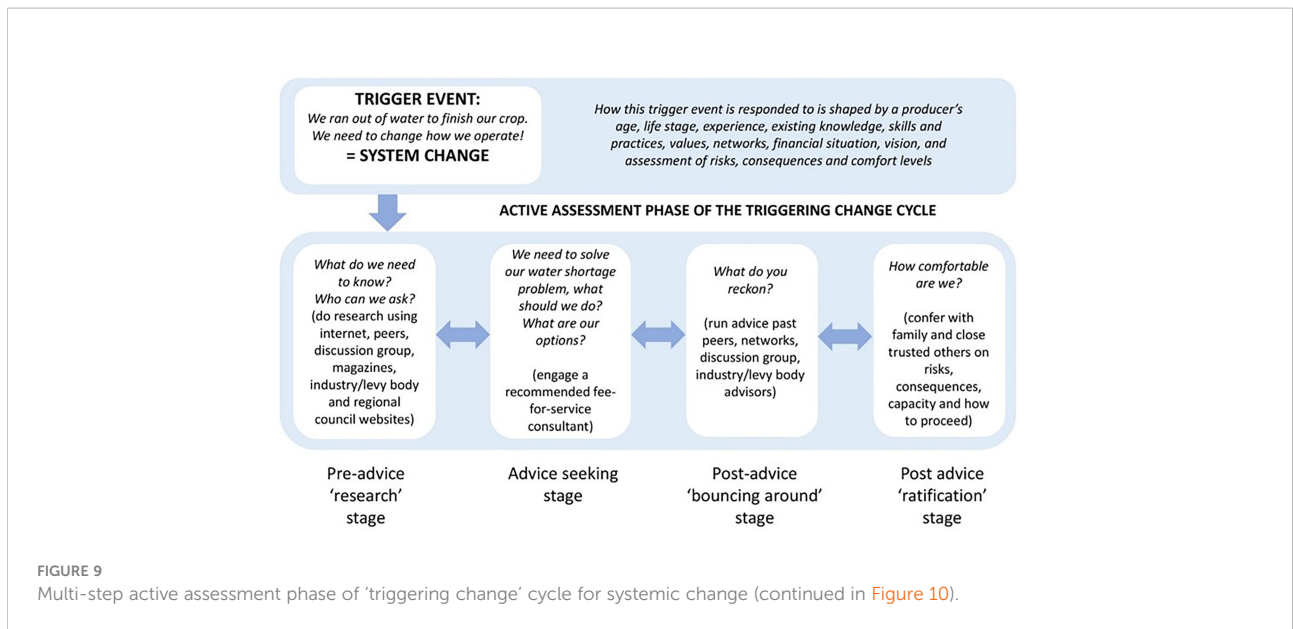
Figures 8–10 capture how seeking advice and deciding when and how to use it is a multi-step and evolving process that is more akin to a journey than a decision to take advice and make a change.

Our research provides important insights into the knowledge practices of producers and invalidates simplistic conceptions of the transfer of knowledge from advisors to producers through filling presumed knowledge gaps that characterizes the four models of extension (Black, 2000) set out earlier.

Importantly, there was the wide and emphatic agreement from the producers we spoke to that they need to do their own research before they seek advice from 'professionals'. They are doing so because they want to make sure they are getting the right advice or at least have the background information to ask the right questions (for their farm context).

Access to information and advice *via* the internet is facilitating these knowledge practices that involve finding out as much as one can before going to advisors. Clearly, the internet has made information and advice highly accessible for producers. Hence, notwithstanding commonly held concerns about the trustworthiness of information sourced from the internet, it is used widely for research purposes, with peers





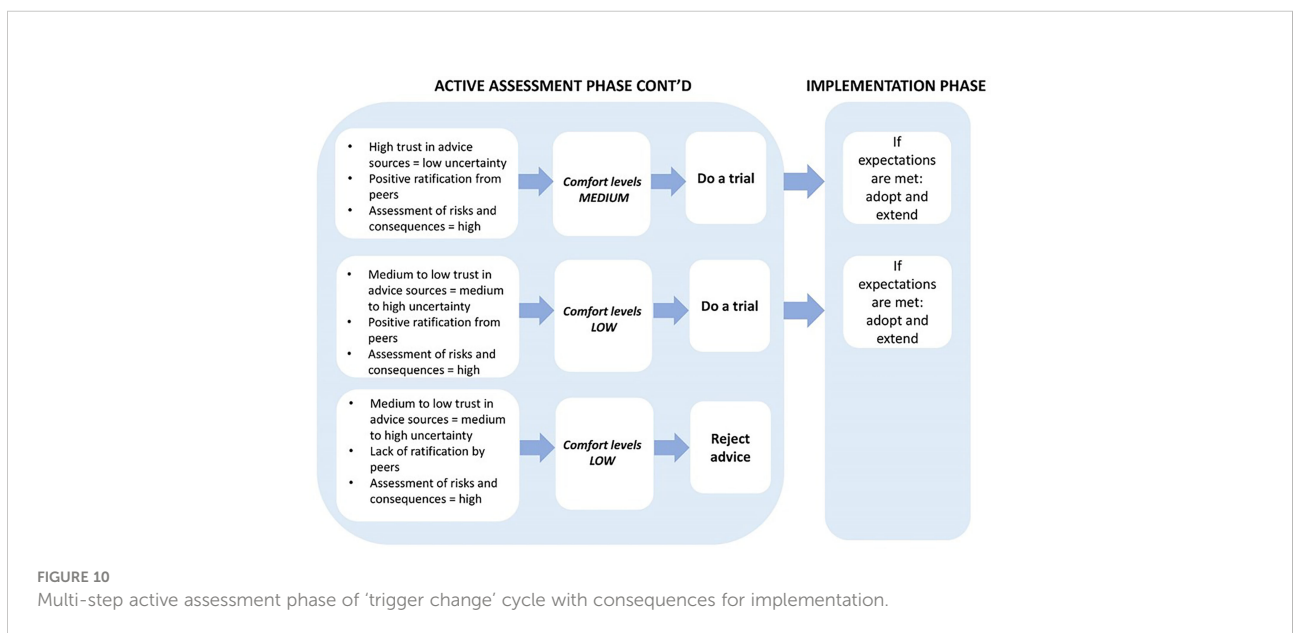
and peer groups drawn on to ratify advice and the reliability of advisors.

What producers described to us is clearly a very active process on their part. It stands in contrast to the models of extension set out earlier (Black, 2000) that assume producers are empty vessels and their knowledge deficits are to be filled by scientists, researchers, consultants, and government agencies. While the contributions of these advisory actors are important, understanding how producers use these sources highlights the profoundly active role producers play in knowledge production.

This paper offers two contributions to research on farmer extension and sustainability transitions. First, it provides insight

into the knowledge practices that help shift farm system trajectories in a way that avoids simplistic conceptions of top-down transfer of information from advisors to producers. Second, the findings highlight the complex active assessment phase of the trigger event change cycle whereby producers undertake research, identify a role for advisors, seek advice and then ratify that advice through informal networks of peers before making either incremental or systemic changes.

These findings confirm the importance of government initiatives, programs and policies that create and support interaction between peers and peer networks of producers as well as trusted advisors who can provide information and advice



to producers. But our findings also confirm that farmers exert significant agency in these networks, as they are curators of advice and information rather than mere recipients. This aligns our paper to recent research which develops farmer-centered approaches (Eastwood et al., 2022) and communities of practice (Dolinska and d'Aquino, 2016) to address complex agricultural problems, as well as research that acknowledges the agency of farmers within networks of actors that enable agricultural innovation and knowledge sharing (Pigford et al., 2018; Klerkx and Begemann, 2020).

6 Conclusions

Our findings build on Sutherland et al. (2013) triggering change cycle by focusing on the knowledge practices of producers. This research shows that the active assessment phase, which is when information and advice are likely to have the most influence on a producer's decision to make changes and/or adopt more sustainable land use practices is complex. All producers are different, and the context of their commercial operations will also be significantly different. However, through this research we have identified some common characteristics across sectors and geographical locations that provide important insights into how producers engage with advice and information and how their knowledge practices have changed in light of environmental cues, government programmes encouraging change and far greater access to advice and information via the internet. These insights are important for moving into the uncharted territory of changing practices for sustainability.

Building on the work of Sutherland et al. (2013) we have broadened the gamut of trigger events that can lead a producer to consider changing practices and, ultimately, shifting a farm's trajectory.

Crucially, we have identified that the active assessment phase of the triggering change cycle, and moves towards implementation, involves multiple steps. Specifically, following a trigger event, producers do their own research to find out what they need to know and to identify what role they want an advisor to play. It would appear that some advisors are making inaccurate assumptions about their role. This situation could be easily rectified by advisors asking producers what role they are to play.

We have found that a producer's network of peers, colleagues, and family members play a crucial role in 'bouncing around ideas' and ratification during the active assessment phase. The new ecological and policy context, coupled with new and sophisticated ways of accessing advice and information, have shifted the dynamics of extension. Producers are not mere recipients of advice and information. They are curators – identifying their needs, seeking advice, weighing it up and ultimately deciding which way to go. Conceiving producers as knowledge curators has important

implications for extension and the programmes governments develop to help producers adopt and adapt to more sustainable land use practices.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by Manaaki Whenua – Landcare Research social ethics process (application 1920/39). The patients/participants provided their written and verbal informed consent to participate in this study.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Appendix 1 – focus group questions

Pre-focus group questions sent *via* email

Answers to these questions helped us categorize producers into those who do and do not use advisors

1. What role are advisors/consultants currently playing within your operation and what services are they currently providing?
2. What are some examples where advice you've received from an advisor/consultants has led to a change in your operation?
3. Do you have a farm environment plan?

Focus group questions for those who DO use advisors

1. Do you currently use advisors or consultants in your commercial operation?

2. What is the difference between information and advice? Is there a difference? If so, what does 'information' and 'advice' mean to you?
3. What factors influence how you use the advice you obtain?
4. How could advisory services be improved?

Focus group questions for those who DO NOT use advisors

1. Why do you currently not use advisors and what factors contribute to you not using advisors?
2. What is the difference between information and advice? Is there a difference? If so, what does 'information' and 'advice' mean to you?
3. What would encourage you to/make you use advisors?