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Bridging gaps: a study of trust and information flow in New Zealand agriculture

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ABSTRACT

Purpose: To examine how farmers in Aotearoa, New Zealand (NZ), engage with information and whom they trust in the digital age, focusing on strategic land-use decision-making.

Design/methodology/approach: Qualitative methods involving 37 commercial farmers were used to explore their preferred information sources, trust and the challenge of accessing credible, strategic knowledge.

Findings: Farmers increasingly rely on informal and digital sources, like social media and artificial intelligence, particularly younger farmers. Information from formal institutions is often perceived as disconnected or biased. Information overload and the challenge of validating trustworthy information from diverse, conflicting sources were significant concerns.

Practical implications: Findings highlight the need for targeted information provision, recognising generational differences. Farmer-led community groups are crucial for knowledge brokering and fostering social capital, supporting sustainable agriculture transitions.

Theoretical implications: This study contributes to diffusion of innovation (DOI) theory by situating information-seeking and decision-making within a digital and increasingly AI-enabled context, suggesting that information-related processes are becoming more decentralised and influenced by emerging digital tools.

Originality/Value: This study offers novel insights into the evolving information interactions in NZ farmers in the digital age, providing a framework for understanding their information ecosystems and strategic decision-making challenges.

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1. Introduction

Information systems have changed radically over the twenty-first century, influencing how farmers interact and make decisions. This period, the information age, is characterised by digitisation, globalisation and the instantaneous exchange of informa-

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tion largely outside of regulation (Castells 2009). Accessibility to information has created extraordinary opportunities for learning and communication but has also brought new challenges for farmers when determining what is trustworthy and credible (Rust et al. 2022). As the volume of information rises, individuals can become overwhelmed or confused, which can hinder learning and impact decision-making and well-being (Bawden and Robinson 2020; Jackson and Farzaneh 2012). Farmers need to make sense of ever-growing masses of information from often conflicting sources to make sound strategic economic and environmental decisions (Starasts 2015).

This presents challenges for effective and sustainable land-use decision-making, which requires access to high-quality information, particularly in the face of evolving market, regulatory and environmental pressures (Seymour and Connelly 2023; Wood et al. 2014). Information sharing and knowledge building follow different patterns in the digital age (Bouma 2019), and there is evidence to suggest that the ways in which farmers interact with information have changed (Kirk et al. 2022; Ministry for Primary Industries 2019; Rust et al. 2022). The ongoing impacts of misinformation and the digital age in the agri-food sector are also not yet well understood (Chowdhury et al. 2023), particularly in Aotearoa, New Zealand (NZ). This underpins the need for a re-examination of the ways in which farmers interact with information, to support effective extension strategies and land-use decision-making.

In this study, we address these research gaps with the aim of understanding how farmers interact with information and who they trust in the digital age. To thoroughly understand the dynamics that take place, this study was guided by the following research questions with a focus on information gathering for strategic land-use decision-making:

- (1) What sources and forms of information do farmers use and trust in the digital age?
- (2) How do farmers validate and interact with information when making decisions?
- (3) Do farmers feel they can find the information they need when making strategic land-use decisions?

1.1. Information and farmers

As a result of the information age, how farmers learn and engage with information systems has changed across both formal and informal sources. Howarth (2005) and Šūmane et al. (2018) recognise that formal knowledge and information systems are often top-down, have a defined purpose and consist of set procedures and rules. In contrast, informal information systems are generally bottom-up (e.g. developed directly by the community of users), adaptable and rely on common practice (Šūmane et al. 2018). Informal and formal systems can work against each other or be complementary, as informal systems may arise to fill gaps related to inadequacies and restraints of the formal system (Howarth 2005).

Previous evidence suggests that farmers consider information from other farmers and veterinarians as trustworthy and that the government is the least trusted source (Kirk et al. 2022; Small, Brown, and Montes de Oca Munguia 2016). A growing body of work suggests that farmers are shifting towards informal information channels that are more interpersonal and digital, including the internet, social media, peers and peer networks (Brown and Roper 2017; Kassem et al. 2021; Kirk et al. 2022; Prost, Gross, and Prost

2022; Rust et al. 2022; Wood et al. 2014). Although institutions (e.g. the government and media), experts (e.g. agricultural advisors and academics) and organisations (e.g. bankers and industry groups) have been viewed as the traditional sources of information (Prokopy et al. 2019; Sligo and Massey 2007; Tarnoczi and Berkes 2010), it is now unclear whether farmers are foregoing these sources of advice in preference for informal, digital and peer-generated information (Rust et al. 2022). The uptake of technologies and alternative extension methods (e.g. podcasts) was accelerated by the COVID-19 pandemic and has resulted in farmers engaging with different forms of learning (Chivers et al. 2023), raising further questions about the implications of these shifts.

Alongside the changes in information systems, farmers are facing global pressures to adopt sustainable practices. This is driving an interest in understanding sustainability-related farmer decision-making processes (Epanchin-Niell et al. 2022; Liu, Bruins, and Heberling 2018). Largely built upon the seminal work of Rogers (2003), it is well known that farmer decision-making is a complex, dynamic and social process, driven by interrelated factors, including information (Dessart, Barreiro-Hurlé, and van Bavel 2019; Epanchin-Niell et al. 2022; Liu, Bruins, and Heberling 2018). When determining a farmer's likelihood of adopting a more sustainable practice, having access to good-quality information from trustworthy sources is considered crucial (Dessart, Barreiro-Hurlé, and van Bavel 2019; Llewellyn 2011; Marra, Pannell, and Ghadim 2003). If farmers are to change or adopt new practices, they first must understand that viable alternatives exist and know how to implement them (Dessart, Barreiro-Hurlé, and van Bavel 2019). Therefore, understanding farmer information-gathering habits in the digital age is of great value to agricultural policymakers, educators and extension agents to improve the effectiveness of knowledge exchanges and information provision.

Behaviourally informed approaches to extension and policy are an important strategy for supporting sustainable agricultural development, as they help to better engage farmers and support how they learn, make decisions and adopt new practices (Dessart, Barreiro-Hurlé, and van Bavel 2019). While it is evident that a plethora of information is available, the unique mix of drivers in the information age raises questions about the potential implications these shifts are having on farmers. As research on the impacts of emerging information technologies in the agri-food sector is still developing (Chowdhury et al. 2023), there is growing recognition of the need to better understand how farmers gather and use information (Liu, Bruins, and Heberling 2018; Rust et al. 2022).

1.2. Farmers and information availability in Aotearoa, New Zealand

Dairy, sheep and beef farming are key sectors in NZ, as a significant contributor to the national economy (Ministry for Primary Industries 2025) and managing 40% of the country's total land area (Ministry for the Environment 2021). Farming systems in NZ have evolved to focus on running a profitable business through the efficient use of resources while complying with environmental and health and safety regulations (Knook and Turner 2020). This shift has taken place within a fragmented extension system, where fee-for-service advisors are key actors along with farmer levy-funded organisations, processors and regional councils (Kirk et al. 2022). Although NZ operates with low to no farming subsidies (Saunders 2019), central government has recently introduced On Farm Support, a free advisory service designed to assist farmers and

encourage more sustainable practices (Ministry for Primary Industries [n.d.](#)). However, the broader extension landscape remains fragmented, creating challenges for farmers seeking reliable and timely information (Kirk et al. [2022](#)). This shortcoming signals the need for a critical examination of the ways in which farmers interact with information, as well as those stakeholders involved in information provision in NZ.

2. Materials and methods

2.1. Analytical framework

To conceptually and theoretically situate the research, we drew upon the foundational work associated with the Diffusion of Innovation (DOI) theory (Rogers [2003](#)) alongside more recent frameworks identifying the role that information plays within broader factors that influence farmers' adoption of more sustainable practices (Dessart, Barreiro-Hurlé, and van Bavel [2019](#); Liu, Bruins, and Heberling [2018](#)). The DOI theory by Rogers ([2003](#)) posits that the decision to adopt an innovation is 'an information-seeking and information-processing activity' motivated by the desire to reduce uncertainty regarding an innovation (p 172).

The decision-making process is influenced by external and internal factors, through communication channels and social systems. Trusted individuals described as change agents play a particularly influential role. Aligned with the theoretical constructs defined by Rogers ([2003](#)) in this study, DOI is operationalised through the exploration of communication channels, social systems and networks, and information-processing activities. These constructs directly informed the design of the interview and focus group guide.

Building on theoretical foundations complementary to Rogers ([2003](#)), Liu, Bruins, and Heberling ([2018](#)) framework emphasises the central role of information in farmers' decisions to adopt Best Management Practices (BMPs). BMPs are related to the actions adopted by farmers to care for natural resources whilst improving sustainability and productivity. Within BMP decision-making processes, Liu, Bruins, and Heberling ([2018](#)) conceptualise the flow of information from macro scales (e.g. policymakers) to micro scales (e.g. farmers) and the importance of trust and tailoring information to contextual situations. When trust is not present or when information is not downscaled or tailored, adoption of BMPs is less likely (Liu, Bruins, and Heberling [2018](#)). The framework also illustrates that trust in the information source may or may not be present, which is also influential in decision-making. The qualitative methods used for this study were designed to elicit insights into the existence of trust and contextual information as described by Liu, Bruins, and Heberling ([2018](#)), which provided a complementary lens to the DOI constructs described by Rogers ([2003](#)).

According to Liu, Bruins, and Heberling ([2018](#)), a better understanding of the modern information sources and their role in informing farmer decision-making is important to inform effective communication approaches and drive sustainable outcomes. Within NZ, these dynamics are shaped by a fragmented extension system and varying levels of trust (Kirk et al. [2022](#)). This environment makes DOI (Rogers [2003](#)) and more recent decision-making frameworks (Liu, Bruins, and Heberling [2018](#)) particularly rele-

vant for examining how communication channels, social systems and trust influence farmers in NZ.

2.2. Qualitative methods

To gain an in-depth understanding of the topic, qualitative methods were utilised. Primary data were collected through 22 semi-structured interviews, followed by one focus group with farmers in NZ, totalling 37 research participants (Table 1). The combination of semi-structured interviews and a focus group provided complementary insights, capturing individual experiences and collective dynamics, strengthening the overall depth of the research. This also allowed for comparison and cross-validation of findings, reducing the risk of method-specific bias.

Targeted purposive and snowball sampling methods were utilised to recruit participants (Tracy 2024). Initial participants were identified through Lincoln University networks, with subsequent participants recruited via peer referral. Participants were farmers who either owned or managed a commercial dairy or sheep and beef livestock farm. The focus was on these farm types as they are the key sectors in NZ. Sampling continued until data saturation was reached, where there was some repetition and/or no new relevant codes emerging in successive interviews (Lim 2024).

Young farmers were intentionally selected for the focus group due to their heightened engagement with digital and emerging information channels, which are central to this study. The participants included 10 young farmers from across Tasman New Zealand Young Farmer (NZYF) groups aged between 19 and 22.

These methods were conducted in accordance with the Lincoln University Human Ethics Committee requirements.

2.3. Semi-structured interviews

A detailed semi-structured interview guide was developed and pretested (Tracy 2024). The guide was designed to explore key DOI information-seeking, validation and decision-making constructs as defined by Rogers (2003) and to answer the key research questions. The themes in the interview guide are summarised in Table 2.

The flexible semi-structured interview approach allowed conversations with farmers to be free-flowing, which added context to the data (Tracy 2024). Ten of the interviews were conducted online and 12 face-to-face. Interviews lasted between 45 and 120 min

Table 1. Research participants.

	Individual farmers	Farming spouses	Total participants
Semi-structured interviews:			
Sheep and beef farmers (SBF)	11	1	13
Dairy farmers (DF)	6	4	14
Total interview participants			27
Focus group:			
Young male farmers (YMF)	6		6
Young female farmers (YFF)	4		4
Total focus group participants			10
Total			37

Table 2. Interview themes.

No	Theme	Interview guide description
1	Background	Background and farming enterprise.
2	Information	What information means to the farmer(s).
3	Information channels and sourcing	How information is sourced and changes over time.
4	Trust and validation	Which sources are trusted and how information is validated.
5	Strategic decision-making	Access to strategic information needed for decision-making
6	Reflections and rank of importance	Additional influential sources and rank of importance.

and were conducted between December 2022 and May 2023. Interviews were recorded, transcribed and then analysed.

2.4. Focus group

The focus group explored topics consistent with the semi-structured interviews using a mix of individual and group activities (Table 3).

A key activity in the focus group was a participatory mapping exercise. This activity was designed to address the research questions by eliciting insights into information sources, trust and the structure of information flows. This mapping approach was particularly useful as it allowed participants to conceptualise and discuss the data, producing a richer understanding of interactions that may have otherwise remained hidden (Ralls and Pottinger 2021).

The focus group was recorded, transcribed and analysed along with the maps from the session.

2.5. Data analysis

Transcripts and data (e.g. notes) were uploaded to NVivo software (R1) and analysed iteratively (Tracy 2024). To focus the data in a hierarchical manner, responses were coded inductively and then ordered into higher-order categories and themes (Figure 1).

Table 3. Focus group themes and activities.

Item	Theme	Description of activities
1	Research overview	• Introduction and overview of research.
2	Information	• Individual reflections on what 'information' means, followed by facilitated whole group discussion.
3	Information system mapping (participatory mapping exercise)	• Participants are split into two groups and instructed to conduct a mapping exercise on an A3 piece of paper. • Groups place themselves (as the farmer) at the centre of the page and collaboratively map all relevant sources of information they engage with. • Participants are prompted to draw connections between these sources and communication channels, indicating the direction and strength of information flows, followed by facilitated whole group discussion.
4	Flows of information and decision-making	• Facilitator asks questions to gain insights into the flows of information: i. Question 1: <i>A university researcher had a major breakthrough in findings that could transform soil and improve productivity. Who from and how might you find out?</i> ii. Question 2: <i>You are a farmer considering diversification. Where would you find information? What would this process look like?</i> Groups discuss questions followed by facilitated whole group discussion.
6	Intergenerational reflections and closing	• Facilitated group discussion to reflect and share perspectives on trust, technology, social networks and intergenerational differences.

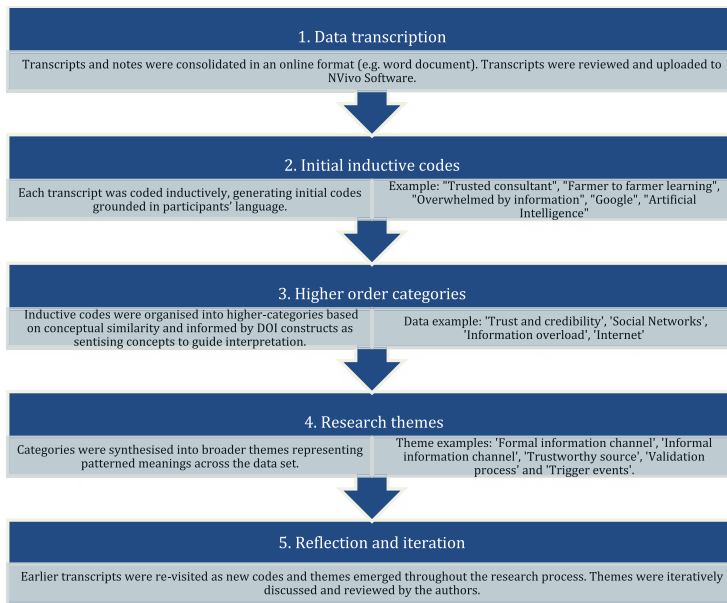


Figure 1. Data analysis process.

While the analysis was primarily inductive, a deductive lens was also applied using DOI constructs to sensitise the category coding process. Specifically, attention was given to identifying patterns related to communication channels, social networks, trust and information flows. This approach enabled the analysis to remain grounded in participants' experiences while also situating findings within the theoretical constructs of DOI (Rogers 2003).

To mitigate potential researcher bias, theme and insight development were discussed between the authors. This debriefing process allowed emerging insights to be critically examined and refined. In addition, a reflexive approach was maintained throughout the analysis, with the primary researcher acknowledging their positionality and actively reflecting on how this may influence data interpretation.

The key themes and insights are presented in the following section, illustrated by individual farmer quotes.

3. Findings

In this section, we present how farmers in NZ interact with and amalgamate information across digital and physical formats. Figure 2 is a conceptual framework illustrating the sources of information that farmers interact with and their relative influence.

This framework was created in response to the sources and interactions described by farmer participants. Consistent with Šūmane et al. (2018), in this study, formal information sources (blue) are defined as those that are institutionalised and structured, whereas informal information sources (yellow) refer to decentralised and socially embedded channels. Sources that adopt formal and informal elements have been coloured green to represent this combination. The uniqueness of each farm meant that the ways that farm-

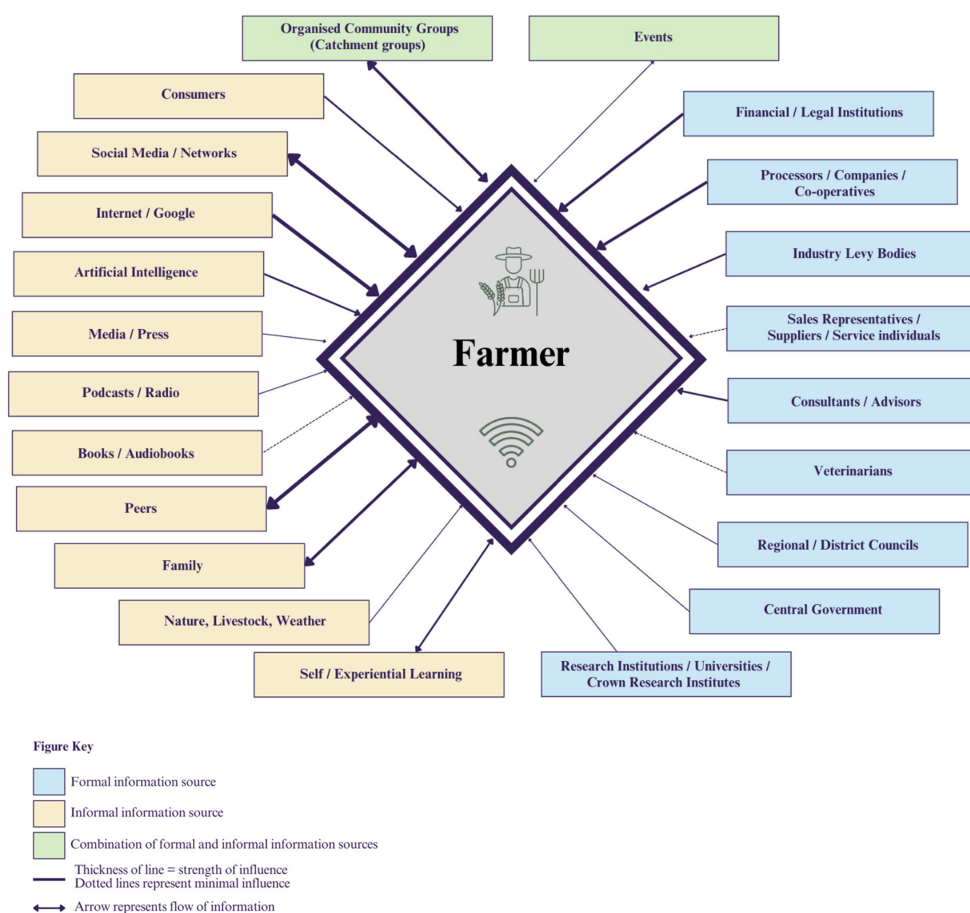


Figure 2. Sources of information farmers interact with in New Zealand.

ers interacted with information were personal, contextual and unique. Despite differences, all farmers recognised that information is fundamental for effective strategic decision-making:

Information is crucial ... if you don't have the right information, you're just gonna fall over.
(DF2)

3.1. Formal information sources

Farmers interacted with several formal information sources, including processors, industry groups and local government. Interactions generally occurred on an ad-hoc basis, and information was gathered as required. Farmers described feeling disconnected from research bodies and the government, and desiring more bottom-up flows of information:

Going back to communication and how it flows, I think there's always a role for trying to potentially make the government a little bit aware of what the actual realities are in farming too you know, I think there's a lot of naivety about what happens on farm and how we farm.
(SBF6)

A majority of farmers identified that they greatly valued science but felt that it was disconnected from real-world applications. It was highlighted that information from research institutions was often technical and difficult to interpret, as one farmer (DF7) reported ‘it’s complicated stuff’. Due to the lack of direct engagement with research bodies, one farmer (DF1) described having very little idea about ‘what they do’. The nature of scientific funding meant that some interviewees were cynical and believed funded research was biased. Some farmers expressed desires to engage more with information from research bodies in ways aligned to farmer learning preferences. One farmer (SBF7) explained the need for ‘local innovation hubs’ that are ‘a safe place where people can interact with science that sits somewhere between the lab, the research organization, and the farmer’. These findings highlight the potential value for integrated styles of applied information sharing as farmers expressed the need for scientists to deliver accessible information that farmers can understand.

Farmers perceived the trustworthiness of information from financial institutions, industry levy bodies, co-operatives and processors as relatively high; however, there were mixed views on the effectiveness of these sources for strategic decision-making. Although industry-related groups were identified as helpful for sourcing information related to production-oriented matters, the relevance for strategic land-use decision-making was mixed due to sector silos and fragmentation of information. This presented challenges for farmers who were interested in seeking strategic information or considering land-use change:

I think it is really challenging because for the vast majority of the time farmers will get information specific from industry sources ... you know some of the information we get is great but it’s also like a closed loop that stops us from looking at what are other potential uses for that land. (SBF3)

Consultants and advisors were used by a minority of interviewees, often on a case-by-case basis to inspire or validate approaches. The choice of consultant largely depended on reputation, alignment of values, and personality. Several interviewees decided to forego consultants because of their cost and/or because they preferred informal information sources. This was especially true for the interviewees who engaged in peer groups and networks, which helped them to gain confidence and act on information:

Before I got involved with the online network [farmer group: quorum sense], we really relied on farm consultants pretty much, and the fertiliser company, and now we don’t. Those were our sole sources previously ... it was kind of like a light bulb moment when he [the consultant] suggested quite conventional tools to go forward, and I was just sitting there thinking no I’m not doing that, and in the past, I would have been thinking I was wrong to judge their expert opinion. (DF2)

Agricultural service organisations and representatives were other commonly mentioned sources of information, primarily to inform operational decisions. However, the value and trustworthiness of these sources varied, as farmers were typically cynical of corporate interests:

Companies just want to sell like fertilizer you know ... they’re not worried about the soil health or anything. They are just telling farmers what they want, you know, they’ve got quotas to make. They’re just trying to sell the product. (DF2)

Overall, farmers made it clear that informal and digital formats were the most utilised channels.

3.2. Digital information sources

Digital technologies such as the internet and social media were identified as indispensable by participants. Farmers commonly used the internet to access Google and various websites, where they gathered information to inform all types of decisions. These sources were used regularly, allowing farmers to overcome significant time, cost and geographical constraints, allowing change to occur at a much faster pace, as noted by (SBF1):

It's real-time, because you know it used to be Friday night you might see people and hear things at the pub but oh, it's too late, yeah next year you could do it, but now it's instant. (SBF1)

The video and audio formats available on the internet also enhanced learning. Farmers reported that information in these formats was easy to assimilate, particularly with the use of visual aspects and storytelling:

YouTube's a really good one for learning. Like I try and do everything myself. So if you don't know something, you go and learn off YouTube so it's really good. And I think there's so much information out there, and the internet is a great source to get it from, but you've got to kind of know what you're looking for too. (SBF8)

Accessibility of listening whilst performing other tasks was reported as an advantage of using podcasts. Complementary to podcasts, the influence of social media and social networks was a consistent theme that arose. For some farmers, it was noted that the adoption of these digital platforms has come with many new learnings:

Social media is a whole new field, a lot of our generation are not really brought up with, it's a learned thing. (DF5)

Participants often described how they follow other national and global farmer influencers on social media whom they looked up to and aspired to be like. This was particularly true for the young farmers who used social media and online channels to indirectly source information from industry and government bodies:

So many farmers still get the newspaper, and things like that. We're probably the next lot like generation that's come through, we use LinkedIn and Facebook and things like that a lot more to find things out. (YF2)

As digital natives, the younger farmers greatly valued digital sources and adopted innovations such as Artificial Intelligence (AI), often used as a search engine in a similar format to Google. Compared to the interviews where no participants explicitly identified using AI, the young farmers adopted AI for a range of purposes and expressed motivations to embrace new technologies in order to stay competitive. However, it was recognised that having foundational farming knowledge will always be fundamental:

It's [AI] good to use it, like you can't miss out on these things or you will get left behind. But you have to make sure that you have an understanding. It's like they don't give you a calculator before they teach you how to do maths. Because you'll get found out if you don't understand something. (YF8)

To improve the effectiveness of knowledge transfer, the younger farmer group agreed that formal institutions would benefit from partnering with innovative and well-respected farmers to disseminate information in meaningful ways:

I think the universities would really benefit through like connecting with those innovative farmers out I guess in the wild and help them implement things, then it would just spread through word of mouth. (YF7)

Farmers' choice of farmer influencers and networks were personal and unique, depending on their goals and aspirations. Some farmers described how they had joined networks and groups online where they transcended industry and geographical boundaries in multidisciplinary communities. For some farmers, belonging to these groups was important not only as a source of information but also for support, inspiration and to validate information:

Sometimes things are really miserable, bank interest rates are high, you've got a drought, you go and talk to your mates ... it's about bonding, and you want to know, you need to feel like you're part of a team in order to feel like you're gonna survive, that's one of the most basic fundamental elements of human nature, isn't it?. (SBF6)

Farmers built confidence by engaging with these networks, often supplementing or foregoing more traditional sources of information and advice. For example, one farmer (SBF1) described this process regarding taking advice from sales representatives:

They used to be like your doctor, you would trust him, but now you can jump online or on WhatsApp and say, look rep says this, and someone might say oh no, or you only need this much, or you don't need it at all we tried this, and it's just networking. (SBF1)

These examples illustrate how digital networks may be changing the nature of how farmers interact and validate information. Across networks and social media platforms, some farmers also shared information on their own pages, acting as information curators. This process was described as creating 'citizen science' (SBF1).

3.3. Other farmers

Other farmers were identified as farmers' most valued sources of information due to their credibility and mutual respect. Credibility was often attributed to having practical experience and participants valued being able to relate to others where there was a shared identity without corporate interests. This increased their receptivity to information: 'Peer-to-peer learning, I think that's number one. Let's cut the bullshit out of it. Yeah, let's cut the marketing out of it. They're not trying to sell me something' (SBF1).

Although other farmers were a highly valued source, the choice and selection of individuals was crucial, as interactions with other farmers were not always positive. Two farmers noted concerns about the agricultural information-sharing culture. This was especially evident for information surrounding sustainability or systems change, as experiences:

We started thinking aloud with some other farmers, but you know, the common comeback was, are you using that airy fairy stuff? And why bash my brains on people that don't want to change? When it takes enough effort to actually do the change yourself anyway. (DF5)

3.4. Organised community groups

Farmer-led catchment groups described by the participants adopted formal and informal aspects to their structure (for further information on catchment groups refer to Sinner et al. 2023). The groups had institutional setups and often received funding; however, they were community-driven. Farmers involved in catchment groups reported the structure and bottom-up approach helped to increase contextual relevance and receptivity to information. To improve knowledge exchanges, one farmer noted that knowledge brokering should occur at the catchment level as an effective way to engage with farmers:

It's the catchment's role to decipher what is going on ... you want more work done at the catchment community level because they are your interface or your knowledge broker. If your knowledge brokering happens at a catchment level or a community level, it's more likely to be adopted. (SBF7)

Farmers also described how catchment groups commonly morphed to serve many other positive functions which connected their community:

It's brought our community together and I think that's where the local hall where we've painted it up and we have an idea about having cups of tea once a week, yeah drop tools and come, just for the sake of socializing locally and starting to learn about our neighbours rather than actually going further afield. (DF6)

These findings highlight how community-driven catchments can assist in knowledge brokering and collective learning processes. It is important to note that there were variances between farmer experiences as certain regions did not have a catchment group and others identified that it was challenging to get other farmers co-ordinated and engaged. One sheep and beef farmer (SB11) described how catchment groups offer great potential, however, to be successful, they need to 'get organised, get the funding, and get the support around them'.

3.5. Trust and validation

Gathering trustworthy information was a key challenge. Farmers felt that there is no single source of truth and reported being critical of everything 'I don't find a lot trustworthy and credible. I make that opinion for myself. So there's no kind of one source of truth that is trustworthy and credible, I take everything at face value'. (DF4)

Regardless of the information source, farmers described how trust was personal, evolved over time, and is closely related to credibility and contextual relevance. The need to be critical was attributed to the unprecedented volume of often conflicting information, which also brought challenges for farmers when attempting to validate information:

Information is so easily accessible nowadays so you can go and find research that supports your theory, or your idea, and then you can go find something that conflicts it or counteracts it and they're all peer-reviewed ... it's almost like information overload. There is so much out there that how do you find the right information for your structure, business, or decision?. (SBF11)

Farmers commonly reported using a cross-referencing and triangulation process to validate information. First, information was validated internally (e.g. through internal cognitive processing, further research online and discussion with family and farm staff) and

then externally (e.g. with respected peers and networks). Attempts to validate information whilst managing information overload were also clearly challenging for farmer participants ‘I feel like there’s an absolute tsunami of information and I don’t know where to start with it sometimes’ (SBF10).

Concerningly, farmers of all ages described how they struggled with information overload. Several farmers described how it negatively impacted their well-being and ability to make effective decisions ‘I reckon I get quite overwhelmed ... sometimes it’s in the too-hard basket’ (YF7).

Several concerns around the evolving risks of online echo chambers, confirmation bias, and misinformation were also expressed:

I think [social media] is good for accelerating learning. But you’ve got to try figure out what’s fake news and what’s not. There’s so many rabbit holes you could get yourself into and you could fill your mind up with a lot of negative stuff pretty quickly. (DF5)

When it came to strategic and sustainability-related decision-making, farmers felt that information was lacking in availability and/or not easily sourced. Farmers identified that a lot of information they interact with is often not relevant to their context. Additionally, farmers described how they most often engage with information related to production, efficiency, and day-to-day matters, with strategic information gathering being much more ad-hoc. One dairy farming couple (DF6) described this as operating in a ‘production-oriented mindset’, which influenced how farmers interacted with information. The same couple (DF6) also identified that it was not more information that was needed, but rather a deep understanding of long-term aspirations and their context to then inform effective information gathering and prevent information overload.

4. Discussion

This research contributes to literature investigating the role of information in farmer-decision-making (Dessart, Barreiro-Hurlé, and van Bavel 2019; Liu, Bruins, and Heberling 2018; Prokopy et al. 2019; Rust et al. 2022) by providing new insights into the evolving ways farmers interact with information in the digital age. In particular, the results of this research expand on earlier literature (e.g. Rust et al. 2022) by highlighting the emerging adoption of AI by younger farmers alongside the presence of information overload in NZ.

4.1. Increasingly digital farming world

This research found that farmers interact with information from a diversity of sources across digital and physical formats, as evidenced in Figure 2. Consistent with previous studies (Kirk et al. 2022; Sligo and Massey 2007; Small, Brown, and Montes de Oca Munguia 2016), farmers interacted with formal institutions such as industry groups, local governments, and research institutions; however, farmers made it clear that informal and digital sources were the most utilised channels.

Compared to the older farmers, younger farmers distinctly adopted innovations such as AI and expressed motivations to use new technologies to stay competitive. These results illustrate differing digital baselines of younger and older generations, which sug-

gests that targeted approaches to information provision may be more effective. Across all participants, however, there was a preference towards digital and interpersonal sources, which are accessible, free and delivered in formats that support assimilation.

4.2. Sources: farmer influencers

The use of the internet, peers, and interpersonal networks was indispensable for farmers, which is aligned with earlier research (Kirk et al. 2022; Prost, Gross, and Prost 2022; Rust et al. 2022). Across social media networks, farmer influencers locally and internationally were valuable sources of information for participants, particularly for the younger farmers who suggested that partnering with influencers and ‘innovative farmers’ is a good strategy for institutions to improve knowledge transfer. This finding is similar to that of Rust et al. (2022), who had comparable results with European farmers, suggesting that farmer influencers are an important source of information who act as a modern version of Rogers (2003) opinion leaders, with the ability to accelerate the adoption of ideas (Rust et al. 2022; Sahin 2006). Consistent with these authors, interviewees were more receptive to influencers with a farming background, which impacted perceived credibility; however, trust in influencers varied, depending on the goals and views of the farmer. Video and audio formats such as podcasts were also identified as useful by farmers to support the transfer of information and kinaesthetic learning processes. As Chivers et al. (2023) note, podcasts offer the potential to be a useful instrument for hybrid approaches to extension methods; however, this has not been widely discussed or investigated.

4.3. Trusted source: other farmers

The farmer participants in this study generally concurred that their most valued and trusted sources of information were other high-achieving farmers and interpersonal networks. Trust was relatively low in online sources, sources with commercial interests, and with central and local government. These results are similar to those of previous authors (Kirk et al. 2022; Sligo and Massey 2007; Small, Brown, and Montes de Oca Munguia 2016); however, the influence of other farmers varied. This is because the view of what achievement represented differed for each farmer. Two interviewees also experienced negative interactions with farmer peers when discussing the adoption of different and innovative practices, which discouraged them from broadly interacting and sharing information. Therefore, trust in information from ‘other farmers’ is a generalised term that should be approached with caution, as the results suggest that the influence of other farmers is personal and unique to each individual. These findings represent the differences that can arise when enquiring about individualised versus more generalised trust (e.g. as noted by Rust et al. 2022); however, overall, the results align with the broad notion put forward by Brown and Roper (2017), who suggest that farmers are likely to be influenced by other farmers in their networks.

4.4. Farmers as active information gathers and co-creators

Aligned with the recent argument presented by Kirk et al. (2022), the results demonstrate that farmers are active in information-gathering processes, engaging as researchers and information curators. This was evidenced by the ways in which the farmers in the present study were creating information on farm (e.g. collecting data, experimenting, and observing), sharing citizen science within networks (e.g. via WhatsApp), and doing their own research on the internet. These results extend on Liu, Bruins, and Heberling (2018) framework, by suggesting that influential information is increasingly being generated at micro-levels (i.e. within community networks and by farmers). Therefore, in addition to recognising the downscaling flow of information (i.e. from information providers and policymakers to farmers), there is a need to recognise how information is being produced at micro levels and the potential importance of the upscaling of information (i.e. from farmers to information providers and policymakers). These findings align with calls for farmers to be recognised as co-creators of knowledge and information (Šūmane et al. 2018). As noted by Kirk et al. (2022) and Wood et al. (2014), linear and simplistic top-down approaches to information provision should therefore be avoided as they are ineffective under such circumstances.

4.5. Farmers and information overload

Many farmers were concerned about misinformation and felt overwhelmed, experiencing what Bawden and Robinson (2020) term as information overload. This led to many farmers ‘not knowing where to start’, experiencing confusion when finding conflicting sources, and feeling concerned about the negative content and echo-chambers online. These results align with the global concerns surrounding the impacts of misinformation on mental health (WHO 2020) and, as society fully moves into ‘hyper history’ and the ‘infosphere’, as Bawden and Robinson (2020) and Chowdhury et al. (2023) stress, digital literacy needs to be taken seriously now more than ever.

Despite the abundance of information that is available, farmer participants commonly felt that information to support strategic decision-making was both challenging to source and lacking in availability in a way that was relevant to their local context. As Kirk et al. (2022) suggest, this points to the need to better coordinate the flow of information between informal and formal sources through intermediaries. Furthermore, as Rust et al. (2022) also note, there may be a more important role for trusted intermediaries now more than ever. That is because these individuals can enhance the exchange of ideas between groups to support connections flowing both ways, where intermediaries can enable farmers as well as researchers to learn about the innovations arising from each other’s work.

4.6. Need for trusted intermediaries

The results suggest that farmer-led community groups, such as catchment groups, could provide an effective vehicle for intermediaries to knowledge-broker whilst also enhancing social capital. The results found that for the farmers involved in successfully established catchment groups, they reported increased receptivity to information, high

contextual relevance, and community connections from their involvement. As Kirk et al. (2022) noted, knowledge brokering through intermediaries at the catchment level is considered effective and important to facilitate sustainability transitions in NZ. These results confirm this assertion and, more broadly, suggest that investigating knowledge brokering through similar farmer-led community groups globally could be an effective means to support information provision and social learning processes.

5. Conclusion

This study highlights the significant transformation in how farmers in NZ interact with information in the digital age. While formal institutions remain relevant, farmers increasingly rely on digital channels, social media, peer networks and emerging technologies like AI, particularly among younger generations. This shift underscores a preference for accessible, free and easily assimilable information formats that support learning and decision-making.

The abundance of information, however, in the digital landscape presents considerable challenges, including issues of trustworthiness, credibility and information overload, which can negatively impact farmers' well-being and decision-making capacity. The research suggests that farmer-led community groups, acting as trusted intermediaries, can play a crucial role in knowledge brokering, enhancing information receptivity, and fostering social capital at the local level. Ultimately, understanding these evolving information dynamics is vital for developing effective extension strategies and prompting sustainable agricultural practices.

6. Recommendations

To inform the design and dissemination of information, public and private institutions should continue to develop digital competencies and policies related to communication, data ownership, and the use of AI.

This could include campaigns, support and upskilling for agricultural stakeholders to manage misinformation and information overload (e.g. as suggested by Bawden and Robinson 2020). In addition, institutions should train agents in soft skills, continually upskill in relevant technologies, and establish feedback loops with farmers to improve the flow of information from micro to macro levels (e.g. as suggested by Kirk et al. 2022). This could involve collaborating with farmers to co-design effective hybrid communication approaches.

Finally, institutions should take stock and work with the farmer influencers and networks already in practice alongside trusted intermediaries to facilitate flows of information. For example, such institutions in NZ would include Dairy NZ, Beef and Lamb, Fonterra, Ministry for Primary Industries (MPI) and the Bioeconomy Science Institute (BSI).

7. Limitations and further research

The qualitative nature and sample size limit generalisability of these findings. A further limitation of the research is that gender differences, as well as those related to different cultures of knowledge (i.e. between Māori and non-Māori land managers), were not investigated or addressed. These limitations, alongside the insights that arose from the project, provide opportunities for future research.

The implications of misinformation, information overload, and digital literacy should be considered, as relatively little is known about the ongoing impacts of these topics in the agri-food sector, as highlighted by Chowdhury et al. (2023). Research should investigate the implications of evolving sources of information, including AI, podcasts and social media. Quantitative analysis to investigate the widespread use and value of these sources would be useful to inform the design of information systems. Understanding the attributes of effective intermediaries and influencers should be considered to assist with information provision. As Rust et al. (2022) suggest, to uncover these key stakeholders, future research could employ social network analysis to pinpoint influencers and understand why they are considered credible. This could extend to investigating nuances across the platforms that farmers utilise.

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