

## How does extension 'fit' in the landscape of sources knowledge and support available to North West Tasmanian agri-food producers?

Sue Kilpatrick, Nicoli Barnes and Pattie Weichert

Tasmanian Institute of Agriculture, University of Tasmania, Locked Bag 1325, Launceston TAS 7250

Email: [Sue.Kilpatrick@utas.edu.au](mailto:Sue.Kilpatrick@utas.edu.au)

**Abstract.** Agriculture and food processing are becoming increasingly knowledge intensive as imperatives to innovate in the face of climate, market and other changes accelerate. The Agri-food Knowledge Matrix attempts to 'make sense' of the vast, complex array of information and support available to North West Tasmanian agri-food producers that is difficult for producers to navigate as they attempt to respond to risks and opportunities. The matrix identifies knowledge holder organisations and enterprises, from local extension to online knowledge repositories, mapping them according to areas of food production practice (e.g., production, business, sustainability) and innovation/change process stages (awareness, decision making, implementation, monitoring and review) for agri-food business in various sectors (horticulture, dairy, etc.). We explore where extension fits in our mapping of the agri-food knowledges held and used in North West Tasmania and suggest steps for improving cross value chain collaboration to give producers access to knowledge and support needed for resilience.

**Keywords:** knowledge sources, extension, innovation, adoption and adaptation, change, resilience

### Introduction

Tasmania has an internationally competitive and growing agri-food sector, producing 5.5 times as much food as is consumed in the state and supplying a wide variety of fresh produce and award-winning niche products to other Australian states and other countries (State of Tasmania 2023; Natural Resources and Environment Tasmania 2022). The approximately 900 farm businesses in the North West region of Tasmania produce 41% of the value of agricultural production from only 16% of Tasmania's farmland. The region is also the location of a number of large food processing companies, for example, Simplot, Fonterra, Saputo, and Greenhams (Department of Natural Resources and Environment Tasmania 2022). There is therefore an accessible pool of expertise in food manufacturing in the region (.id Consulting Pty Ltd 2021).

Agri-food business in the North West is dominated by small and medium enterprises (SMEs), which are predominantly family based businesses. There is potential to significantly increase the value of agri-food production in the region, particularly through supply chain linkages (.id Consulting Pty Ltd 2021). While family farms and entrepreneurial agri-food producers are seeking to create sustainable businesses in North West Tasmania, small local producers lack easy access to supply chain networks. Nor do they have the professional research, economic backing and development support needed to navigate fast-changing technology (Rotz et al. 2019) and adaptations for climate change. There are similar access barriers to understanding and accessing knowledge about systems and processes that capture and monitor environmental impacts (Jai 2021). A region's future competitiveness, sustainability and resilience is threatened when it is disconnected from its agri-food economy (Stone & Rahimifard 2018).

Agri-food systems sit at the intersection of natural systems and economies, with food production requiring decentralised control because it is reliant on local knowledge and skills (Van der Ploeg 2016). Climate change and fast-changing technologies demand innovation (Rahman 2015). Innovation requires the right knowledge to make decisions, implement change and monitor the effectiveness of that change. Knowledge management and sharing knowledge throughout the supply chain is essential if agri-food businesses are to be sustainable and thrive into the future (Beske et al. 2014; Dung et al. 2020). Stone and Rahimifard (2018) argue that this knowledge management and access to broader relationships across the supply chain, sit alongside capacity to learn and adapt as being essential. In practical terms, this means that appropriate knowledge acquisition processes should alert small and medium enterprise (SME) agri-food businesses to changes in end user needs and preferences, new opportunities and risks (Wicaksono & Illés 2022), raise awareness of new ways of doing things and new resources to do them, all of which are especially relevant in the context of fast changing technologies (Rotz et al. 2019). These understandings have implications for what extension work is required in this space.

In the project this paper was drawn from, a dynamic capabilities perspective (Teece et al. 1997) has been used to consider how agri-food businesses can act both entrepreneurially and in collaboration in order to make changes, but still be resilient and thrive in the context of ongoing

external changes. Knowledge acquisition is an important part of such adaptive processes and value chains (or supply chains) that work collaboratively (Dung et al. 2020). Both horizontal collaboration, for example, between agricultural businesses and vertical collaboration, for example between agricultural businesses and food processing businesses, are needed, with collaboration from others such as food safety, animal welfare and marketing agents to improve supply chain resilience and sustainability (Leat & Revoredo-Giha 2013; Wicaksono & Illés 2022).

The innovation system described above needs more than a linear transfer of knowledge to facilitate cross supply chain knowledge sharing, learning, adaptation and innovation. Trust and social capital must be built and maintained amongst all stakeholder groups in the supply chain (Paschen et al. 2021). The innovation system needs collaboration structures or vehicles that bring people together and make the most of cross supply chain synergies and manage risks holistically (Jai 2018). Clusters, incubators and accelerators can enable entrepreneurship and creativity, building capacity to respond to external factors, facilitating commercialization and competitiveness. Such an innovation system model is not new, Freeman (1988) and Lundvall (1992) suggested that whole nations access and develop such innovation systems.

### ***Extension, innovation and adoption***

An innovation typically attracts a few early adopters, then increasing numbers until a small number of 'laggards' finally take up the innovation (Rogers 1995). Over time we have come to understand that learning is a social process influenced not only by science and logic, but by attitudes and values, as explained by theories such as the Theory of Planned Behaviour (Ajzen 1991) and the perceived usefulness and ease of use of new technology or equipment (Afzal et al. 2022). This basic understanding has been augmented by understandings such as that some people learn best by reading or talking to others, some in groups, others one on one with experts (Kilpatrick et al. 2003). Some have 'boundaries' that limit their capacity to change, lines they are reluctant to cross despite promise of return. Boundary examples are going into debt or employing more staff (Turner et al. 2017). It is useful to have some source of support to check when change doesn't go to plan, examples are experts, other producers and case studies (Kilpatrick & Johns 2003).

Extension is part of a learning ecosystem; agri-food producers can select among providers and sources of knowledge and learning when making changes to practices. Farm business have different preferred learning 'patterns' (combinations of sources used), and the combination varies by type of innovation. Kilpatrick and Johns (2003) found, for example, that less progressive farm businesses making a management or marketing practice change relied on a single trusted expert, while more progressive businesses drew on multiple learning sources including experts, other farmers and print and online media.

A long history of extension research has used the transfer of technology model to explain how farmers learn individually or in groups led by an extension 'expert' with the knowledge that farmers need to make change through technology transfer (Jai 2018). Group-based extension presents opportunities for interaction with other farmers (who are also 'experts') as well as facilitators in the context of receiving new information (Kilpatrick 2000). Extension has evolved toward more participatory approaches that build rural and food production capacity (Oladele 2020). The impact of COVID too has increased willingness internationally of extension facilitators to try, and farmers to join, online 'e-extension' activities (Afzal et al. 2023). Extension is now regarded as a key part of the agricultural knowledge system and innovation cycle despite changes in how extension is implemented over time. It acts to reduce commercial and safety risks, and improving environmental management (Rahman 2015).

Extension can therefore be seen as a key component of not only the adoption of existing innovations; but also co-creation or co-innovation of new knowledge. Paschen et al. (2021) investigated the process of co-innovation in the Australian agricultural extension and advisory system. They found it was essential to engage supply chain partners including large food processing companies as well as SMEs and agricultural extension and advisors. However, competition between processing companies, including for SME produce suppliers and with the final product in the marketplace, can act as a barrier to the collaboration necessary to maximise co-innovation benefits. Continuity, developing and maintaining shared vision and relationships through the supply chain must therefore be resourced, for example, by an intermediary or broker (Paschen et al. 2021). Intermediaries can promote the social learning that must occur among supply chain participants (Turner et al. 2020). Extension has a key role to play in coordinating such a system (Oladele 2020).

A value chain approach has been used to explore and explain the interconnectedness of the agri-food system and the key role of sharing knowledge and collaborative learning, however extension

has tended to be segregated to the operational aspects of production, disrupting the efficient functioning of the value chain (Oladele 2020). Extension that has worked along the value or supply chain in developed economies such as Australia has typically been associated with large food processing companies, such as milk or vegetable processors. Large food processing companies provide extension services to their suppliers, motivated by the processor wanting to standardise produce arriving at the factory, and maximizing commercial return (Paschen et al. 2021). The processing company typically has market intelligence about end user demand, and the resources to develop processes for farmers to implement to minimise variation in quality of produce it purchases.

Those working in extension therefore need to recognise and address producer concerns. Producers' perceptions of risk or vulnerability, their perceptions of their own ability to plan, learn and reorganise to cope with the change, and their interest levels, all contribute to change actually occurring on the ground (Marshall & Marshall 2007, Preston & Stafford 2009). Choosing the 'right' approach to extension is therefore important (Preston & Stafford 2009). Resourcing is essential for success, as is a co-productive, networked, collaborative learning pathway (Cliffe et al. 2016), via small group processes rather than individual approaches (Klenk et al. 2017). Extension must address these demands to improve adoption and the capacity of those participating in extension activities. It is vital for experiential learning through proven frameworks to improve producer responses to vulnerabilities in innovation and change (Cliffe et al. 2016), including in Tasmania (Hall et al. 2019).

*Extension and North West Tasmania* Traditionally, large food processing companies in North West Tasmania play a large role in extension for their produce suppliers, linking on-farm and value add agri-food production. This is likely to result in a competitive rather than collaborative supply chain (Paschen et al. 2021). The Tasmanian Institute of Agriculture, a joint venture between the University of Tasmania and Tasmanian Government became responsible for all Government research and development, including group extension activities in 2010, with the State divesting itself of one on one production and technical extension and asking the private sector to pick up this role (Walker 2010). Similar changes occurred in other States around the same time. Natural capital extension activities in Tasmania have largely become the responsibility of Natural Resource Management regional bodies, and government funded organisations such as Landcare.

The larger project drawn on in this paper addressed the research question: what knowledge is available to assist North West Tasmanian agri-food producers to be resilient and innovate? In particular, what knowledge and resources are available that allow them to understand and collaborate across the value chain for resilience? In this paper we argue that extension is vital in making the connections and building the collaborations required across the regional value chain for agri-food businesses to learn and innovate together to build prosperity within North West Tasmania.

## **Methodology**

The project adopted a qualitative research approach using thematic reflexive analysis (Braun & Clark 2019). This approach is inductive and iterative. It allows for, and encourages flexibility, collaboration, consultation, discussion and modification of themes over time as data is collected and analysed, with the aim of reaching agreement about themes present in the data. The research team drew on team meetings, the advisory group, individual interviews and group discussions with agri-food industry and knowledge provider representatives in reaching final themes. The scope of the funded project meant that individual agri-food producers were not included in data gathering, except incidentally where several interviewees also operated SME agri-food businesses. The focus of further funding will be on SME agri-food businesses and their use of the matrix. The project received ethics approval from the University of Tasmania Human Research Ethics Committee ID27894.

To address the project research questions identified above and to begin mapping the agri-food knowledges in North West Tasmania, two activities were instigated. A project advisory group was established and a framework to 'contain' the knowledge mapping was developed. The project advisory group was made up of representatives of agri-food producer associations, regional development and natural resource management bodies and the local Drought Resilience Adoption and Innovation Hub.

An appropriate framework to present and order sources of knowledge was also developed. A matrix style layout was chosen in consultation with the advisory group (see Figure 1 below). It reflected the stages in the innovation or adoption process where agri-food producers may require knowledge (awareness, decision making, implementation, monitoring and review) and areas

where innovation or change might be made (for example, technical production, business management, natural resource management).

We next located sources of knowledge through a web search, uncovering a mix of service providers who could provide agri-food producers with knowledge or information, sometimes applied to their business context, and sites or tools containing information that agri-food producers could draw on in the innovation or adoption process. These sources of knowledge could be either physically present in the region, and/or available via a website. Websites were scanned to identify the areas of knowledge the organisation could provide to agri-food businesses and the innovation stages for which that knowledge would be useful. Knowledge sources were placed in the matrix and categorised according to the type of organisation, noting that a single organisation could fit more than one category. Area categories included industry association, government, research, education and training, industry advisory service, product supplier and community service.

As a result of placing sources in the matrix we expanded from a single Excel spreadsheet matrix into similar matrices on multiple spreadsheets in a workbook, one worksheet each for knowledge sources that applied to all or most agri-food business or multiple sectors (for example, knowledge about business practices and individuals' resilience), and other spreadsheets for sources that applied only to a particular agri-food sector, for example, dairy, horticulture, seafood or food processing businesses.

We validated both our workbook knowledge matrix layout and the knowledge sources within it with the advisory group and through a mix individual and group interviews. Some interviewees were knowledge user stakeholders, such as agri-food membership-based bodies and regional development bodies; and some knowledge service providers, including agronomists, researchers, agri-tech businesses, rural business advisors, NRM bodies and Drought Hub staff. A total of 35 people based in, or providing services to North West Tasmania provided input to the research team about the matrix. Some individuals were both users and providers of knowledge and around half the knowledge providers could be considered to work in the field of extension. For the purposes of this study an organisation is classed as engaging in extension if it visited agri-food businesses and gave advice pertaining to particular businesses or provided group learning opportunities that included two way communication giving advice pertaining to knowledge application in particular businesses.

As we showed and explained the knowledge matrix excel workbook to the advisory group and interviewees they suggested additional knowledge sources as well modifications to the categorisation of areas of innovation where knowledge could be used and the arrangement of the spreadsheets. During these interviews/discussions it became apparent that commercially provided knowledge sources should be separated from government and non-profit sources, and future users of the spreadsheet should be alerted to the fact that not all commercial providers might be present and that inclusion in the spreadsheet was not an endorsement of the quality of services or information provided. The knowledge matrix workbook was modified as interviews were conducted and analysed.

## **Findings**

What resulted from this exploration was a deep dive into the knowledge and knowledge holders that would be of use to Agrifood knowledge consumers in North West Tasmania. In this paper we focus our exploration of the knowledge contained within the Matrix to that pertaining to extension. We explore where extension fits in the map of agri-food knowledge available for use in North West Tasmania and suggest how extension could improve producer access to the knowledge and support they need to innovate and be resilient, particularly in the context of the regional agri-food value chain.

To contextualise the place of extension, we start by presenting the types and areas of knowledge resources that are relevant to agri-food businesses across multiple sectors, before looking more closely at the extension available to agri-food businesses in the region.

### ***What types of organisations provide knowledge and resources to the agri-food industry in North West Tasmania?***

This section provides an overview of who provides the knowledge that could be useful for agri-food businesses. Figure 1 below is an example of one of the excel worksheets from the knowledge matrix. It captures the providers relevant across most production sectors of agri-food business (multiple sector). These organisations provide sector-generic information and services (for example, business management and work health and safety information). The worksheet contains

over 40% of knowledge providers identified. To understand the structure of the worksheets available in the matrix:

- There are worksheets relevant to agri-food businesses in multiple sectors, and others that specifically target single sectors – horticulture, dairy and livestock, seafood, and food processing businesses.
- The first column of each matrix sheet lists knowledge provider organisations colour coded according to organisation type (agri-food associations /member-based, government, non profit/ government funded program delivered by other organisations, research, education and training, and community organisations).
- Commercial (for profit) knowledge providers are noted in three single rows as agrifood service providers, non-agri-food specific commercial organisations or purchasers of agri-food product. Commercial organisations which were readily located through a web search are listed on a separate sheet.
- All organisations including those on the commercial sheet have embedded web links for ease of locating further information.
- Other columns note the areas in which knowledge and resources are provided (production, technology and equipment, natural resource management, business, funding and banking, people – work health and safety, people – wellbeing, marketing, sustainability, advocacy) and the stages of the innovation process for which the available knowledge and resources could be used (awareness, decision making, implementation, monitoring/ evaluation, continuous improvement and review).

**Figure 1. Example of knowledge matrix workbook: Multiple sector-relevant knowledge sources**

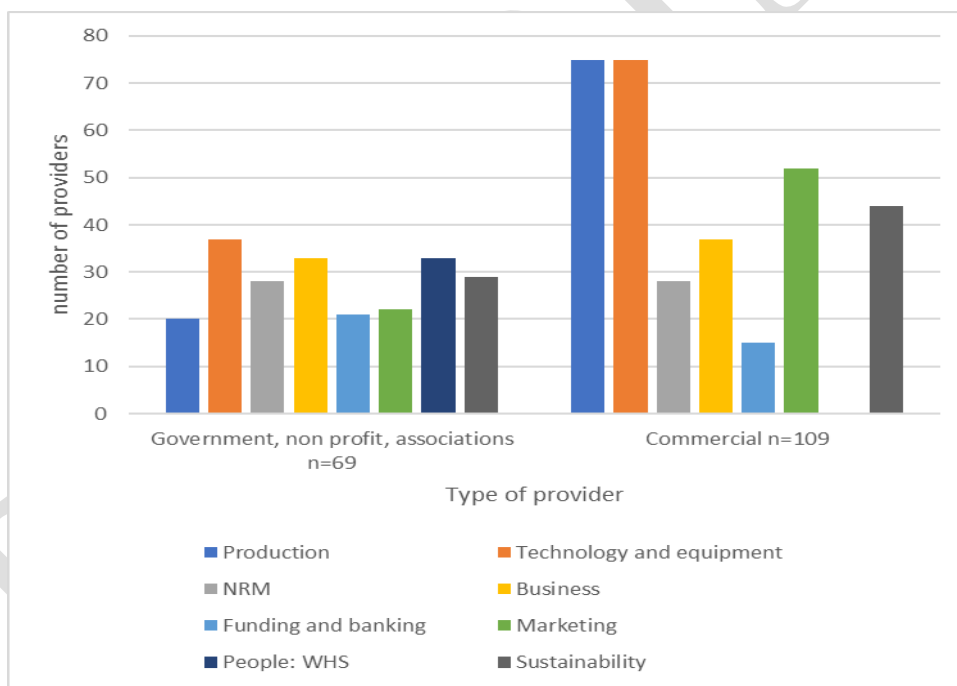
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	
		Area information and/or support										Innovation stage							
		Production	Technology and equipment	NRM	Business	Funding and banking	Marketing	People, Work Health & Safety	People Wellbeing	Sustainability	Advocacy	E-Enabler?	Awareness	Decision Making	Implementation	Monitoring/ Evaluation/ Continuous Improvement			
1		We provide info/support/resources for innovation:																	
2																			
44	Legal Aid																		
45	Tasmanian Fire Service																		
46	Tasmanian Irrigation																		
47	Agrifutures																		
48	TIA																		
49	TasTAFE																		
50	University of Tasmania																		
51	Sprout Tasmania																		
52	RESEED																		
53	Tasmanian Agricultural Education Network																		
54	Agritas Trade College																		
55	2STEN																		
56	Agricultural Advisors and Consultants																		
57	Seedlab Tasmania																		
58	The Van Diemen Project																		
59	Enterprize Tasmania																		
60	SWITCH Tasmania																		
61	Primary Employers Tasmania (part of TFGA)																		
62	Soil Wealth																		
63	Sustainable Table																		
64	Banking Services for Agribusiness: Some tools available on websites																		
65	Business Consultants																		
66	Digital and other equipment suppliers and related service businesses																		
67	Tasmanian Small Business Council																		
68	Tasmanian Chamber of Commerce and Industry																		
69	North West Community Legal Centre																		
70	Live Well Tasmania																		
71	Tasmanian Aboriginal Centre																		
72	Flinders Island Aboriginal Association Inc.																		
73	Brumby Hill Aboriginal Corporation																		
74	North West Ecofest																		
75	Headspace																		
76	Anglicare																		
77	Rural Alive and Well (RAV)																		
78	Lifeline																		
79	Beyond Blue																		
80	MensLine Australia																		
81	Men's and Community Sheds																		
82	West North West Working (recruitment and training)																		
83	Advisory services of processors & purchasers of farm produce																		
84	Advisory services of processors & purchasers of farm produce/livestock																		
85	Water and Irrigation																		
86	Valuer services - fee for service																		
87	Legal Services																		
88	Private Equity																		
89	Mental Health Providers																		
90	Insurance (for agribusiness)																		

Figures 2 and 3 below summarise the information in these worksheets (example of which is Figure 1 above) by 'area of information' (excluding 'people-wellbeing' and 'advocacy', where extension is unlikely to be represented) and innovation stage. Non-commercial providers are grouped together to provide a high level overview of the nature of knowledge available. Because individual commercial providers are not named on individual sheets, but are grouped together on a separate list, Figures 2 and 3 include all commercial providers, noting that some commercial providers may not have been identified through the web search.

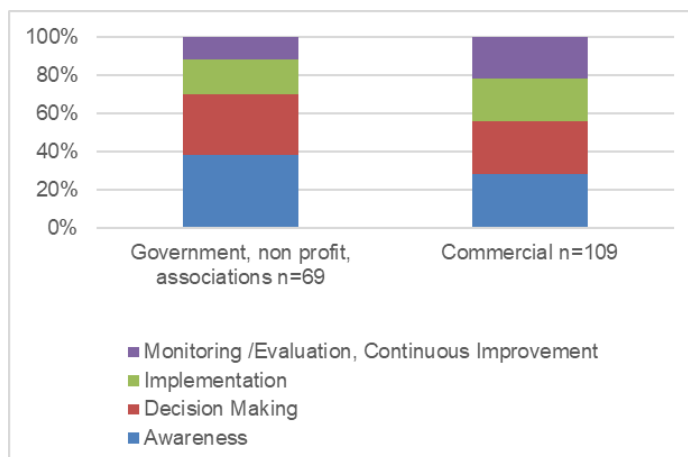
The pattern of information and support areas and innovation stages in the multiple sector worksheet (Figure 1) is typical of single sector worksheets, except that there are fewer business and funding and banking knowledge providers on single sector worksheets. This is not surprising as these tend to provide knowledge and resources that apply to SME businesses regardless of sector. Food processing, typically the second step in the value chain, after agriculture and aquaculture production, has considerably fewer (just six) knowledge provider organisations compared to agriculture and aquaculture sectors which each have over 20 sector-specific knowledge providers.

Commercial providers are weighted more heavily toward production, technology and equipment, and marketing knowledge and resources than is the government and non-profit provider grouping, while commercial providers are absent from people-work health and safety (Figure 2). Government and non-profit providers are less likely to provide knowledge in the later implementation and monitoring/improvement innovation stages (Figure 3). No food processing specific commercial knowledge providers were identified.

**Figure 2. Information and support relevant to multiple sectors of agri-food businesses by area of innovation**



**Figure 3. Innovation stage activity by type of knowledge supplier organisation**

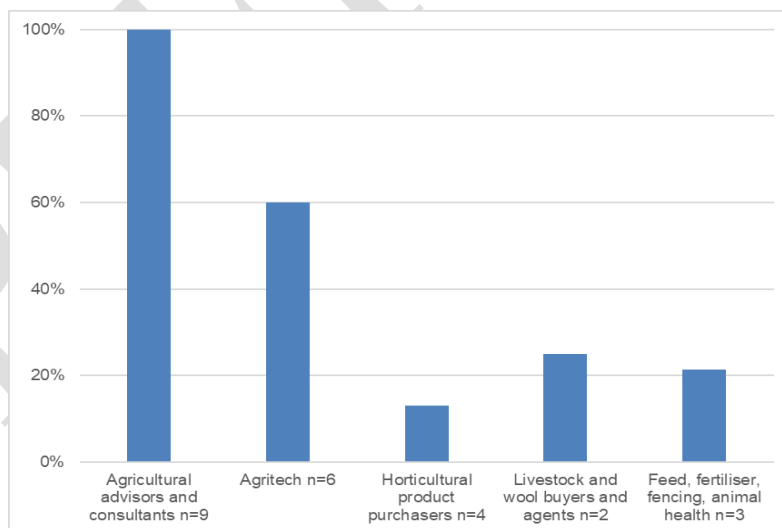


**Extension**

Of the 69 government, non-profit and associations on the multiple sector-relevant sheet, 11 provide extension services, with all but one of those providing services for all innovation stages. When sector-specific extension provided by government, non-profit and associations listed on other worksheets is added, an additional four extension providers bring the total number to 15. These four extension providers service horticulture (two), dairy and livestock (two) and food processing (two) sectors (one covers two sectors). Of the 109 commercial organisations across all the workbooks, 22 provided extension services. Extension therefore makes up a relatively small proportion of knowledge provider organisations available to North West Tasmanian agrifood producers.

In comparison, the types of commercial providers and the extent to which they are engaging in extension are shown in Figure 4. All agricultural advisors and consultants and 60% of agritech suppliers in North West Tasmania engage in extension to some extent.

**Figure 4. Proportion of commercial suppliers engaging in extension by type of supplier**



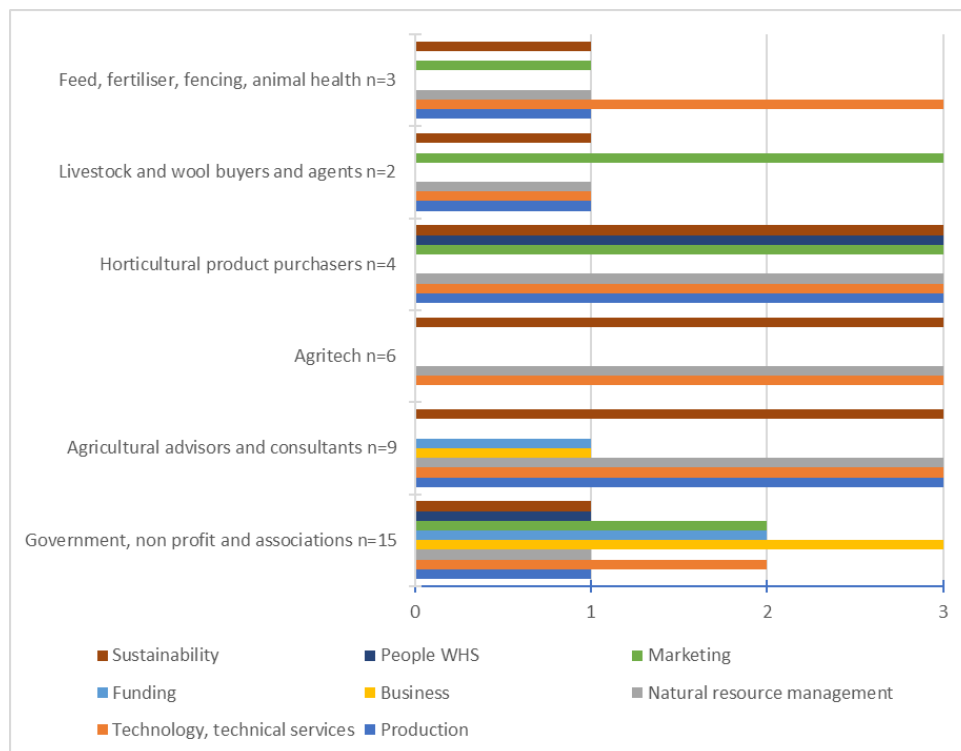
*For what areas/types of innovation does extension provide knowledge and services to the agri-food industry in North West Tasmania?*

Figure 5 is a heat map which shows the approximate proportion of each type of provider organisation which offer extension services for each of the eight areas of knowledge (see legend at the bottom of the heat map).

Government, non-profit and association extension provides knowledge in all eight areas listed. Agricultural advisors and consultants provide knowledge in all areas except marketing, which is

provided by sector specific extension from horticulture product purchasers, livestock and wool buyers and agents and one feed, fertiliser and animal health supply business. Business knowledge is only provided by government, non-profit and association, and agricultural advisors and consultants extension providers, although many non extension providers are also available for agri-food producers to draw on for business advice (see Figure 2). Knowledge about technology and equipment is available from a wide range of providers, most commercial.

**Figure 5. Heat map: Area of knowledge provided, concentration of extension services for each provider type**



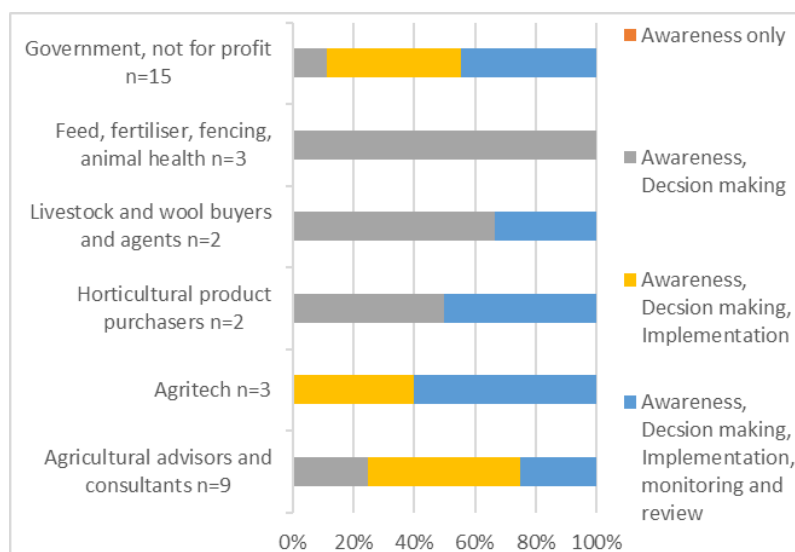
Heat map zones: Proportion of extension providers 0-1 < 40%; 1-2 40%-60%; 2-3 > 60%.

The areas covered by extension broadly align with the areas covered by multiple sector-relevant government, non-profit and association organisations, and all commercial providers, shown in Figure 2.

*For what types of organisations does extension provide knowledge and resources for various stages of innovation?*

Figure 6 shows that all extension services provide more than awareness in progressing innovations and change, with a proportion of all types (except feed, fertilizer, fencing and animal health) providing knowledge for all innovation stages. The majority of extension providers offer knowledge for later innovation stages, defined as being customised to the individual agri-food business contexts. This is mainly in the form of services, although some providers have tools for agri-food businesses to enter their own data.



**Figure 6. Innovation stage reach of extension services**

Showing percentage of provider type covering innovation stage.

Considering Figure 6 and Figure 3, it appears that extension providers are more likely to be active in servicing later innovation stages than the identified knowledge providers as a whole. This suggests extension is well placed to play a key intermediary role in supporting the resilience of the regional agri-food value chain and the SME producers within it. As Rahman (2015) noted, extension is a key part of the innovation cycle.

### **Connecting and co-creating knowledge across the value chain**

Is there evidence in North West Tasmania of the collaborative learning or coordination among value chain participants that researchers have suggested is needed to innovate and adapt to be resilient into the future (Pashen et al. 2021, Turner et al. 2020, Oladele 2020)? While the project reported here has only scratched the surface of the data needed to fully address this question, there are some clues from our analysis of knowledge provider websites that some knowledge providers and extension providers do aim to foster such collaboration. Not all provide extension services that actively involve agri-food SMEs. The Tasmanian Agricultural Productivity Group, a North West Tasmanian based advocacy body which also takes a leadership role in selected innovative projects is an example, recognising:

The benefits of broad industry collaboration, both between sectors and between pre and post farm gate interests, is more evident today than ever and critical to providing the optimum policy and priority settings for growth of the Tasmanian economy. (Tasmanian Agricultural Productivity Group n.d.).

Another example, the Tasmanian Seed Industry Group aims to connect across the seed production supply chain, however, the Group's scope does not extend beyond seed production into the regional value chain, to crops:

TSIG encompasses all aspects of the Tasmanian seed production industry, from farmers to agronomists, seed companies, seed testing, government and researchers. (Tasmanian Seed Industry Group 2023)

National sector-specific Research and Development Corporations (RDCs) also aim to collaborate across the value chain. There are extension programs, typically devolved from RDCs to be delivered by regional organisations, that have the potential to connect North West SME businesses into the regional value chain. Examples target dairy, vegetable and meat agri-food businesses. Meat and Livestock Australia (2023) runs carbon neutral and pasture programs. Hort Innovation funds VegNET, an extension program delivered in the region by a local agricultural advisory/consulting company which connects regional vegetable growers with the value chain and facilitates innovation (AUSVEG n.d.). DairyTas, an arm of Dairy Australia, provides extension and training programs for farmers and food processors that facilitate innovation and are connecting with government and organisations from other parts of the value chain:

DairyTas works to deliver both Tasmanian-specific and Australia-wide dairy research, development, extension and education activities that support and develop dairy farmers to build robust and

sustainable businesses... cooperates with a range of industry and government stakeholders... works to leverage additional funds... (Dairy Australia 2023)

Many other national bodies aspire to promote cross value chain collaboration, for example, the Australian Agritech Association's mission states:

We're connecting the community of agritech innovators, farmers, investor groups, government regulators, researchers, industry bodies and interested public to catalyse profitable innovation, expand sustainability and environmental awareness.... (Australian Agritech Association n.d.)

While such national associations may be actively working with agri-food producers in the region, our research did not uncover any explicit mention or evidence of cross-value chain collaboration on the ground in the region. Neither was there evidence that commercial extension providers are connecting and facilitating learning and innovation across the regional value chain, apart from extension programs funded to deliver programs developed by RDCs.

DairyTas is the only extension provider working across the value chain in the region, it services both food production (dairy) and the food processing sectors. There is just one other extension provider for food processing SMEs in the region, the Food and Agribusiness Growth Centre (n.d.), which uses clusters to connect to other parts of the value chain.

### **Discussion and conclusion**

This project is just the first step in understanding and strengthening the resilience of the agri-food ecosystem in North West Tasmania. We acknowledge that individual agri-food businesses were not consulted in this scoping project. Identifying and mapping the types of knowledge providers and nature and scope of knowledge they can provide to SME agri-food producers has exposed a diversity of actors and wide scope of knowledge available to the region's agri-food system, though the food processing sector, a key step on the value chain, is not as well served as other sectors.

However, extension is active in the region. Extension workers can be expected to be skilled at understanding individual agri-food businesses, their preferred learning patterns (Kilpatrick & Johns 2003) and how best to engage the SMEs in acquiring and using new knowledge to make changes to practice (Jai 2018, Oladele 2020, Afzal et al. 2023). This places them in a unique position to make connections via the gap that has been uncovered in the coordination and connection needed to create an innovative and connected system. While extension appears to be playing some role in fostering coordination and connection there is scope for a much bigger role, through both horizontal and vertical collaboration (Leat & Revoredo-Giha 2013; Wicaksono & Illés 2022).

Better connecting food processing to the system and drawing on the pool of technical food processing expertise in the region (.id Consulting Pty Ltd 2021) through building relationships, drawing on a wider understanding of risks and opportunities and co-learning is a potential cross value chain trial collaboration project that could be coordinated by extension (Stone & Rahimifard 2018, Wicaksono & Illés 2022). Extension is well placed to build the necessary trust and social capital amongst producers and processors in such a cross value chain project (Paschen et al. 2021). Extension could act as an intermediary to engage and bring the perspectives of the larger agri-food businesses in the region in the project, as recommended by Paschen et al. (2021).

We suggest another action is to contact all the regional, state and national organisations which stated an aim to connect across supply and value chains to explore establishing a dynamic, collaborative regional value chain that provides SME agri-food producers in the region with accessible connections. SMEs must be engaged in value chain innovation; they cannot each be expected to navigate the complex agri-food ecosystem and its value chain independently. They need access to research that is customised for their individual needs and financial backing to support and navigate climate change and fast-changing technology (Rahman 2015, Rotz et al. 2019). Given that SMEs tend to be time poor, regional value chains which collaborate up and down the chain are better placed to be resilient. SMEs tend to find extension approachable, making extension well placed to customise knowledge for individual agri-food businesses and connect the SMEs to a regional value chain collaborative structure.

Co-learning learning through proven frameworks is required to improve producer responses to vulnerabilities in innovation and change (Cliffe et al. 2016). Further investigation is needed to determine whether a cluster or other structure would be most effective to make the most of cross value chain synergies and manage risks holistically for a resilient value chain in North West Tasmania (Dung et al. 2020, Jai 2018, Freeman 1988, Lundvall 1992).

## Reference list

- .id Consulting Pty Ltd 2021, *Tasmania economic review September 2022*, report for Regional Development Australia Tasmania. Available from <<https://www.rdatasmania.org.au/grants-and-documents/>> [18<sup>th</sup> August 2023].
- Ajzen I 1991, 'The theory of planned behavior', *Organizational Behavior and Human Decision Processes*, vol. 50, pp. 179-211, <[https://doi.org/10.1016/0749-5978\(91\)90020-T](https://doi.org/10.1016/0749-5978(91)90020-T)>.
- Afzal A, Kilpatrick S & Turner L 2023, 'Five capitals framework: Understanding the use and adoption of e-extension by dairy extension workers in Tasmania, Australia and Punjab, Pakistan', *Rural Extension and Innovation Systems Journal*, vol. 19, no. 1, pp. 9-21, <<https://www.apen.org.au/static/uploads/files/reis-1901-2023-r2-wfrapxphvxsf.pdf>>.
- Afzal A, Kilpatrick S, & Turner LR 2022, 'Tasmanian Dairy Farmers' attitudes towards using e-extension methods; Strengthening the dairy extension system for a sustainable dairy industry in Tasmania, Australia', *Sustainability*, vol. 14, no. 21, 14585, <https://doi.org/10.3390/su142114585>.
- Australian Agritech Association n.d., *Our mission*, <<https://ausagritech.org/about/our-mission/>> [01 September 2023]
- AUSVEG n.d., *VegNET*, < <https://ausveg.com.au/resources/development-extension/vegnet/>>, [07 September 2023].
- Beske P, Land A & Seuring S 2014, 'Sustainable supply chain management practices and dynamic capabilities in the food industry: A critical analysis of the literature', *International Journal of Production Economics*, vol. 152, pp. 131-143, <<https://doi.org/10.1016/j.ijpe.2013.12.026>>.
- Braun V & Clarke V 2019, 'Reflecting on reflexive thematic analysis', *Qualitative Research in Sport, Exercise and Health*, vol. 11, no. 4, pp. 589-597, <<https://doi.org/10.1080/2159676X.2019.1628806>>.
- Cliff N, Stone R, Coutts J, Reardon-Smith K & Shahbaz M 2016, 'Developing the capacity of farmers to understand and apply seasonal climate forecasts through collaborative learning processes.' *The Journal of Agricultural Education and Extension*, <[https://DOI: 10.1080/1389224X.2016.1154473](https://doi.org/10.1080/1389224X.2016.1154473)>.
- Dairy Australia 2023, *DairyTas about*, <https://www.dairyaustralia.com.au/dairytas/about> [07 September 2023].
- Department of Natural Resources and Environment Tasmania 2022, *Tasmanian Agri-Food Scorecard 2020-21*, Available from: <<https://nre.tas.gov.au/Documents/Tasmanian%20Agri-Food%20SCORECARD%202020-21.PDF>> [09 August 2023].
- Dung TQ, Bonney LB, Adhikar RP & Miles MP 2020, 'Entrepreneurial orientation, knowledge acquisition and collaborative performance in agri-food value-chains in emerging markets', *Supply Chain Management: An International Journal*, vol. 25, no. 5, pp.521-533, <http://dx.doi.org/10.1108/SCM-09-2019-0327>.
- Food and Agribusiness Growth Centre n.d. *Clusters*, <<https://www.fial.com.au/building-capability/clusters>> [08 September 2023].
- Freeman C 1988, 'Japan: A new national system of innovation', in *Technical Change and Economic Theory*, G Dosi, C Freeman, RR Nelson, G Silverberg & L Soete eds., Pinter Publishers, London, pp. 330-348.
- Jia X 2021, 'Agro-food innovation and sustainability transition: A conceptual synthesis', *Sustainability*, vol. 13, no. 6897, <<https://doi.org/10.3390/su13126897>>.
- Hall A, Turner L & Kilpatrick S 2019, 'Using the Theory of Planned Behaviour framework to understand Tasmanian dairy farmer engagement with extension activities and inform future delivery', *Journal of Agricultural Education and Extension*, vol. 25, no. 3, pp. 195-210, <<https://doi.org/10.1080/1389224X.2019.1571422>>.
- Kilpatrick S 2000, 'Education and training: Impacts on farm management practice', *The Journal of Agricultural Education and Extension*, vol. 7, no. 2, pp.105-116, <https://doi.org/10.1080/13892240008438811>.
- Kilpatrick S & Johns S 2003, 'How farmers learn: different approaches to change.' *The Journal of Agricultural Education and Extension*, vol. 9, no.4, pp.51-164, <<https://doi.org/10.1080/13892240385300231>>.
- Klenk, N, Fiume A, Meehan K & Hulme M 2017 'Local knowledge in climate adaptation research: moving knowledge frameworks from extraction to co-production.' *WIREs Climate Change*, vol. 8, issue Sept/Oct. Doi: 10.1002/wcc.475.
- Leat P & Revoredo-Giha C 2013, 'Risk and resilience in agri-food supply chains: The case of the ASDA PorkLink supply chain in Scotland', *Supply Chain Management: An International Journal*, vol. 18, no. 2, pp.219-231.
- Lundvall BÅ 1992, *National systems of innovation: Towards a theory of innovation and interactive learning*, Pinter Publishers, London.
- Marshall NA & Marshall PA 2007, 'Conceptualizing and operationalizing social resilience within commercial fisheries in Northern Australia.' *Ecology and Society*, vol. 12, no, 1, <<http://www.ecologyandsociety.org/vol12/iss1/art1/>>.

- Meat and Livestock Australia 2023, *About MLA*, < <https://www.mla.com.au/about-mla/>>, [02 September 2023].
- Oladele OI 2020, 'The agricultural value-chain extension model: concepts and applications in Africa', *Agro-Knowledge Journal/Agroznanje*, vol. 21, no.4, 137-150 <<https://doi.org/10.7251/AGREN20041370>>.
- Paschen JA, Ayre M. King, B, Reichelt N & Nettle R. 2021, 'Shaking it up: The realities of 'doing'co-innovation in a privatised agricultural advisory and extension system', *Journal of Rural Studies*, vol. 87, pp. 338-351, < <https://doi.org/10.1016/j.jrurstud.2021.09.003>>.
- Preston BL & Stafford-Smith M 2009 'Framing vulnerability and adaptive capacity assessment: Discussion paper. CSIRO Climate Adaptation Flagship Working paper No. 2, <[https://research.csiro.au/climate/wp-content/uploads/sites/54/2016/03/2\\_Working-Paper2\\_CAF\\_PDF-Standard.pdf](https://research.csiro.au/climate/wp-content/uploads/sites/54/2016/03/2_Working-Paper2_CAF_PDF-Standard.pdf)> [17 August 2023].
- Rahman MZ 2015, 'An 'innovation-cycle framework' of integrated agricultural knowledge system and innovation for improving farmers' climate change adaptation and risk mitigation capacities: A case of Bangladesh', *Journal of Agricultural Extension and Rural Development*, vol. 7, no. 7, pp. 213-220, <<http://dx.doi.org/10.5897/JAERD2014.0653>>.
- Rogers EM 1995, 'Diffusion of Innovations: modifications of a model for telecommunications', *Die diffusion von innovationen in der telekommunikation*, pp. 25-38.
- Rotz S, Gravely E, Mosby I, Duncan E, Finnis E, Horgan M, ... & Fraser E 2019, 'Automated pastures and the digital divide: How agricultural technologies are shaping labour and rural communities', *Journal of Rural Studies*, vol. 68, pp. 112-122, <<https://doi.org/10.1016/j.jrurstud.2019.01.023>>.
- Stone J & Rahimifard S 2018, 'Resilience in agri-food supply chains: A critical analysis of the literature and synthesis of a novel framework', *Supply Chain Management: An International Journal*, vol. 23, no. 3, pp.207-238 < <http://dx.doi.org/10.1108/SCM-06-2017-0201>>.
- State of Tasmania 2023, *Tasmania delivers*, Office of the Coordinator General, Launceston, Available from: <[https://www.stategrowth.tas.gov.au/\\_data/assets/pdf\\_file/0010/394363/Tasmania\\_Delivers\\_-\\_Food\\_and\\_Agriculture.pdf](https://www.stategrowth.tas.gov.au/_data/assets/pdf_file/0010/394363/Tasmania_Delivers_-_Food_and_Agriculture.pdf)> [09 August 2023].
- Tasmanian Agricultural Productivity Group n.d., *About us*, <<https://tapg.net/about-us/>> [01 September 2023].
- Tasmanian Seed Industry Group 2023, < <https://www.tsiq.org.au/>> [02 September 2023].
- Teece DJ, Pisano, G & Shuen A 1997, 'Dynamic capabilities and strategic management', *Strategic Management Journal*, vol.18, no. 7), pp.509-533, < <https://www.jstor.org/stable/3088148>>.
- Turner JA, Allen W, Fraser, C, Fenemor A, Horita A, White T, Chen L, Atkinson M & Rush M, 2020, 'Navigating institutional challenges: design to enable community participation in social learning for freshwater planning', *Environmental Management*, vol. 65, no. 3, pp. 288-305, <<https://doi.org/10.1007/s00267-020-01256-x>>.
- Turner L, Wilkinson R, & Kilpatrick S 2017, 'Boundaries to change: insights into the change process of beef and sheep farmers', *Rural Extension and Innovation Systems Journal*, vol. 13, no. 1, pp. 9-18, <<https://search.informit.org/doi/10.3316/informit.192694946787767>>.
- Van der Ploeg JD 2016, 'Theorizing Agri-Food Economies', *Agriculture*, vol. 6, no. 3, 30, <<https://doi.org/10.3390/agriculture6030030>>.
- Walker F 2010, 'Review of extension structure and processes in Tasmania', *Agricultural Science*, vol 22, no. 1, pp. 7-8, < <https://doi.org/10.3316/informit.038105407837039>>.
- Wicaksono T & Illés CB 2022, 'From resilience to satisfaction: Defining supply chain solutions for agri-food SMEs through quality approach', *PloS One*, vol. 17, no. 2, e0263393, <<https://doi.org/10.1371/journal.pone.0263393>>.

## Acknowledgements

The project on which this paper was based was funded by an IDEAS grant from the Australian Department of Agriculture, Fisheries and Forestry Future Drought Fund.