What prevents the adoption of regenerative agriculture and what can we do about it?

Lessons from Participatory Modelling

Daniel C. Kenny

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"Plans to protect air and water, wilderness and wildlife are in fact plans to protect man."

Stewart Udall, US Secretary of the Interior 1961-1969

"You cannot protect the environment unless you empower people, you inform them, and you help them understand that these resources are their own, that they must protect them."

Dr. Wangari Maathai, Winner of the 2004 Nobel Peace Prize

"The greatest of all determining factors on the health regeneration or else degradation of those very landscapes boils down to the way we think, what we believe, and how we model in our minds the way the world and our landscapes work."

Dr. Charles Massy, *The Call of the Reed Warbler*

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List of Abbreviations

PM	**P**articipatory **M**odelling
SES	**S**ocio-**E**cological **S**ystems
FCM	**F**uzzy **C**ognitive **M**apping
RegenAg	**Regen**erative **Ag**riculture

1 What prevents the adoption of regenerative agriculture and what can we do about it? Lessons from Participatory Modelling

Abstract

Australian agriculture faces a unique challenge in providing sufficient food for an island nation on limited arable land, while combating challenges of drought, fire, flooding, and desertification. While agriculture has traditionally conformed to intensive conventional methods, regenerative agricultural methods (RegenAg) are designed to attune agricultural practices to the natural design of earth's cycles and support systems. Past attempts to introduce these methods suggest their adoption hinges on a good understanding of biophysical processes, and also, crucially, on landholder attitudes, beliefs, perceptions, and values. If ignored, these attitudes, beliefs, perceptions, and values can become an obstacle for transitioning towards synergistic relationships with the land. 'Narratives', or the stories individuals tell themselves provide a way to both understand these attitudes and perceptions, and provide a format with which to communicate with stakeholders.

For researchers, educators, consultants, and trainers, combining 'narratives' with Participatory Modelling (PM) processes can precede and accompany any effort to stimulate wider adoption of RegenAg. To provide a blueprint of how outreach for RegenAg might be attuned to people's belief systems and personal narratives, I report on a PM workshop conducted with RegenAg stakeholders in Australia, aimed at co-constructing a semi-quantitative conceptual model using Fuzzy Cognitive Mapping (FCM). The FCM was used to unpack stakeholder perspectives into a 'mental model' of the barriers and opportunities for adoption of RegenAg practices, and to identify actions that may be actioned to close the gap between the two. To promote a better understanding, communication and internalization of the outcomes represented by the model, I extracted the dominant narratives to highlight the complexity of the agricultural system and to better reveal what stories might lead to better outcomes. These methods and findings are relevant for those seeking to promote adoption of RegenAg in Australia, including landholders, non-profit and research organizations, and government officials. While RegenAg has made significant headway in Australia in the last decades, incorporating what can be learned from behavioral science presents an opportunity

for grassroots conversations and community engagement to scale a transformative dialogue as we seek to regenerate the Australian landscape.

Preface

This project was part of doctoral research undertaken at the University of Technology Sydney, examining how insights from the behavioral sciences—how people think, learn, and behave— might improve the design, facilitation, and evaluation of Participatory Modelling (PM) to drive better management of socio-ecological systems (SES), as exemplified by the adoption of regenerative agriculture (RegenAg) in Australia as an example of one such system. There were two key aims: 1) to apply insights from behavioral science to improve the facilitation of PM and other participatory outreach methods; and 2) to understand the barriers preventing increased adoption of RegenAg and to devise education and outreach strategies to overcome those barriers. This project partnered with The Mulloon Institute to conduct this research, and drew from the expertise of RegenAg advocates, including academics, government officials, trainers, and landholders.

I initially interviewed RegenAg stakeholders to understand their experience with RegenAg, and what they saw as the key barriers to adoption from training farmers, conducting research, or observing their peers. This provided the basis for a PM workshop to bring together advocates of RegenAg in an effort to 'map' what stands in the way of increasing adoption in Australia, using fuzzy cognitive mapping. I then followed up with stakeholders to continue to refine the map and the collective understanding of RegenAg, culminating in the extraction of several 'narratives' that capture various stories that are present in the Australian agricultural paradigm. As a result, I present the gaps, resource needs, and solutions identified by the stakeholders and the narratives, in the hopes of improving outreach and education campaigns in the RegenAg space. To do so, this research drew on several key areas of research, outlined below.

Acknowledgments

This project and this research report was supported by the University of Technology Sydney (UTS) and the Australian Government National Landcare Program funding provided through The Mulloon Institute. This report is an outcome of doctoral research undertaken at UTS, examining how insights from the behavioral sciences—how people think, learn, and behave— might improve the design, facilitation, and evaluation of Participatory Modelling (PM) to drive better management of socio-ecological systems (SES), as exemplified by the adoption of regenerative agriculture in Australia. The research partnered with The Mulloon Institute, and drew from the expertise of RegenAg advocates, including academics, government officials, trainers, and landholders.

Ethics Approval

This study was approved in line with the University of Technology Sydney Human Research Ethics Committee [UTS HREC] guidelines, project number ETH19-3712.

1.1 Introduction

In the middle of 2019, the Australian landscape began to burn. By the time the fires ran their course, over 240 days later, more than 30 people had died, 3500 homes had been destroyed, 306 millions tons of carbon dioxide had been released, and costs were approaching $100 billion (Lee, 2019; Guy, 2020; Gourlay et al., 2020; Read and Denniss, 2020). The entire country was and, in many places, still is reeling from the devastation. With links to climate change increasing and suggesting the possibility of a repeat in the future (Shukman, 2020; Lucas et al., 2007), serious questions confront both policymakers and Australian citizens about how this issue can be dealt with so as not to face this level of devastation ever again. This issue is particularly pertinent for farmers, a group severely affected by the fires, and the drought leading up to it (Heard, 2019; Davey and Sarre, 2020; Bell, 2020; Flannery, 2020). Unfortunately for agriculture, as a system where social desires do not necessarily align with vested interests, current policy regimes, environmental trends, or market pressures, there are no simple solutions.

In the last few decades, Australian farmers have seen enormous changes in their farm systems, but also in the social, economic, and political systems that govern the land across the country (Stafford Smith et al., 2007). Agriculture is inherently exposed to "multiple, simultaneous and inter-connected ecological, economic and social pressures" (Feola et al., 2015; O'Brien and Leichenko, 2000). The impacts of these pressures are typically seen over long-time periods (Oomen, Ewert, and Snyman, 2016; Hacker et al., 2010), as the lands on which they farm tend to be governed by 'slow variables' i.e., variables that are crucial to the health of the ecosystem, but whose trends can only be understood in timeframes of decades or longer, despite short-term variations. These variables include climate patterns, (including rainfall), ground coverage of perennial species, local environmental and scientific knowledge, and others (Stafford Smith et al., 2007; Hacker et al., 2010).

Farm ecosystems are shaped by these slow variables, which have their own natural trends, but farms are also under increasing and more immediate pressure from human interventions. The complexity of all these interactions make farms a difficult system to manage; there is simultaneously a resilience and a fragility to these tightly linked ecological, economic and social systems (Janssen, Anderies, and Walker, 2004; Quaas et al., 2007). For example, fires can carry serious consequences by altering groundcover, changing the physical properties of the soil (including hydrologic properties), altering the composition of soil microbial communities, changing and altering the lands cycles of carbon and nitrogen fixation, and ultimately, reducing the number of plants holding the soil in place (Peri et al., 2016). This makes erosion more likely, and the land more susceptible to flooding. These chains of impact carry implications for people's livelihoods by ultimately affecting farm productivity (Oomen, Ewert, and Snyman, 2016).

As such, we need an understanding of both the thresholds and non-linear trends in these complex, socio-environmental systems, and crucially, the role of the individuals within it, as it is their preferences and decisions that shape these farm ecosystems (Anderies, Janssen, and Walker, 2002; Ostrom, 2009; Jakoby et al., 2014). The perceptions and beliefs of individual farmers (who have the final word on whether and how the policies are implemented),

are rarely fully integrated into policymaking decisions, and therefore those policies often fail to make a lasting impact (Burton, 2004). When farmer perceptions are considered, it is often with a simplistic profit driven motive, which has time and time again been shown to be misguided and overly simplistic (Borges et al., 2014; Ranjan et al., 2019; Gosnell, Gill, and Voyer, 2019; Senger, Borges, and Machado, 2017; Pannell et al., 2006; Leys and Vanclay, 2011). Lessons from practice and scholarship show that farmers consider multiple factors in their decision making beyond money, including environmental stewardship, family legacy, and community (Feola et al., 2015).

Fortunately, regenerative agriculture (RegenAg) presents a solution to some of the issues facing Australian agriculture, and it presents a more holistic consideration of the forces at play on the farm. In contrast to conventional agricultural techniques which may focus on a mechanistic and reductionist approach to maximal production, RegenAg methods instead focus on aligning with landscape function, regenerating biodiversity, and partnering with animals, microbes, and pollinators for a more holistic and resilient approach (Chapman, 2019; Gordon, 2020; Murphy, 2021). While there are many techniques, practices, and traditions within RegenAg, for this paper, I define RegenAg broadly as an "alternative form of food and fiber production, concern[ed] with enhancing and restoring resilient systems supported by functional ecosystem processes and healthy, organic soils capable of producing a full suite of ecosystem services, among them soil carbon sequestration and improved soil water retention" (Gosnell, Gill, and Voyer, 2019). While in the last few decades, adoption of RegenAg practices (such as cell grazing, holistic management, natural sequence farming, and others) has increased, conventional farming techniques remain the dominant paradigm.

As scientists and policymakers seeking to support enduring transitions towards a sustainable and regenerative model of agriculture, we need to develop a holistic understanding of ecological, environmental, and social factors and how they shape the preferences and motivations of farmers (Jakoby et al., 2014; Burton, 2004). This is necessary because ultimately farmers are the agents undertaking action and therefore their buy-in or inaction directly determines the success of any sustainability program or policy on the ground (Feola et al., 2015). If we understand this, then we can better design incentives, regulations, and institutional reforms, as well as choosing times when it's better not to get involved at all (ibid.). Using participatory modelling to focus on the perceptions and motivations of farmers, as told by the 'narratives' they see in the system, this research project seeks to ultimately use this understanding to create a more enduring form of bottom-up change, rather than a top-down policy that is subject to change with each new election cycle (Blackstock et al., 2010). This does not mean that existing policies or incentives should be abandoned, nor should attention wane from a necessary redesign of institutional support for RegenAg. However, a ground-up understanding of farmer decision-making and motivations and the stories they tell is more immediately available to us. If we can first listen to understand, then align communication strategies with those messages, education and outreach efforts may be more likely to be adopted by farmers in the first place.

1.2 Conceptual Framing and Case Study

1.2.1 Socio-Ecological Systems and the Importance of Human Learning

Addressing socio-environmental problems in the Anthropocene requires a deeper understanding of the way humans conceive and perceive a given issue or problem situation and how people's knowledge, motivations and behaviors can get in the way of collaboration and policy implementation (Ives and Kendal, 2014). These problems of SES are, at their core, made 'wicked' by the conflicting values and interests imposed upon them by people (Norton, 2012). As such, this 'social' component means humans are a key part of the problem, and also a part of the solution (Xiang, 2013; Conklin and Weil, 2007). Ultimately, understanding and transforming human behavior for better management of the system is key to achieving the desired outcomes (Reed et al., 2010; Bruggen, Nikolic, and Kwakkel, 2019). The inherent uncertainty, conflicting values, and unpredictability of SES means that "it is simply not possible, nor desirable, to understand and manage such complex social and socio-ecological problems through a centralized administration and enforcement of rules, as they tend to over-ride the diverse values and goals underlying these complex issues" (Schön and Rein, 1994). The 'command and control' model does not work (Armitage, Marschke, and Plummer, 2008; Defries and Nagendra, 2017). So, to change behavior, it is better if the issues are "widely understood, discussed and owned by the people whose behavior is being targeted for change" and this is possible through learning (Australian Public Service Commission (APS), 2007).

Learning to manage wicked problems requires a 'deeper' sort of knowledge and learning, the type that helps us to transcend the goals and paradigms of system (Meadows, 1999a), sometimes referred to as transformative or loop learning (Mezirow, 2000; Argyris and Schön, 1978; Keen, Brown, and Dyball, 2005). This deeper knowledge must surpass single-loop, limited to the question of: "Are we doing things right?" (Yu et al., 2016), and instead move to the more transformative levels of double and triple loop learning (Keen, Brown, and Dyball, 2005). Double-loop learning examines underlying assumptions and models driving our actions and behavior patterns asking instead: "Are we doing the right things?" (Yu et al., 2016). And triple-loop learning helps us to interrogate those values and norms that define our worldview, (i.e. "What do I value? How do I define what is 'right'?"), leading to changes and updates in those "deep-seated beliefs and mental models" that form a key leverage point in changing systems (Meadows, 1999a; Yu et al., 2016; Pahl-Wostl, 2009; Keen, Brown, and Dyball, 2005).

Next, is to understand how individual learning can emerge and endure in larger, social patterns. This can be thought of as changing individuals to change the system (Latané, 1996). Levin (2002) notes that working with problems of SES requires understanding how individual behaviors within the system both influence and are influenced by collaboration, group dynamics, social networks, institutions and policy; through feedbacks that flow from the bottom-up and from the top-down. Participatory approaches seek to prioritize and strengthen the co-construction of bottom-up feedback, mediated through learning. We, and other researchers, refer to and conceptualize this learning as the transformation of 'mental models' (Chi, 2008; Henly-Shepard, Gray, and Cox, 2015). A mental model is a "personal,

internal representation of external reality that people use to interact with the world around them" based on an individual's experiences, perceptions, and understandings of the world (Jones et al., 2011). Other researchers have also used this approach to engage stakeholders and to elicit their mental models in building better understanding and management of SES (Henly-Shepard, Gray, and Cox, 2015; Walters and Holling, 1990; Reed et al., 2010; Bakken, 2019; Bruggen, Nikolic, and Kwakkel, 2019; Gray et al., 2017; Jones et al., 2014). In these cases, success has been achieved not by reaching 'consensus', but rather by reaching a 'shared understanding', meaning "stakeholders understand each other's positions well enough to have intelligent dialogue about the different interpretations of the problem, and to exercise collective intelligence about how to solve it" (Conklin, 2006). Because 'wicked' problems are a complex interaction of differing values and perspectives, participatory processes of this nature become a social negotiation to create a more complete understanding of the problem and a more comprehensive response (Conklin, 2006; Australian Public Service Commission, 2007).

1.2.2 The Difficulties of Communicating Complexity

Communicating complexity is a challenge in participatory processes seeking to manage SES (Castilla-Rho et al., 2017; Ghazoul and McAllister, 2003; McLeod and Childs, 2013; Meadows and Wright, 2008). Despite the best efforts of science, the complex nature of our reality means we can never 'know it' entirely or perfectly (Danermark et al., 2001; Edwards, O'Mahoney, and Vincent, 2014). This is why science has theories, rather than definitive and conclusive 'proof'. While the scientific process of research encourages accepting uncertainty, the design of the human mind struggles to internalise it (Beratan, 2007; Levine, Chan, and Satterfield, 2015). Various explanations exist as to why that happens (Korteling, Brouwer, and Toet, 2018; Seitz, Paloutzian, and Angel, 2017) yet the most accepted view centers around our limited ability to process information, the shortcuts our brains use to circumvent complexity, and our preference for black and white answers, as opposed to those that contain some level of ambiguity. The human brain limits the amount of information we can process to conserve energy which leads to 'hard and fast' rules and mental models to make decision-making easier and more effective (Hutchinson and Gigerenzer, 2005; Tversky and Kahneman, 1974; Simon, 1955); these are our heuristics and cognitive biases (Gilovich, Griffin, and Kahneman, 2002). Efficiency in neurocognitive function therefore pursues a desire for certainty and for simplicity.

This desire for certainty plays a key role in two tendencies of the human mind: finding patterns, and creating meaning (Shermer, 2011). The ability to see and understand patterns is compatible with complexity, but it must be trained as the default 'wiring' of the brain is to see patterns where none may exist or to confirm information into a pre-existing pattern because it aligns with personal beliefs or values. These tendencies of the mind, left alone, lead to oversimplification. This process by which we form our understanding of the world is that we default to accepting what we 'see' to be true until proven otherwise, and it is neurologically easier for us (and probably rewarding) to accept 'truth' than it is to disagree or disprove something, or, crucially for complex issues, to think it's uncertain (Harris, Sheth, and Cohen, 2008; Sacks and Hirsch, 2008). Ambiguity and being wrong are neurologically

unpleasant. We are often unaware this is happening. In the process, we take cues from our social circles and our environment on 'proper beliefs' (McAdams and McLean, 2013), leading to a multi-level, multi-loop feedback system (Figure 1; synthesized from (Levine, Chan, and Satterfield, 2015; Seitz and Angel, 2020).

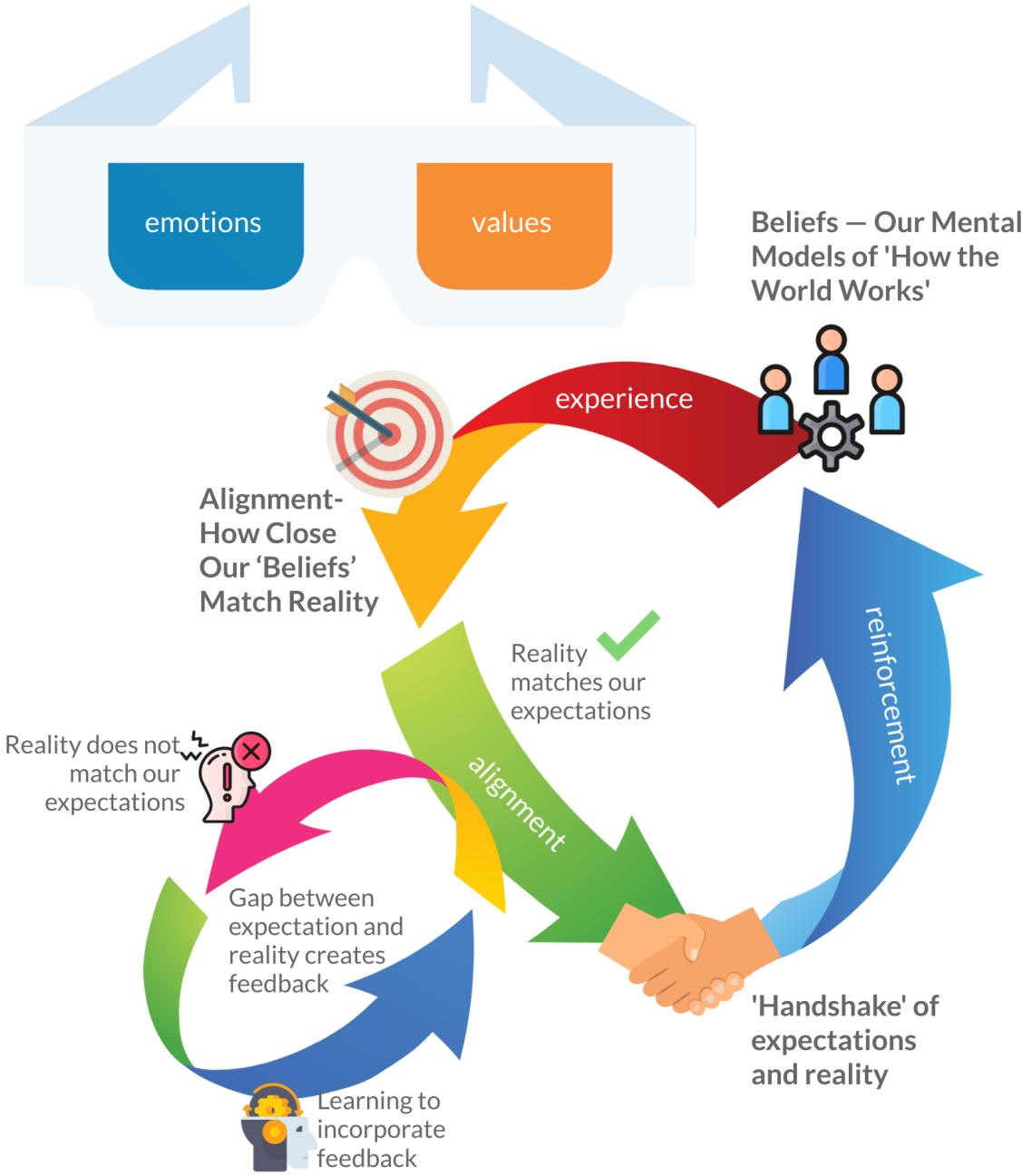

FIGURE 1.1: Our beliefs and expectations are based on our mental models of the way the world works. These mental models are constantly being tested to see if our expectations are 'met' by reality. When there is a mismatch between the expectations of our mental models and reality, it creates a 'gap'. We can seek to address that gap by accommodating new information and updating our mental model accordingly, or ignore that information and keep our mental model the same. This entire process was long assumed to be a rational process. Instead, we have learned how our emotions and values 'colour' every stage of this process, influencing what we see, what we miss, and what we avoid to maintain our existing mental models. As a result, researchers seeking to work with people, like PM, must understand and align with this process. Synthesized from (Levine et al., 2015; Seitz and Angel, 2020).

1.2.3 The Importance of Participatory Modelling (PM)

Systems thinking is understanding that a system is more than the sum of its parts, and introduces concepts like emergence, feedback loops, non-linear behavior, and uncertainty that are crucial to manage complex systems, (Checkland, 1981; Keen, Brown, and Dyball, 2005; Meadows and Wright, 2008). Meanwhile computer simulation modelling allows us to explore solutions and scenarios in a safe 'virtual' environment—one that allows us to grapple with the 'complexity' of a system without actually intervening and experiencing real-life consequences (Luna-Reyes et al., 2019; Epstein, 1996). One method that combines both of these approaches is participatory modelling (PM). PM is an umbrella term for tools and methods where stakeholders (i.e., members of the system of interest) build the model with researchers (Kenny, 2017; Voinov and Bousquet, 2010). In effective PM exercises, participants are empowered to ask questions, find answers, and make key decisions in the model-building process (Lynam et al., 2007; Cuéllar-Padilla and Calle-Collado, 2011; Gaddis and Voinov, 2008).

What is less understood in PM is how to overcome the patterns of the human mind that pose a significant barrier to the sort of transformational and systemic change sought by practitioners, a barrier also faced by RegenAg advocates (Voinov and Gaddis, 2017; Hamalainen, 2015). Although the model produced during a PM process is useful, the increasing interest in the social engagement, negotiation, learning, and mediation that occurs 'around' the modelling effort stands to benefit PM, participatory research, and, in this instance, our grassroots efforts to increase adoption of RegenAg. That interest in engagement, negotiation, learning, and mediation can also apply to other participatory methods of engaging with stakeholders. As such, in this research, I explored the use of narratives as one way to address the challenge of communicating with stakeholders to urge action and ownership of sustainable RegenAg practices in the hopes of drastically transforming Australian landscapes (Eakin et al., 2019; Moezzi, Janda, and Rotmann, 2017).

1.2.4 Case Study: The Mulloon Institute and Regenerative Agriculture

The Mulloon Creek Catchment is located in the Southern Highlands of New South Wales and is part of the traditional country of the Yuin people, covering an area of 23,000 hectares and comprising more than fifty kilometres of creeks and tributaries, and four floodplains (1.2). Mulloon Creek Catchment feeds into the Shoalhaven River, which forms a vital source for Sydney's drinking water. The landscape of the catchment has historically been associated with pasture production, for both sheep and cattle (Thackway, 2019).

The Mulloon Rehydration Initiative, run by the Mulloon Institute, is a catchment-scale land management project. The project is a collaboration of 20 private landholders, comprising both production and amenity landholders. It aims to rebuild the natural landscape function of the entire Mulloon catchment to boost its resilience to climatic extremes through more reliable stream flows, improved ecosystem functioning and enhanced agricultural productivity. It does so through an approach called 'Natural Sequence Farming' (NSF).

Natural Sequence Farming focuses on the vegetation, the daily water cycle, and the hydrology of the area as these are the three critical areas controlling the landscape (Andrews,

2008). Mulloon Creek has trialled NSF since 2005. There were significant challenges in garnering support, both from the local community, and government agencies, but eventually, the Mulloon Rehydration Initiative was formed in 2016. The Project and TMI employ a number of RegenAg practices, including natural sequence farming, indigenous expertise, and others, and they employ extensive research to measure the biophysical, economic and social impacts of its practices, including the implementation of formal scientific instrumentation and monitoring (Institute, 2016). The Project has received enough attention that the United Nations Sustainable Development Solutions Network chose Mulloon as one of five global demonstration projects for sustainable and productive farming (ibid.), and they were recently awarded a $3.8 million dollar grant by the federal government to demonstrate the effectiveness of rehydration activities and train and educate land managers in holistic management, natural sequence farming, and regenerative agricultural practices (The Mulloon Institute (TMI), 2021).

TMI is a leader in this space, and outreach and education is a huge part of their portfolio. However, TMI and other RegenAg groups and leaders still face an uphill battle when it comes to adoption. Books like Charlie Massy's *The Call of the Reed Warbler* point out the urgent need to make this transition, and details some of the barriers to doing so, based on nearly 80 interviews with farmers around Australia who had made the transition to RegenAg (Massy, 2017). However, as the adoption of RegenAg has increased, and the evidence base continues to grow, the question has started to move from "Is RegenAg good?" to "How do we convince more people to do it?" Which is a horse of an entirely different colour, but one that holds serious implications for the future of farming in Australia.

1.3 Methods

1.3.1 PM and Fuzzy Cognitive Maps

Within Participatory Modelling (PM), Fuzzy Cognitive Mapping (FCM) is a tool commonly used (Christen et al., 2015; Giabbanelli, Gray, and Aminpour, 2017; Gray et al., 2015; Henly-Shepard, Gray, and Cox, 2015; Halbrendt et al., 2014; Hester, 2015; Ozesmi and Ozesmi, 2003; Nyaki et al., 2014). FCM is a semi-quantitative knowledge elicitation technique used to represent the 'mental model' of an individual or a group—this takes the form of a qualitative 'map' of how someone believes a given system functions, by identifying the variables or concepts of the system and relationships between them (Özesmi and Özesmi, 2004; Winsen et al., 2013). The quantitative element of the knowledge elicitation process comes from the relationships between variables (A and B), which can be either positive (>0) indicating an increase in A increases B, or negative (0<) indicating an increase in A results in a decrease in B (Hester, 2015). The weights given to those relationships indicate the 'strength' of the causal relationships (Vergini and Groumpos, 2016). Overall, the focus of the FCM exercise is on identifying key feedbacks of the system, to illustrate what variables are present in the system and how they affect each other (Vliet, Kok, and Veldkamp, 2010). The FCM can be created by an expert or a stakeholder, as an individual or as a group (Ozesmi and Ozesmi, 2003).

FIGURE 1.2: The Mulloon Creek catchment and land stewardship activities conducted by the Mulloon Institute (TMI), located near Braidwood in New South Wales. TMI focus on landscape rehydration activities, using Natural Sequence Farming. Activities include building leaky weirs, contour banks, embankments, and vegetation plantings, among others and have been linked to raising the water table, improving biodiversity, decreasing erosion, and building drought resilience.

When it comes to SES as complex adaptive systems, FCMs can be useful and effective in guiding communication, comprehension, and problem solving, without the use of complex mathematics (Winsen et al., 2013; Vergini and Groumpos, 2016). FCM is generally an adequate engagement tool "(i) when dealing with complex problems; (ii) in situations where human behavior is important but hard to quantify; (iii) in situations where personal knowledge is available while scientific knowledge is incomplete; (iv) in situations where problems are wicked, involving many parties and with no easy solutions;" (v) when the problem requires public involvement (possibly mandated by law) (Özesmi and Özesmi, 2004). However, they are not without their challenges and shortcomings. One of the main challenges is the difficulties humans face in trying to share their perspective on the system that is distorted by their own biases and values (ibid.), and the limits of human knowledge (Fairweather, 2010). These challenges can somewhat be addressed by combining the cognitive maps of individuals and by cross-checking with other sources of information and methodologies (interviews, surveys, etc.) to improve the accuracy of any 'map' or model (Özesmi and Özesmi, 2004).

Despite these challenges, FCMs offer advantages that make them well suited for tackling the complex socio-environmental problems Australian farmers and advocates of RegenAg face. FCMs are easy to to teach, easy to use, and they offer a systematic way to model a system and provide a clear representation of system feedbacks with a short turnaround (Özesmi and Özesmi, 2004; Vliet, Kok, and Veldkamp, 2010; Winsen et al., 2013). FCM also works well with data that might be missing, is not well-defined, or might be uncertain (Özesmi and Özesmi, 2004). The flexibility of the method allows for input from any number of stakeholders and experts, thus encouraging communication between and across diverse areas of knowledge (Vliet, Kok, and Veldkamp, 2010), which can in turn stimulate a productive environment to test interventions and policy scenarios in the aims of seeking better management (Winsen et al., 2013; Papageorgiou and Salmeron, 2013). To summarize, FCM provides an efficient and useful methodology that can handle complex, uncertain systems that cross various fields of knowledge, which is precisely the type of problems Australian farmers face in their socio-environmental landscapes.

1.3.2 Stakeholder Participation: Virtual Workshop in a Pandemic

While we originally planned for our FCM workshops to be face-to-face, COVID-19 and NSW government regulations on social distancing in mid-2020 made this impossible. At the time, the restrictions limited the number of people gathering in one place, closed gyms, reduced availability of public transit, and restricted seating in cafes and restaurants (NSW Government: Health, 2021). After some deliberation, the research team decided to pivot to an entirely virtual workshop. Due to the widespread availability of free team collaboration and video conferencing software, we were able to hold the workshop in an entirely digital format using a combination of Zoom and MURAL (a digital workspace and 'virtual whiteboard' for collaboration (Tippin, Kalbach, and Chin, 2018)). We used Zoom videoconferencing to hold the call with everyone, and then used MURAL (www.mural.co) (ibid.) for the FCM exercise. The benefit of this virtual approach was that it allowed us to engage with our stakeholders during a time of lockdowns and social distancing, but there were disadvantages as well, largely due to technical problems of unstable internet.

For our workshop, We invited fifteen participants and while thirteen accepted, eleven ended up participating with two late withdrawals. The aim of the workshop was to elicit mental models of the barriers facing adoption of regenerative agriculture, via facilitated stakeholder interaction. To do so, we designed a virtual workshop consisting of four stages: (1) plenary, (2) elicitation, (3) modelling, and (4) debrief.

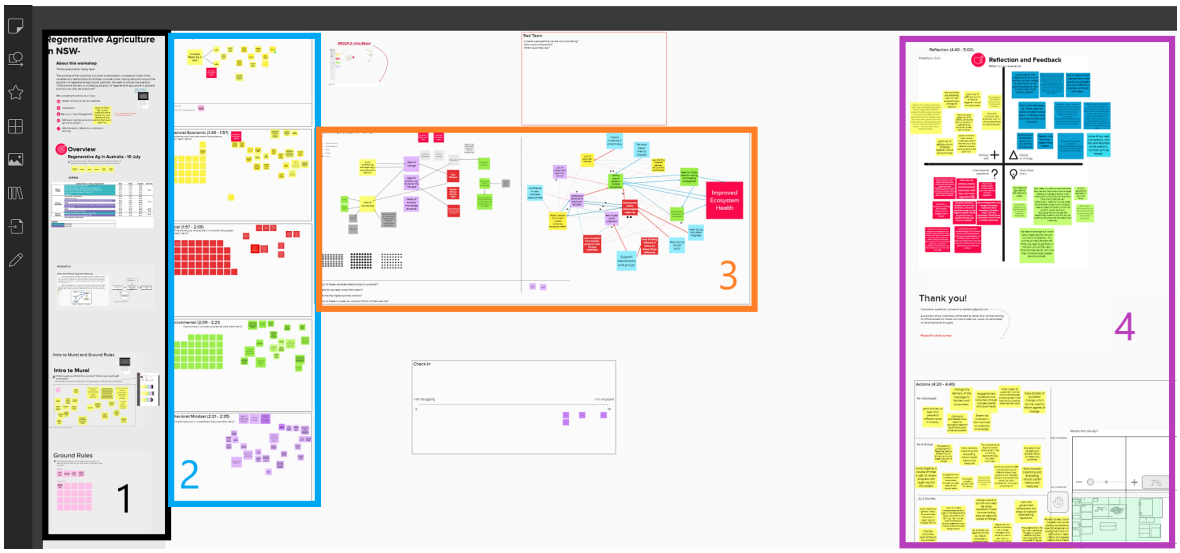

FIGURE 1.3: A screenshot of the structure we created on MURAL for each of the four stages of the workshop: (1) plenary, (2) elicitation, (3) modelling, and (4) debrief.

We put together a facilitation team consisting primarily of PhD students to work with each stakeholder group (participants were split into two groups for the elicitation and modelling stages before reconvening for the debrief). Each facilitation 'team' had a facilitator, a modeller, and a support person and the entire workshop was video-recorded. The facilitator was in charge of leading participants through the process of building the FCM, solving any issues as they arose. The modeller was responsible for drawing on MURAL for the modelling phase, and creating 'stickies' for participants who had trouble accessing MURAL. The support person kept an eye on the chat and the video to make sure participants had the chance to participate. They asked clarifying questions when necessary. The research team trialed the process a month beforehand with a group of postgraduate students and academics to gain familiarity with the virtual methods and to 'stress test' the virtual approach. We also provided participants with tutorial videos on how to use Zoom and MURAL (see here for an introduction to MURAL and here for navigating MURAL) in the week leading up the workshop.

Plenary We developed pre-defined templates in MURAL to provide a sequence of activities for the group to work through. The plenary session started with introductions from participants and the research team. This included introductions to the overall research of the lead facilitator, an overview of the work of the Mulloon Institute, a presentation on the modelling process and the concept of cognitive biases, and a tutorial activity to make sure everyone felt comfortable using MURAL's features (e.g., adding a 'sticky' note, commenting on other notes, and voting). In the first activity, we discussed our shared purpose and

setting the goal and modelling 'metric' that would be the focus of the subsequent elicitation and modelling stages. Considering that the theme of the workshop was on the barriers to adoption of RegenAg, the discussion centered around what 'metric' or indicator might best reflect the success or failure of this effort. We set aside 15 minutes for this activity, considering we had already introduced initial ideas for the metric (the number of farmers practicing RegenAg and/or the number of hectares under RegenAg production) over email prior to meeting. We ended up needing more time for this activity, as many in the group had different ideas about what the metric should be, and, quite understandably in retrospect, more time was needed to explain the purpose of this 'metric' in defining the process of the workshop. Ultimately, our group decided that '*Improved Ecosystem Health*' was the ultimate 'metric' or outcome of interest that RegenAg sought to promote. Participants were then told that the goal of the following activity (the elicitation phase) was to unpack key variables that directly or indirectly contribute to the state of this outcome. Then, during the modelling phase, we would set out to establish how these variables might be interrelated, and to identify a portfolio of levers that could exert a positive effect on key variables within the system.

Elicitation Armed with the notion of '*Improved Ecosystem Health*' as the outcome of interest for the system, we used Zoom's breakout room feature to divide participants into two groups (group 1= six participants, group 2= five participants) to build two FCMs. Each group then moved through the process of brainstorming and ranking of causal 'factors' or 'variables' that might contribute to or hinder '*Improved Ecosystem Health*' under four categories that were pre-established by the research team: (1) Economic/Financial, (2) Environmental, (3) Social and (4) Behavioral.

Under each category, the group's participants were given time to write down their thoughts on what the key factors either driving or hindering the adoption of RegenAg are, based on their knowledge, experiences, beliefs and perspectives. We did not impose a limit on how many factors each participant should contribute, and they completed this activity on their own—with little to no discussion—to avoid groupthink (Janis, 1991). We then proceeded to discuss, as a group, what each participants' factor contributions meant, with the aim of casting a vote on the top three factors. For each category of factors, we allocated 5 minutes to the individual elicitation of factors, 10 minutes to group deliberation, and 5 minutes for a polling activity (participants were allocated 3 votes to allocate to the group's sticky notes). We repeated the process for each of the four categories, ending with twelve factors that progressed to the modelling phase.

Modelling During the modelling phase (which was allocated a total of 60 minutes), and taking cues from participants' views expressed through an open discussion, the facilitating team began to draw connections between the top twelve factors, establishing positive and negative relationships and how 'strong' these relationships were between the factors—i.e., their polarity. Participants decided how these factors related to each other and how they contributed to our ultimate 'metric' of '*Improved Ecosystem Health*'. The role of the facilitators during this phase of the participatory process was to draw the connections between factors,

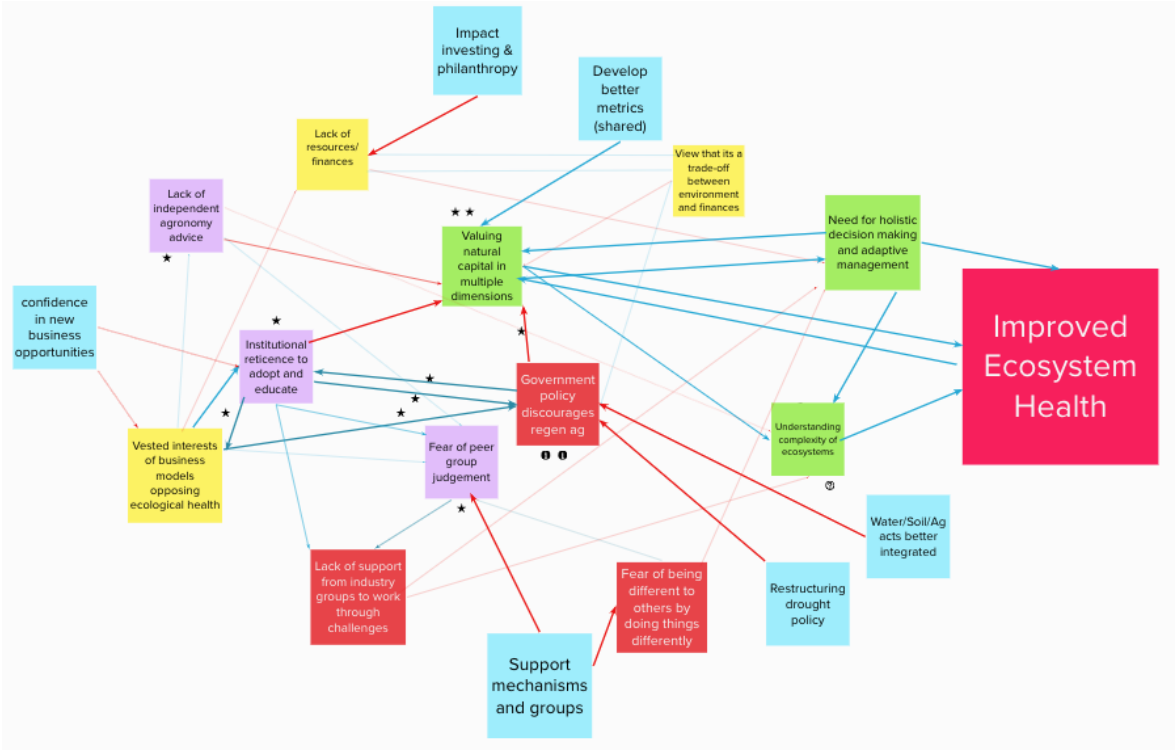

FIGURE 1.4: A screenshot of the initial FCM built during the modelling phase in MURAL. Green stickies were environmental, yellow stickies were economic/financial, red stickies were social, purple stickies were behavioral, and blue stickies were 'levers' or actions that could be taken to influence the system. Our metric, '*Improved Ecosystem Health*' was the measure we sought to influence and understand, as a broader proxy for the success of RegenAg. Arrows indicated causal relationships. Red arrows were negative or 'balancing' relationships, and blue arrows were positive or 'reinforcing' relationships.

inquire as to their polarity and strength, and to ask clarifying or prompting questions about why that relationship existed and if there were other factors to consider. One person's role was to keep the conversation moving, and one of the other facilitators primarily handled the technical aspects of the FCM modelling, primarily in drawing the connections. An additional support person monitored the chat room on Zoom for any nonverbal contributions or if the facilitator missed a participant eager to say something.

In planning the workshop, we set aside time for when the group finished building the mental model map (i.e., identified all relevant causal relationships between factors for the four categories, and establish their polarities); they could also look to identify and add 'levers' to the map, actions or policies that might be capable of shifting key 'factors' to move towards a better state for the chosen 'metric'. For example, Group 2 identified several levers, including '*Restructuring Drought Policy*' to affect '*Gov't Policy Discouraging Regen Ag*' and '*Support Mechanisms and Groups*' to address '*Fear of Peer Group Judgment*' and '*Fear of Being Different to Others*'. In short, 'levers' were ways participants identified an ability to 'shift' or 'transform' a factor within the model, and thereby alter the system in the hopes of moving closer to the metric of '*Improved Ecosystem Health*'.

One of our groups (Group 2) got through this stage, building a complete 'map', while the other (Group 1) was unable to complete drawing connections between the 12 identified factors due to time constraints.

Debrief Time was devoted at the end of the workshop for a 'debrief' session consisting of two parts. In part 1 (20 minutes), the two groups were brought together to share and to present their 'maps', noting the similarities and differences between each. At this time, we were not seeking to combine the models. After sharing the different models, we set aside 30 minutes for the whole group of participants to reflect on what next actions should be in the attempt to improve adoption of RegenAg (10 minutes), and for the group to reflect on their experience of the process and workshop as a whole (20 minutes). For a discussion on RegenAg, we divided 'Next Actions' into actions that could be taken as individuals, as a group, and as a society, with time given for participants to put down their individual thoughts on their own (no discussion) before coming together to briefly discuss these as a group. Reflection on the process was guided by a template available on MURAL (see figure below), dividing quadrants between "What worked well?", "What needs to change?", "What are new ideas to try (for next time)?", and "What are the unanswered questions?" Participants were given time to put down their thoughts and discuss section by section.

Follow-up In the aftermath of the workshop, follow-up interviews were conducted with the participants to evaluate their experience of the workshop and to provide space for any feedback, on the model or the process, that they were unable to provide during the workshop. Then, the conceptual model results from the two groups were combined into one model by the facilitator after comparing to find common variables and aggregate them, and re-visiting the recordings and transcripts of the workshop, to determine what possible connections could be added, similar to the Rich Elicitation Approach (LaMere et al., 2020). This combined model was digitized into Mentalmodeler.org as an FCM online software, and sent to participants via email for approval and feedback (ibid.) with a full record of the changes made.

In addition, as a result of this follow-up process, we also identified key 'narratives' present in the FCM. Narratives have been used before in communicating the results of FCM (Eakin et al., 2019), but are not widely used in PM, despite their suitability for communicating complexity (Ryan, 2019), and their use in working on environmental issues (Moezzi, Janda, and Rotmann, 2017). As our stakeholders were not experienced modellers, we deliberately used narratives to communicate and interpret the model results for participants, similar to Eakin et al. (2019), but using a template of our own to highlight the story, the actors, and the implications of the narrative for both the model and the necessary solutions **??**. The outcomes of this post-processing were then presented to participants to validate and/or propose any changes, to the model and to the narratives.

1.3.3 Data Analysis

In analyzing fuzzy cognitive maps (FCM), Özesmi and Özesmi (2004) lay out the steps to move towards analyzing a social model, which includes determining an adequate sample size, using graph theory to analyze the structure of the models, condensing the models for comparison, and then using neural network computation to analyze outcomes and simulate different policy options. After transcribing the aggregated FCM into the MentalModeler software (www.mentalmodeler.org) we were able to calculate the following statistics (Kokkinos et al., 2018):

- Total number of variables
- Total number of connections
- The network 'density', as the actual number of connections divided by the number of connections possible in the 'map' (i.e. if all variables were connected to each other, that would be a density of 1).
- The average connections per variable
- Complexity score, as the ratio of receiver variables to transmitter variables.
- Centrality rankings as a proxy for the most 'influential' variables, which depends on the number and strength of the connections attached to a variable. The higher a variable's centrality, the more influence it has on the 'map' when it changes.

In examining the maps, it is important to identify transmitter, receiver, and central variables. The 'centrality' of a variable is determined by the number of relationships and the cumulative weight of those relationships coming in and going out; the higher that number is, the more important that variable is to the feedbacks of the system (Vanwindekens, Baret, and Stilmant, 2014). Transmitter variables (or forcing functions) have a lot of relationships going out and none coming in, while receiver variables take in the relationships of other variables and send none out (Ozesmi and Ozesmi, 2003). Identifying and labeling these variables in a FCM can help generate insight into the way agents view their system; for example (taken from Ozesmi and Ozesmi (ibid.)):

> *"Local people and hunters have more transmitter variables in their maps than NGO personnel [did in their maps]. This indicates that local people and hunters see themselves and the Uluabat Lake ecosystem as being under outside control and dependent on outside forces."*

In all FCM exercises, it is important to remember that complexity is not the ultimate goal; **the aim is for the model to be a useful representation of reality** (Özesmi and Özesmi, 2004), whether there are many variables or a few. Klein and Cooper (1982) discovered that the number of variables in a map does not determine its success, and therefore we encourage the approach of keeping a model as simple as possible to solve a particular problem, and no simpler (Vanwindekens, Baret, and Stilmant, 2014), which is in line with the recommendations of the modeling literature.

1.4 Results

1.4.1 Macro-, Meso- and Micro-scales of FCM

The model created in the aftermath of the workshop reflected a collaboration of individual mental models, and we devised a process to analyze this at three scales: the macro (a comparison between all of the networks in the FCM and their 'global' characteristics), the meso (an analysis of the 'communities' or clusters present in the model), and the micro (an analysis of the most relevant 'variables'). With each of these 'lenses' (macro, meso, and micro), it is possible to extract and condense the critical information of the 'map' to answer key questions. For example, what is central or most influential to each network? How do you compare between networks? Which 'variables' from each category (financial, social, environmental, and behavioral) are the most powerful?

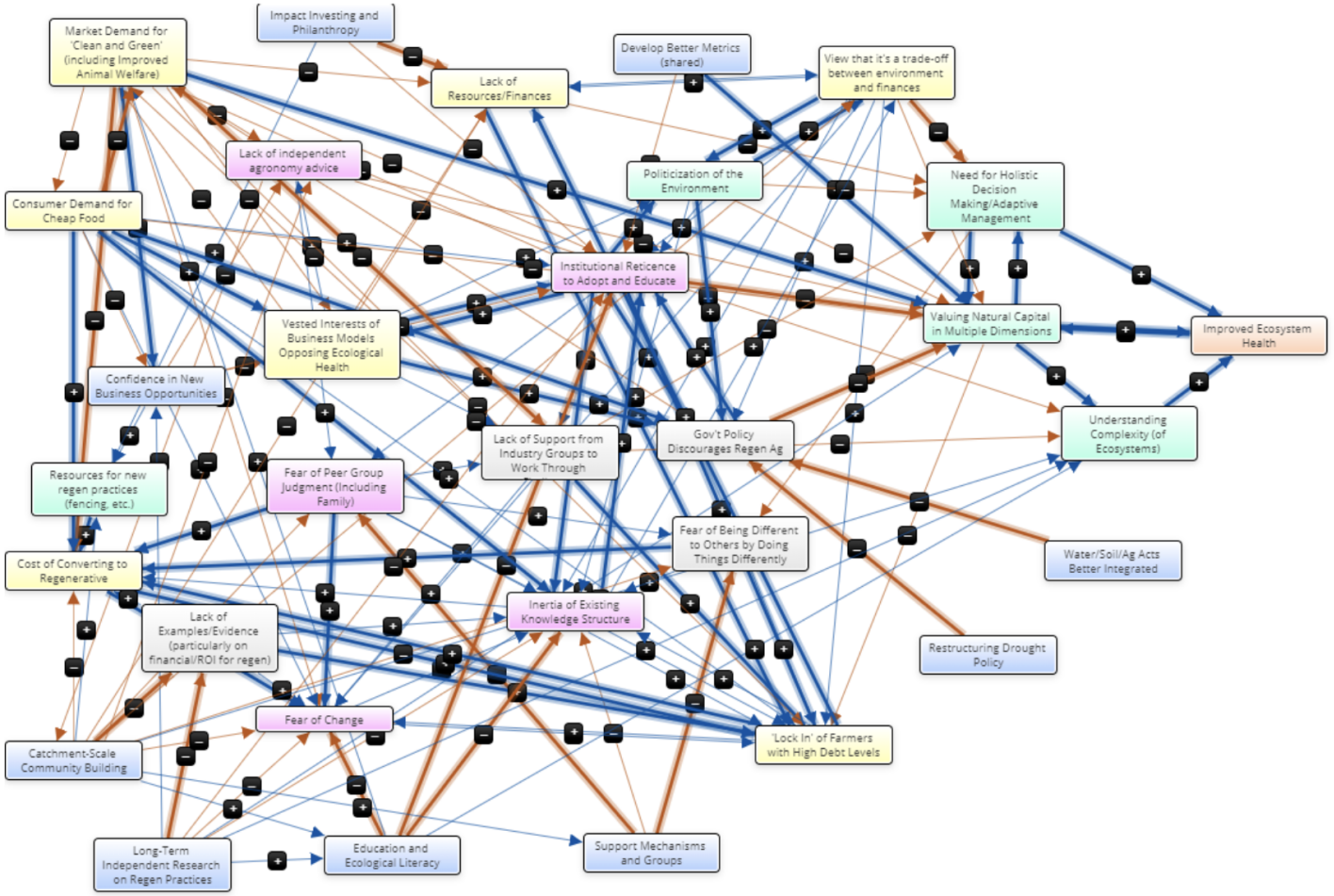

FIGURE 1.5: The combined FCM elicited from our workshops. We used different colors to reflect the different variable categories, similar to what we had used in MURAL (green= environmental, yellow= financial/economic, gray=social, and pink=behavioral), while our 'levers' or actions we could take were in blue. Our metric, '*Improved Ecosystem Health*' in orange, was the measure we sought to influence and understand, as a broader proxy for the success of RegenAg. Arrows indicate causal relationships. The color of the arrows indicated their polarity (Red arrows were negative or 'balancing' relationships, and blue arrows were positive or 'reinforcing' relationships) and the width of the arrow indicated the strength of the relationship (thick were 'strong' relationships, thin were 'weak' relationships).

1.4.2 Macro-scale analysis: The System

The aggregated FCM (Figure 1.4) comprised 31 concepts, with 141 relationships. This included 5 transmitter components (levers: '*Impact Investing and Philanthropy*', '*Develop Better Metrics*', '*Restructuring Drought Policy*', '*Water/Soil/Ag Acts Better Integrated*' and '*Long-Term Independent Research*'), and only 1 receiver component (the goal of the system, '*Improved Ecosystem Health*'). The five most 'central' variables were (in order) '*Institutional Reticence to Adopt and Educate*', '*Valuing Natural Capital in Multiple Dimensions*', '*Cost of Converting to Regenerative*', '*Gov't Policy Discourages Regen Ag*', and '*Lock In of Farmers with High Debt Levels*".

Statistic	**Total**	**Interpretation/Insight**
Number of Variables	31	Each iteration of 'modelling' added more variables as stakeholders further appreciated and expressed the complexity of the system, and the interconnection of various forces, including economic, social, environmental, and behavioral, that are present and interacting in this system. The initial modelling process did limit the number of variables considered due to time constraints so this increasing complexity as time progressed is expected.
Number of Connections	140	With the addition of 'variables', the number of connections greatly increased from the first iteration of the model to the current version. This is reflected in the Connection Per Component, which roughly doubled from 2 to 4.5 from the initial workshop to the final iteration of the model. A greater number of connections represents an increasing recognition of the interconnectedness of the system, which can make for a challenge, in the 'wicked complexity' (Rittel and Webber, 1973) of not being able to isolate variables, and also an opportunity, in that the right actions can have far-reaching effects in the system.

Network Density	0.15	Our network density was quite low, although we did see an increase from the first iteration of the model to the final version. As the actual number of connections divided by the number of connections possible in the 'map', the more connected the map and the variables within became the higher the density. We expected the increase in the number of connections as everyone grew more comfortable with the modelling process and had more time to think of them in the follow-up outside the constraints of the workshop. The increase in connections reflects the 'wicked complexity' of this system as an interconnected web of financial, social, environmental, and behavioral drivers.
Connections per Component	4.51	From the initial model to the final iteration, the Connection Per Component roughly doubled from 2 to 4.5. The majority of the connections in the map are 'positive' in their influence, so this increase in connections could, without the presence of balancing 'negative' connections, further spiral the system deeper into the conventional agricultural paradigm.
Complexity Score	0.20	This is a low score, as we only had one receiver component, our metric for the system of '*Improved Ecosystem Health*'. This 'score' is specific in the way it defines complexity as it perceives a model to be less complex "when many transmitters are represented with only a few outcomes (receiver variables) of those pressures represented" (Henly-Shepard, Gray, and Cox, 2015). More 'outcomes' could be added to the model, but the process we used was quite structured in using one metric to guide and narrow the focus.

Number of Transmitter Components	5	The relatively low number of 'transmitter variables is likely a product of our approach to building the model. All of these components were 'levers', variables added to reflect actions that could be taken to influence the system. In that sense, it makes sense they have only outgoing arrows, designed as they are to 'impact' the system. In further iterations of the model, it would be interesting to see how other variables, especially other levers, might integrate with these identified variables, as it happened with other variables (ex; *Long Term Independent Research* has a positive effect on *Education and Ecological Literacy*).
Number of Receiver Components	1	This was our goal and metric for the system, '*Improved Ecosystem Health*' that we established at the beginning of the exercise. As such changes in the system, in theory, should affect this metric, for good or ill. It is likely other metrics exist and could be used to monitor different parts of the system. Focusing on one metric was an intentional choice to narrow the discussion for our workshop.
Number of Ordinary Components	25	The majority of our variables were ordinary components, meaning they were variables with incoming and outgoing connections. As noted by Henly-Shepard, Gray, and Cox (2015), this demonstrates the "significant interlinkages and influences between system components", potentially a sign of further complexity in the system. It is unsurprising how interwoven this system is, as agriculture, and RegenAg in particular, is a product of "multiple, simultaneous and inter-connected ecological, economic and social pressures" (Feola et al., 2015).

TABLE 1.1: FCM Results

1.4.3 Micro-scale analysis: Honing in on Variables

Centrality 'Centrality' in an FCM serves as a proxy for the most 'influential' variables in a given network. Each variable's centrality score depends on the number and strength of the connections attached to a variable. The higher a variable's centrality, the more influence it has on the 'map' when it changes, a result of the combination of the number of relationships and the cumulative weight of those relationships coming into and going out from that variable (Vanwindekens, Baret, and Stilmant, 2014).

Component	Centrality
Institutional Reticence to Adopt and Educate	10.1
Valuing Natural Capital in Multiple Dimensions	7.9
Cost of Converting to Regenerative	7.5
Gov't Policy Discourages Regen Ag	7.4
'Lock In' of Farmers with High Debt Levels	7.3
Market Demand for 'Clean and Green'	5.7
Consumer Demand for Cheap Food	5.2
Inertia of Existing Knowledge Structure	4.8
Vested Interests of Business Models	4.2
Politicization of the Environment	4.1
Need for Holistic Decision Making/Adaptive Management	4.0

TABLE 1.2: FCM Results- Centrality

Measures of 'centrality' can provide insight into key traps and pain points in the system. Institutions, mainly government, play a large role in this system, as the most central variable is '*Institutional Reticence to Adopt and Educate*', with '*Govt Policy Discourages Regen Ag*', '*Inertia of Existing Knowledge Structure*', and '*Politicization of the Environment*' all making the top ten. This suggests the dominant paradigm of government policy is one supportive of conventional agriculture, borne out by the role conventional agriculture plays in the Australian economy, and the relatively low percentage of Australian agriculture belonging to RegenAg or other alternative measures. This has the potential to be a reinforcing feedback loop that solidifies lock-in to traditional agricultural practices, particularly considering the influence of the Market ('*Consumer Demand for Cheap Food'*) and Business ('*Vested Interests of Business Models*'). Without policies or actions to provide a balancing relationship (reflected by the red arrows and largely present from the 'levers' in the map), these variables are all connected by

positive relationships, with an increase in one leading to an increase in another, without an obvious incentive to change. This perception among stakeholders is striking, although perhaps not surprising given the number of stakeholders in the workshop who self-identified as 'pioneers' or 'mavericks' during the modelling process.

According to workshop participants, business and industry is also largely arrayed against RegenAg ('*Vested Interests of Business Models*', '*Consumer Demand for Cheap Food*', '*Lack of Support from Industry Groups*'), although they also noted the opportunities within that sector ('*Market Demand for Clean and Green*'). The connections between '*Consumer Demand for Cheap Food*', '*Vested Interests of Business Models Opposing Ecological Health*', and '*Gov't Policy Discouraging Regen Ag*' had strong positive arrows between them, suggesting a reinforcing system that is difficult for RegenAg to 'break into' without serious policy or business investment and intervention.

Possible ways to intervene in this system were identified by the 'levers', the blue variables, which are either transmitter variables (outgoing connections only), or loosely and weakly influenced by other levers, such as '*Long-Term Independent Research*' having an effect on '*Education and Ecological Literacy*'. None of these levers, which can also be seen as interventions in the system, rank highly in centrality. This is unsurprising, as they were added last as inputs into the system, limiting their connections and therefore their centrality, but also worth noting as it also may reflect the difficulties of influencing this system with so much 'reticence' and 'inertia' ingrained. This would reiterate the need to find balancing relationships within the system, starting with '*Valuing Natural Capital in Multiple Dimensions*'.

'*Valuing Natural Capital in Multiple Dimensions*' scores highly on centrality, a reflection of the number of strong connections it primarily receives. This was a key variable of focus, with strong ties to a '*Need for Holistic Decision-Making*' and '*Understanding Complexity of Ecosystems*' as environmental variables capable of directly improving the metric of '*Improved Ecosystem Health*'. Others in agriculture (Bank, 2014), and more broadly in sustainability (Costanza and Daly, 1992; Costanza et al., 2014), have called for a valuing of natural capital, and it stands to reason this would be a vital issue for stakeholders as they seek to place a financial value on the often ignored positive externalities of RegenAg. '*Valuing Natural Capital in Multiple Dimensions*', as the second most central variable on the map, determining where and how to influence this variable would be a vital first step for those seeking to increase adoption of RegenAg. Such efforts to value natural capital may also help to address two of the closely related variables that also score highly on Centrality: '*Lock-In of Farmers with High Debt Levels*' and the '*Cost of Converting to Regenerative*'. These and other variables reflected the perceived difficulties, as one put it, of "going green when you're in the red". Transitioning to RegenAg can require a high up-front cost either in additional resources (ex; the cost of fencing to move to cell grazing) or in reduced income by shifting away from high-production farming. These additional expenses may or may not reflect reality, particularly when considering the return on investment and resilience offered by many RegenAg practices, but the 'perception' of the expense seems to be important for those considering a transition. As many farmers are already in debt, these remain significant challenges, even when ignoring the additional social costs and mental strains of making such a change while dealing with judgment or pressure from peers and family. The additional variables of the

'*Lack of Resources/Finances*' and the '*View that It's a Trade-Off Between Environment and Finances*' lend further support to the significance of this barrier facing those seeking to transition to RegenAg. Understanding the variety of factors affecting this particular barrier, while complex, is possible due to the visual and interconnected nature of the FCM.

Complexity Over the course of the model iterations, the average number of connections for each variable increased from 2.5 to 4.5, likely due to stakeholders feeling more comfortable expressing how interconnected the system was, and the fact that they were given more time to reflect on and internalise the knowledge captured in the map. These changes in the FCM demonstrated a greater understanding of the connectedness of the system, reflecting the complexity of the issue and showing evidence for social learning (Henly-Shepard, Gray, and Cox, 2015; Reed et al., 2010; Fazey et al., 2007). It is possible that given more time, stakeholders would continue to identify new connections, but there is a risk of diminishing returns, as more connections does not always lead to greater understanding.

It is also worth noting that despite the increase in the average connections reflecting a greater complexity to the system, this was not reflected in the Complexity Score, defined as a function of transmitters to receivers, which was quite low at 0.2 (on a score ranging from 0-1, with 1 being high complexity) (Henly-Shepard, Gray, and Cox, 2015). We were not concerned by this result, as this was a product of the process we used, beginning with a singular metric, '*Improved Ecosystem Health*', which was our sole receiver variable and the measure for which we sought the system to work towards improving. Other authors have noted this score might not necessarily negate the complexity of the model, as the lack of receiver components "could in fact be a sign of a complex model that shows significant interlinkages and influences between system components" (ibid.).

Furthermore, many demonstrated an understanding of complexity and systems thinking during the workshops, which may have been self-selected among RegenAg practitioners who have to account for the effects of biodynamic influences on their economic and social activity of agriculture. It is still noteworthy, as they noted the reinforcing nature of a number of institutional barriers and policy barriers that were identified as a part of the workshop. For example, one area of focus was the the policy 'triangle of death', a reinforcing loop between '*Vested Interests of Business Models*', '*Institutional Reticence to Adopt and Educate*' and '*Gov't Discourages Regen Ag*'.

> *"In a negative sense, um we were focused on a little triangle of interactions between the yellow one on the bottom left, the vested interests, linking up to institutional reticence and linking across to government policy. And that little circle travels its own kind of thing in a vortex to the bottom and takes us away from what we need to do in valuing natural capital and improving ecosystem health. So those vested interests... they were a couple of key factors."*

While not explicitly stated as such, this is evidence of systems thinking in identifying the micro-structures or systems motifs (in this case a moderated effect motif) present in the network, linking causality that accelerated the effect of 'Vested Interest' and 'Gov't Policy' both have on 'Institutional Reticence' (Levy, Lubell, and McRoberts, 2018; Gray, 2018). It is

encouraging that RegenAg practitioners were aware of these feedbacks within the system, as previous studies had shown that familiarity with systems thinking is not always reflected in any subsequent 'model' (Levy, Lubell, and McRoberts, 2018; Schmitt Olabisi et al., 2016), and systems thinking has long been linked with positive outcomes in sustainability, and the ability to improve decision making in SES (Levy, Lubell, and McRoberts, 2018; Gray, 2018; Levin, 1998; Ison, Maiteny, and Carr, 1997; Halbrendt et al., 2014; Meadows, 1999b).

1.4.4 Meso-scale analysis: FCM Narratives

'Narratives' have been used as a part of qualitative research in psychology, anthropology, sociology, health research, and climate and energy research (Moezzi, Janda, and Rotmann, 2017; Overcash, 2003). It can be defined as "collecting and analyzing the accounts people tell to describe experiences and offer interpretation" (Overcash, 2003). In the aftermath of the construction of the FCM, we analyzed the initial model results, the recordings of the workshops, and interviews. As a result of this process we identified five key 'narratives' in the FCM, and we used these to communicate the model results with stakeholders, asking them to offer feedback on the validity of the narratives and on their implications. Each narrative consists of:

- **The Story:** a brief description of what the narrative is.
- **The Actors:** identifying who the key players might be in such a story.
- **The Model:** what implications this story has for the model (in our case the representation of the RegenAg system using FCM), both in how it is currently reflected in the model and what might need to change accordingly.
- **The Solutions:** if this story is true, what solutions or actions are needed to address the narrative in seeking to increase adoption of RegenAg practices.

We see these narratives as a means to establish an ongoing conversation, especially as some participants reached out to the research team after the workshop to share their own narratives.

Narrative	Story	Actors	Model	Solutions
Narrative 1: Government First	The culture and current paradigm is so enshrined in society that only the government has the resources and the ability to break us out of it. It is their job to protect the environment and future generations and they must act and do so quickly. Their investment in and provision of incentives for transitioning to RegenAg is the first step in creating a spill-on effect to the rest of the system.	-The Australian Government -The Prime Minister and Cabinet (particularly Ministers of: Agriculture, Drought and Emergency Management, Environment, Education -Voting Public	'*Government Policy Discourages Regen Ag*' and '*Institutional Reticence to Adopt and Educate*' are two factors at the center of the model, and both currently in the top 5 'most central' and influential variables. This is a result of the number of strong, causal arrows emerging from and being received by these factors. Should this narrative be true, even more of these links will need to emerge from these 'variables' to create effects on the rest of the system as 'forcing' mechanisms. The pressure would then be to create relationships that positively influence these key variables to 'encourage' more of a transition or transformation to RegenAg.	If 'Big Government' is the problem, then 'Big Government' must be a part of the solution, although this includes the federal and state government. While noting the effect the individual voters and media have on the government, if this narrative is true, a drastic reform at the level of Federal Government policy is needed. More incentives need to be provided for a switch to RegenAg, and could show up in a reform of drought policy, or an integration of water and soil acts, perhaps more in line with watershed boundaries as opposed to arbitrary political lines. Workshop participants noted that not only does this commitment need to be significant, it also needs to be 'long-term' in order to align with the cycles of natural capital and to "give confidence to land managers, industry, educational institutions, NGO's, and the broader public." Part of that effort could then include greater efforts to inform the voting public of these issues and/or actively push Parliament to embrace policies benefiting regenerative agriculture by directly lobbying the relevant Departments and Ministers.
Narrative 2: The Market Matters	The combination of 'Consumer Demand for Cheap Food' and 'Vested Business Interests', along with the surrounding infrastructure can keep conventional agriculture in place by creating a system that seems to race to the bottom. As noted by one participant, the "consumer demand/expectations for 'brandless' cheap food commodities [is a] major hindrance" to the adoption of regenerative agricultural practices, as they tend to carry a higher up-front cost, and often necessitate premium pricing as a result. Shifting this demand to food more aligned with holistic and regenerative practices puts pressure on businesses and government to incentivize those practices further and provide the structures and policies needed to produce at scale.	-Australian consumers -Woolworths, Coles, and other supermarkets -Agribusiness -Department of Agriculture -Banks and Financial Institutions	Much of this story is reflected in the upper left corner, with 'Consumer Demand for Cheap Food', 'Vested Business Interests' and 'Lack of Support from Industry Groups' all playing a key role in keeping the current paradigm focused on conventional production to meet the needs of the market. If this narrative were true, the connections between these three variables would be strong, and would further tie into 'Institutional Reticence', 'Gov't Policy Discourages Regen Ag', '*Lack of Resources/Finances*', and '*Cost of Converting to Regenerative*' to lock in market control and limit regenerative to a niche category. To change it, this reinforcing system would need to be broken.	Find ways to increase consumer demand for products of RegenAg (affecting 'Consumer Demand for Cheap Food' and 'Market Demand for 'Clean and Green"), which could happen in a number of ways: Provide government incentives to subsidize the cost of regenerative products, either in out of the gate packaging and production, or in reducing the high up front costs needed to switch to regenerative. Create regional processing and distribution centers in high agricultural areas devoted to regenerative products and lowering costs by producing at scale. Incentivize supermarkets to carry regenerative products either at lower prices or in high-value locations in stores to encourage more sales Increase funding to marketing and advertising to craft a more compelling narrative for regenerative products to direct-sell to consumers.

Narrative 3: Pressured Communities	Our communities have been conditioned to feel conventional agriculture is the only way, and this is present in our interactions with family members, neighbors, and peers in the agricultural world. As noted by one stakeholder, the supporting structures around agriculture (banks, agronomists, certain industry groups) also "have a lot invested in conventional farming" which strengthens this connection. Unless we can actively promote supportive mentors, community champions, community groups, and a solid evidence base, people will continue to avoid transitioning to practices viewed as 'unconventional', even 'radical'.	-Landcare -Local Land Services (LLS) -Local councils -Banks (Bank managers and accountants) -Agronomist groups -RegenAg practitioners and trainers -Individual landholders and farmers -Non-profit organizations	Currently, the fear-based trifecta, 'Fear of Peer Group Judgment', 'Fear of Change' and 'Fear of Being Different to Others', play a central role here (which is similar to 'Start with People', Narrative 4). However they combine, with the 'Lack of Examples/Evidence' and the 'Cost of Converting' and 'Lock In' of Farmers with High Debt Levels' to create a risky proposition of upsetting social norms with the possibility of little to no pay-off. If this were the dominant narrative, these factors would need to be more connected to the 'Vested Interests of Business' as this provides further disincentives, possess a stronger connection to the 'View that Regen Ag is a trade-off between environment and finances' as this is a fundamental assumption of many who resist transition to RegenAg. These would have to be far more interconnected with the rest of the map, with 'Support Mechanisms and Groups' and '*Long-Term Independent Research* on Regen Practices' being pushed as a way to address these challenges.	The policy should center on 'normalizing uptake' of RegenAg practices to remove any social stigma that comes from such a transition or practice. Being able to point to indicators of success, or cultural capital (Bourdieu, 1986; Burton, 2004; Sutherland and Darnhofer, 2012) for regenerative farmers, such as increased income or production, can help shield such farmers from criticism. Therefore, building up evidence and case studies to complement these transitions, ideally over the long-term can help. In addition, identifying and working with local and community champions, which could include members of local Councils, NGO's, or fellow farmers, could present additional social visibility and support. Providing training and support and building "communities of practitioners and networks of conversation" can also assist, and can span across regions due to the access and ease of the internet and social media channels.
Narrative 4: Start with People	We have to start from the ground-up in creating a cultural change, by capturing the hearts and minds of farmers through conversations, education, and outreach. This is where conversations and dialogue need to proceed, both in understanding where individual circumstances work against a transition to RegenAg, and in tailoring messaging to highlight if, where, and how practices of RegenAg might better align with the values and beliefs of farmers considering a transition.	-CSIRO -Universities -RegenAg practitioners and trainers (including holistic management, landscape rehydration, and other areas) -Non profit and research organizations (like The Mulloon Institute and Soils for Life) -Individual landholders and farmers	This narrative puts the various 'fear' variables as the central focus, along with the 'Inertia of the Existing Knowledge Structure'. If this narrative were true, this would also require recognizing how deeply rooted the trifecta of Fear variables, namely 'fear of change', is in individual minds increasing the number of arrows emerging from this space, many of them weak, but with deep roots throughout the system. As a result, '*Education and Ecological Literacy*' and 'Understanding Ecological Complexity' would need to play a much greater role in addressing these influences.	Appropriate solutions would need to address the fear that underlies much of the social and institutional resistance. Education and outreach would be the center-piece of this effort to have conversations and dialogue with the aims of transforming the hearts of minds of the agricultural industry, highlighting the "hope, dreams, and aspirations" of "leaving the land in better shape for the next generation.." This would also include better marketing and targeting of consumers to have them switch to products of RegenAg. However, it is likely this scale of change is likely to be long-term, as noted by participants, likely decades.

Narrative 5: Community by Community	As agriculture is often an area confined by ecological boundaries, we have to identify potential communities of farmers within watershed areas and provide incentives for individuals to change and for communities to collaborate. This is similar to Narrative 3, but instead focuses on an organization-led charge to benefit from the emergence of social, economic, and environmental outcomes that arrive from mutual support and collaboration on a conversion to RegenAg. Farmers need support from each other and from experts to complete this change successfully. The challenge is to find and/or create the good reasons that the members of a potential community will need to convert to RegenAg. That may include new marketing opportunities, or changes at the watershed scale allowing for improved production, or new social opportunities resulting from collaboration. Ideally, a permanent organization must be set up to undertake the work of identifying suitable communities, convincing the community to join, and to oversee the process of this change. The role of this organization is to marshal the expertise and resources required to totally transform existing farming operations into truly Regenerative Agricultural farms in such a way that the farmers involved achieve better outcomes and significantly improve their quality of life in ways that are congruent with their values.	- Community-led organizations or non-profits - RegenAg practitioners and trainers (including holistic management and landscape rehydration) - Business consultants (including people experienced in community organization and decision making, marketing and sales, logistics, technology and finance) - Farmers of the targeted communities	In many ways, this narrative is the culmination of some of the other narratives, in that it acknowledges the fear-based role of narratives 3 and 4, (and seeks to provide farmers with the means to deal with a '*Fear of Change*', '*Fear of Peer Group Judgement*', and 'Fear of Being Different to Others'), while highlighting the risk proposition of a perceived high '*Cost of Conversion*' or the '*Lock-In of Farmers with High Debt Levels*', and the difficulties of nudging people towards new ways of doing things. The '*Lack of Examples/Evidence*' and '*Inertia of Existing Knowledge Structure*' also play a role here, and in part this model of watershed community conversion seeks to address those variables to provide the incentives necessary for farmers to change. If this 'narrative' were true, then '*Catchment-Scale Community Building*' becomes the primary lever, and the model would need to reflect the various relationships that either exist or that can (reasonably) be built in order to drive change in the system. More, stronger arrows would need to emerge from this variable to influence (directly or indirectly) the most central variables of the system, including 'Institutional Reticence to Adopt and Educate', '*Valuing Natural Capital in Multiple Dimensions*', '*Cost of Converting to Regenerative*', '*Gov't Policy Discourages Regen Ag*', and '*Lock In' of Farmers with High Debt Levels*". It could also bring to the table with the farmers a wide range of external parties with experience, knowledge, skills, finance, and other resources to address 'Lack of independent agronomy advice'. Such an effort might also provide the case study needed to address the '*Lack of Examples/Evidence*' and to realize the economies of scale needed to remove the financial limitations of '*Lack of Resources/Finance*', '*Resources for new regen practices*', and the '*Cost of Converting to Regenerative*'.	In recognition of different areas and regions requiring different land use and management approaches, this narrative recognizes that solutions should be presented and tackled at the catchment and community scale. By having a community or catchment working together, an organization can identify solutions that mutually benefit the organization at multiple levels, including but not limited to increased production, better profit margins, stronger social ties, or greater environmental benefits. This could involve coordinating with local councils and farmers within the catchment and would necessitate an organizing body to ensure the appropriate training, education, and support were being delivered for the community needs. By converting a whole community, one can benefit from the economies of scale that can be delivered, as well as the combined expertise. Groups like The Mulloon Institute are one example of what this solution and narrative could look like.

TABLE 1.3: FCM Results- Narratives

1.5 Discussion

This research identified three key 'themes', with proposed applications to explore further in increasing adoption of RegenAg, specifically in delivering effective outreach and education to that effect. The work highlights increasing adoption of regenerative agriculture will require investment to break the 'reinforcing' structure of Australian agriculture, how 'narratives' can be an effective tool in formal and informal research, and the necessity of using deliberate and proactive strategies to address the fear of stakeholders in individual and collective conversations.

1.5.1 Inertia, Barriers, and Reinforcement in Regenerative Agriculture

This case study and the results of the workshop highlight that the actions needed to increase adoption of RegenAg must break the current 'reinforcing' paradigm of conventional agriculture. Stakeholders, a mix of landholders, trainers, researchers, and advocates, drew on their experience and knowledge to identify relationships within the Australian agricultural paradigm. Currently, business, government, the market, and social pressures seem to spiral down together in a race to the bottom, with few existing relationships in the system to incentivize a transformation. Understanding these complex forces highlights the need for coordinated actions at the institutional, social, and individual levels, across immediate and long timescales (decades). It is vital that RegenAg advocates, like TMI, find the messages and actions that overcome any paralysis of action in individuals and in communities (Polasky et al., 2020).

From the analysis of the FCM, we are able to make suggestions about variables and relationships of interest. Our centrality analysis highlighted several key variables, several of which ('*Institutional Reticence to Adopt and Educate*', '*Gov't Policy Discourages Regen Ag*', and '*Inertia of Existing Knowledge Structure*'), highlight the influential role that institutions, mainly government, play in Australian agriculture. This suggests the dominant paradigm of government policy is one supportive of conventional agriculture, borne out by the role conventional agriculture plays in the Australian economy, and the relatively low (in comparison) percentage of Australian agriculture belonging to RegenAg or other alternative measures. The supportive, even reinforcing nature of the agricultural paradigm and the relationships between entities (government, business, and consumers) has the potential to 'lock-in' these conventional agricultural practices, as it is difficult for RegenAg to break in to those relationships. Without significant policies or actions to provide a balancing relationship, there is no obvious incentive to change. Climate change could be one incentive, as it presents a severe challenge to human society. However, its impacts are often unclear, disputed, or occur over the long-term. Without making the severe consequences of conventional agriculture (through impacts on climate change, biodiversity, human health, or something else) immediately apparent, it is difficult for RegenAg to generate enough urgency to push through.

As pointed out by stakeholders, due to the lack of balancing relationships counteracting conventional agriculture, the system is also pulled into a 'race to the bottom'. This lack of balancing arrows (red arrows) can be seen within the system, particularly without the presence of the 'levers'—the blue icons noting actions we can take. Many of these levers were

discussed or identified during the Modelling stage of the workshop as possible 'solutions'. If the 'levers' or actions we can take to act in the system are removed, the number of balancing connections in our model reduces by nearly half, going from 48 to 27 negative relationships, meaning the ability of the system to deliver on the outcome of interest '*Improved Ecosystem Health*' becomes diminished. If there is a push for conventional agriculture, the system, as it's currently drawn, intensifies that as a pull downwards into methods that continue to extract from the land. This impetus can rapidly move to enshrine the dominant paradigm of conventional agriculture in a downward spiral as degrading land leads to more artificial inputs, leading to further degrading land and more money and incentives being put into the system to prop it up.

In addition, a number of barriers, including an up-front cost to convert to regenerative, debt levels, lack of resources, and ingrained view that environmental and economic outcomes cannot both be achieved, all suggest a transition to RegenAg is expensive. This expense may or may not reflect reality, particularly when considering the return on investment and resilience offered by many RegenAg practices, but the 'perception' of the expense seems to be important for those considering a transition.

While it is important to note this may not necessarily reflect the reality of the system (those balancing feedbacks may or may not exist regardless of what is shown here), the fact that stakeholders in favor of RegenAg believe this to be true is striking. Understanding these key variables and relationships highlights areas of concern and opportunities to address for RegenAg, identifying several variables and relationships worthy of further investigation. Each of these relationships could be improved and/or challenged by asking questions such as "How do we know this to be true?", "What would need to be seen for it to be proven true/false?", "What might some indications be to show that we are wrong?". But these critical questions cannot be asked if there is nothing to explore in the first place.

Insights from the FCM also leads to the question of: how can actions, particularly balancing relationships, be introduced to the system? This question is of interest to financial institutions and governments, many of whom have already begun work in this area (Bank, 2014). The levers on the FCM represent possible policy/intervention opportunities that workshop participants perceive as fundamentally relevant to a wider adoption of RegenAg in Australia. These opportunities are further discussed and explored in our five narratives. Notably, the solutions outlined under the five narratives coincide in the need for well coordinated, multi-scale (state; catchment, community) and multi-actor (federal, state, local government; industry; farmers and local communities) efforts to promote the desired shift from traditional to RegenAg practices. What is clear from our exercise, is that among RegenAg practitioners, the role institutions play seems to matter to them a great deal, but they also note the importance of interactions at different scales, including with social groups, personal identities, and the habits and values of landholders.

This need for work at various scales is documented within the RegenAg movement (Chapman, 2019; Gordon, 2020; Murphy, 2021) and within the research. As noted by Gosnell, Gill, and Voyer (2019), there are a number of 'spheres' or scales in which to push for RegenAg, including the personal, the practical, and the political. Our work found a similar

pattern. The FCM process noted behavioral traps and pain points of individual farmers, which are perhaps just as difficult, if not more so, to change than government policy. This includes '*Fear of change*', '*Fear of Being Different...*,' and '*Fear of judgment from peers*'. As an area perhaps less explored within agricultural policy, but with a growing body of research on the importance of stakeholder outreach and 'tailored' communication (Price and Leviston, 2014; Liu, Bruins, and Heberling, 2018), there is a potential to change 'faster' through education and outreach. We, like others (Gosnell, Gill, and Voyer, 2019) advocate that education and outreach should center on the personal sphere, aiming for critical awareness (Brookfield, 1987), reflection (Whitfield et al., 2015; Bruggen, Nikolic, and Kwakkel, 2019) and transformative learning (Mezirow, 2000; Keen, Brown, and Dyball, 2005) that allows for the deeper questioning and altering of underlying values and beliefs (Meadows and Wright, 2008). Determining where and how to value natural capital would be vital for those seeking to increase adoption of RegenAg. Such efforts may also address the difficulties of "going green when you're in the red."

Another source of uncertainty is the inherent complexity of the socio-ecological system we are studying here. A farm is subject to consumer demand, market prices, government policy, social pressures from peers and family, environmental disasters, long-term climatic trends, access to education and research, and the struggle to get up early in the morning. It is impossible to know with absolute certainty the status of some of these variables, or the nature of their relationships. In this sense, the model here does not, and cannot, perfectly reflect reality (the map is not the territory, (Korzybski, 1941)). Not only that, but some of these barriers, particularly institutional ones, are not only complex, but slow moving, requiring huge efforts and investments to drive change over the long-term. Left untouched, this seemingly insurmountable challenge could be discouraging. Complexity and uncertainty, however, cannot be an excuse for inaction. The identification of key variables and relationships, as we've done here, provides one path forward to asking better questions, and finding more targeted actions. The PM exercise and the FCM produced provides a blueprint of the first steps we should be taking to untangle the complexity and uncertainty of the system in attunement with people's beliefs and perceptions of how the agricultural paradigm operates. With these new insights in hand, our knowledge of the system becomes a little more complete, and we can work with stakeholders to look for new leverage points for change.

1.5.2 The Power of 'Narratives'

Communication with stakeholders can be improved by using the power of storytelling (narratives) to communicate research results in a clear and compelling way. Narratives and stories have been used for research in psychology, anthropology, sociology, health research, and climate and energy science. A 'narrative' can be defined as "collecting and analyzing the accounts people tell to describe experiences and offer interpretation" (Overcash, 2003). Narratives create a structure of 'meaning', and can be used to understand, rewrite, and shape beliefs (Baumeister and Newman, 1994; Luhman and Boje, 2001; McAdams and McLean, 2013). Narratives offer a practical way to communicate complexity, a device to collect and to understand counterarguments without becoming divisive, and a mechanism to urge action and ownership of the research findings. By collaborating with stakeholders to identify and

validate patterns, we extracted 5 narratives from our collective model, each as a possible interpretation of the 'patterns' within the system that highlighted key variables and suggested possible solutions to pursue.

By developing 'narratives' to report the findings of our FCM, we accomplished a few different objectives.

First, narratives transformed the complexity of the FCM into a structure more suited to communicate of complexity of this issue and the system(s) it involves. PM can facilitate the representation and communication of complexity in SES issues, as the often visual nature of the exercise, particularly methods like fuzzy cognitive mapping, causal loop diagrams, and systems dynamics, can more easily illustrate the interconnected nature of these systems (Voinov et al., 2018). However, the limitations of people in their ability to process complexity and the tangled web PM sometimes creates, means that complementing PM with additional measures to convey and, at times, simplify this complexity, is an area that demands attention. Narratives, as used by Eakin et al. (2019) and as we have described them here, provide one way to do that. While a simplification of reality, the presence of multiple (and at times conflicting) narratives can convey the complexity of these issues without being overwhelming. Together, narratives and FCM allowed for the scaling of the spectrum between specificity and focus vs the interconnections of the 'big picture', as we did with moves between a category of variables (ex; financial/economic) to drawing the connections between the variables to represent the whole system.

In short, we used narratives as a tool to reduce complexity in order to find possible solutions. Based on the FCM that was elicited, the narratives derived from it, and follow-up discussions with workshop participants, we identified several recommended areas of focus to improve adoption of RegenAg in Australia at various scales:

Narrative 1: Government First — If 'Big Government' is the problem, then 'Big Government' must be a part of the solution. This includes a coordinated effort from Federal and State governments. While noting the effect the individual voters and media have on the government, if this narrative is true, a drastic reform of government policy is needed. More incentives need to be provided for a switch to RegenAg, and could show up in a reform of drought policy, or an integration of water and soil acts, perhaps more in line with watershed boundaries as opposed to arbitrary geopolitical ones. Stakeholders noted that not only does this commitment need to be significant, it also needs to be 'long-term' in order to align with the cycles of natural capital and to "give confidence to land managers, industry, educational institutions, NGO's, and the broader public." Part of that effort could then include greater efforts to inform the voting public of RegenAg interests and actively push Parliament to embrace policies benefiting RegenAg by direct lobbying from RegenAg advocates and practitioners towards the relevant Departments and Ministers.

Narrative 2: The Market Matters — Find ways to increase consumer demand for products of RegenAg (affecting 'Consumer Demand for Cheap Food' and 'Market Demand for 'Clean and Green"), which could happen in a number of ways:

- Provide government incentives to subsidize the cost of regenerative products, either in out of the gate packaging and production, or in reducing the high up front costs needed to switch to regenerative.
- Create regional processing and distribution centers in high agricultural areas devoted to regenerative products and lowering costs by producing at scale.
- Incentivize supermarkets to carry regenerative products either at lower prices or in high-value locations in stores to encourage more sales.
- Increase funding to marketing and advertising to craft a more compelling narrative for regenerative products to direct-sell to consumers

Narrative 3: Pressured Communities — 'Normalize uptake' of RegenAg practices to remove any social stigma that comes from such a transition or practice. Being able to point to socially accepted indicators of success, or cultural capital (Bourdieu, 1986; Burton, 2004; Sutherland and Darnhofer, 2012) for regenerative farmers, such as increased income or production, can help shield such farmers from criticism. Therefore, building up evidence and case studies to complement these transitions, ideally over the long-term can help. In addition, identifying and working with local and community champions, which could include members of local Councils, NGO's, or fellow farmers, could present additional social visibility and support. Providing training and support and building "communities of practitioners and networks of conversation" can also assist, and can span across regions due to the access and ease of the internet and social media channels.

Narrative 4: Start with People — Appropriate solutions would need to address the fear that underlies much of the social and institutional resistance. 'Inducing epiphanies' as sought by Gosnell, Gill, and Voyer (2019) would be crucial. Central to this effort, education and outreach to converse and and engage in dialogue with skeptics, with the ultimate aims of transforming the hearts and minds of the agricultural industry, highlighting the "hope, dreams, and aspirations" of "leaving the land in better shape for the next generation.." This would also include better marketing and targeting of consumers to have them switch to products of RegenAg. However, the time-scale for this scale of change, as noted by participants, is likely to take decades.

Narrative 5: Community by Community — In recognition of different geographical areas and bio-regions requiring different land use and management approaches, this narrative recognizes that solutions should be implemented both at the catchment and community scale. By having a community or catchment working together, an organization (non-profit or even a government department) can identify solutions that mutually benefit the organization at multiple levels, including but not limited to increased production, better profit margins, stronger social ties, or greater environmental benefits. This could involve coordinating with local councils and farmers within the catchment and would necessitate an organizing body (such as TMI) to ensure the appropriate training, education, and support were being delivered for the community needs. By converting a whole community, one can benefit from the economies of scale that can be delivered, as well as the combined expertise.

Second, the presence of multiple, at times conflicting, narratives also provides a tool to *increase complexity* in order to prompt doubt, curiosity, and interest from those loyal to a singular narrative. As pointed out by organisational psychologist, Dr. Adam Grant, doubt and curiosity prompt an attitude of discovery, wanting to know more, and revealing the complexity of an issue can achieve this (see Figure 1.6). While each 'narrative' is a simplification of reality, the presence of multiple stories actually allows us to embrace complexity and to communicate it Eakin et al., 2019; Ryan, 2019; Luhman and Boje, 2001; Elliott, 2005. By showing a number of possible, plausible narratives, we demonstrate that there is more than one way to see and interpret the system, helping participants to acknowledge that their interpretation is not the only one. And even if valid, their chosen narrative is probably imperfect or incomplete.

As such, we consider narratives as an instrument to communicate complexity that is constantly evolving and under construction, aligning with the iteration so desired and so necessary in working with and educating stakeholders. In education and outreach efforts, community-led organisations, like the Mulloon Institute, can take advantage of narratives in a number of ways, including constantly monitoring communication channels to ask what narratives are being communicated, both by TMI and by stakeholders. Different narratives can then be drawn on to 1) reduce complexity in order to teach and to find meaningful, immediate actions and 2) to increase understandings of complexity by showcasing how multiple, even conflicting narratives make adoption of RegenAg much more than a black and white issue. Recognition of that complexity is the first step to finding the leverage points needed to transform our agricultural system (Meadows, 1999a).

The bottom line is that it is critical to engage stakeholders in the adoption of RegenAg, as it is both a context-specific area of practice within the limits of the land and, it is a personal and social issue (Pannell et al., 2006; Triste et al., 2018; Prokopy et al., 2019). We believe therefore that building on the current study, perhaps by further investigating the validity of the narratives and their implications, could identify further actions to take to improve adoption, as well as highlight additional barriers that the movement may face and that were not apparent to the participants of our FCM workshop. Blindspots in the FCM could be illuminated from input from and conversations with the voices and perceptions from conventional agriculture. By understanding the focus of different (and at times opposing) stakeholder groups, facilitators, educators, and trainers could focus future discussions on those actions and policies upon which there is both broad consensus and a sufficient evidence base to operate. FCM was a suitable tool for us to use to negotiate this effort in a small sample size, but it is not the only available. Regardless of the tool chosen, investigating other narratives may be worth exploring in subsequent research with other stakeholders of Australian agriculture, including conventional farmers.

1.5.3 Addressing Fear through Considered Communication

While institutional and policy barriers present a significant challenge to the adoption of RegenAg, considerations of individual landholders and the various levels of 'fear' that might hold them in place has massive potential for action in education and outreach. Addressing

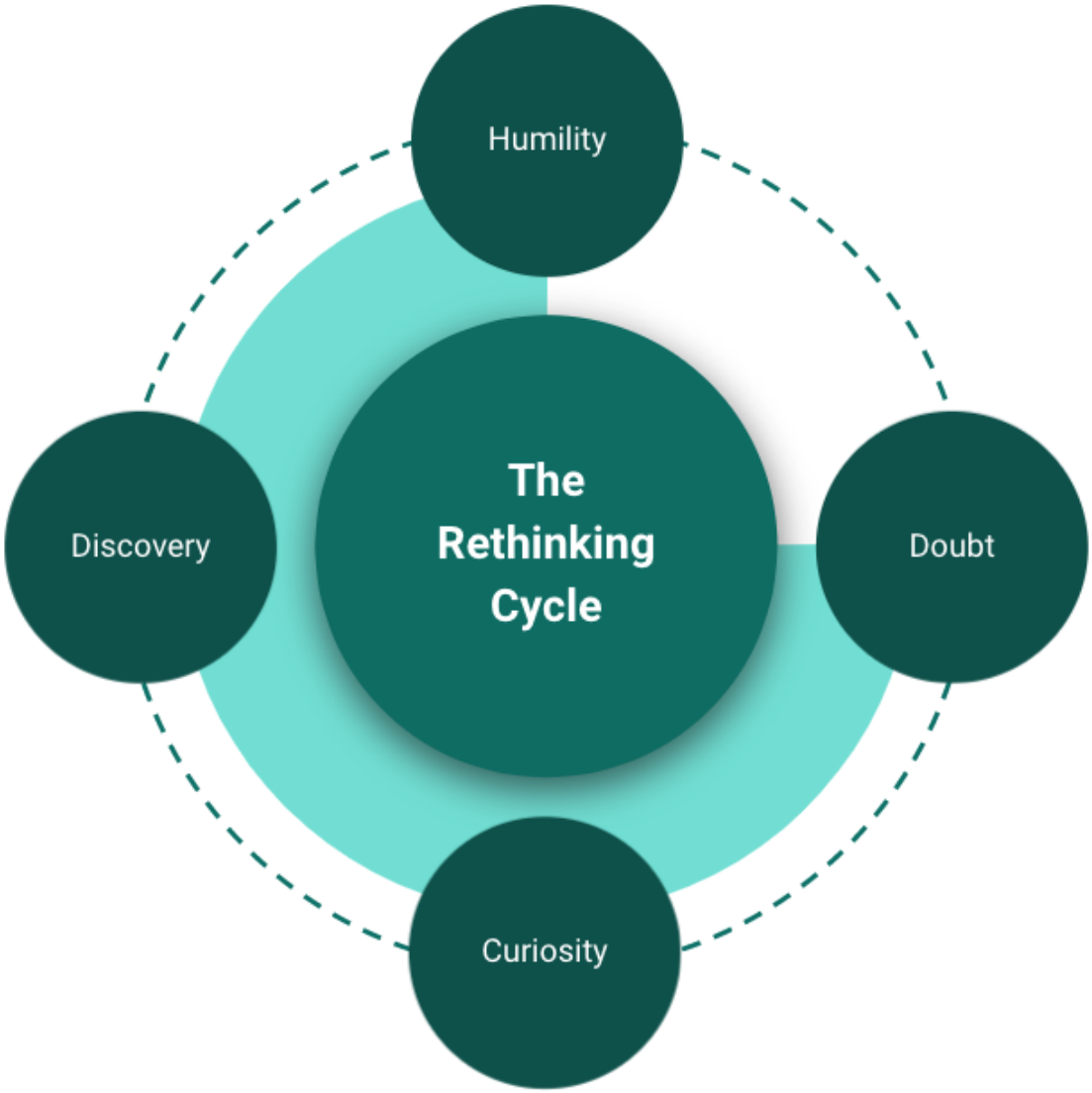

FIGURE 1.6: At any point, facilitators and educators can urge people to 'rethink', instead of becoming locked in to one narrow viewpoint, by encouraging humility, doubt in the certainty of one's view, curiosity to know more, and/or discovery, the active search to find different answers. Sourced from Grant (2021).

this fear in its myriad of forms can be undertaken in the short-term to complement and to ultimately strengthen longer-term efforts to address social, market, and institutional forces.

'Fear of change', 'Fear of being different', and 'Fear of judgment from peers' were all mentioned in the workshop, suggesting 'fear' plays a central role in the adoption of RegenAg. Research supports this notion as perceived threats (including what is seen as, consciously or unconsciously, an attack on someone's identity) can lock people into negative thought patterns that make learning and behavior change very difficult, bordering on impossible. Emotions play a key but under-appreciated role in learning (Dirkx, 2008) so approaching people with warmth and acceptance, is crucial, as creating an atmosphere free of judgment is both key to getting people to unlock and share their perspectives and, vitally, puts them

in a mindset to have mental models transformed. Stakeholder emotions impact their behavior, inside and outside of group settings, and it easy for these emotions to spread between participants (emotional contagion) making balancing the group's dynamics a delicate dance (Slotte and Hämäläinen, 2015; Druckman and Olekalns, 2008; Martinovsky, 2015). Positive emotions can open up mental models to transformation, and negative emotions can place them behind bulwarks if they feel threatened or judgment (Kaplan, Gimbel, and Harris, 2016; Nauroth et al., 2017). The words chosen and atmosphere created can contribute to warmth and acceptance, thus promoting learning, or they can create destructive conflict, which is unlikely to allow for teaching or change.

To address fear as educators, building trust is also incredibly valuable. Drawing from the work of organisational psychology, the concept of 'psychological safety' means creating an environment where healthy argument is possible, and people can bring their best selves (Edmondson and Lei, 2014). Psychological safety recognizes that conflict in a shared space is unavoidable. However, if learning and innovation are paramount, people must feel secure to share their views and take interpersonal risks without judgment (ibid.). Leaders in groups settings must play a key role in creating such an environment. As educators or trainers, we can reduce stress and fear in the people we speak to by establishing our motives and intentions clearly, and aligning that with a common interest of our stakeholders. For example, "I am not here to tell you what to do, I am here to learn with and from all of you", or a similar framing encourages a mutually beneficial focus on collaborative learning.

It is worth noting the purpose of the workshop or group exercise and the selection of stakeholders who are 'in the room' are also two key and foundational parts of that process (Voinov and Gaddis, 2017; Jones et al., 2016), as stakeholders cannot feel secure in a room with a cause they don't believe in and people they don't trust (Kappas, 2013; Kaplan, Gimbel, and Harris, 2016). Tactically, there are a number of ways we can build psychological safety, including:

- Establish a common purpose. "We are all here to learn" is a common and great starting point.
- Present conflict as an opportunity for discovering things together from different perspectives.
- Reframe failure. Finding points or perspectives of disagreement present an opportunity to learn, rather than a reason to quit. 'Winning' an argument is not the goal.
- Humility and vulnerability prompt curiosity, which is crucial to getting others to be 'open' to dialogue, and ultimately to learning.

Another key to psychological safety, and trust in general is the idea of active listening. Listening is undoubtedly (and somewhat obviously) important, but active listening involves three discrete skills that can be practiced and developed by facilitators: paraphrasing, mirroring, and labeling. Paraphrasing is where the facilitator uses active listening to summarize the previous conversation and put it back on the stakeholders to expand and confirm this understanding is correct. This skill demonstrates an authentic intention to understand other people in the room (Vecchi, Van Hasselt, and Romano, 2005; Evans et al., 2008) and is similar

to the idea of Rapaport's Rules in debate, where the facilitator might restate the point of a stakeholder when it comes to a contentious idea and aiming to do so that their response is "Thank you for putting it better than I could" (Dennett, 2013). Showing interest in other points of views and asking questions to clarify and to explore different possibilities invites stakeholders to own the next actions and promotes the dialogue needed to make it happen (Leppänen et al., 2018). From that place of mutual understanding, the group can then move to stating disagreement in a more productive state of mind.

Mirroring involves repeating the last few words of someone else's statement as a question, to show attentiveness and elicit further explanation. For example, when one of our stakeholder stated "And then you can build an evidence base to show people that agriculture can in certain circumstances contribute to improved ecological health," the facilitator met that with "Improved ecological health?" and an upward inflection to prompt the stakeholder to further explain what is meant by those terms, both for the facilitators understanding, and the collective understanding of other stakeholders. By encouraging stakeholders to elaborate on their views with a restatement of their words, as a question, mirroring is designed to prompt others to refine their thoughts, particularly on how they define and understand key terms to prevent misunderstandings.

Emotional labeling (ex; "it sounds like you are frustrated" or "it seems like you feel powerless") is often combined with paraphrasing. By putting a name on emotions, facilitators can further promote safety and trust through emotional resonance, or the sense of 'I feel your pain' (Schrock, Holden, and Reid, 2004) which in turn can create a positive emotional environment (Giorgi, 2017; Kappas, 2013; Leppänen et al., 2018). Recent research from neuroscience, political science, and social psychology all agree with "acceptance" as a key underlier, pointing out the need for this emotional resonance and labeling, the ability to say "I understand and feel your pain", even if we don't agree with it (Martinovsky, 2015).

Active listening and Rapaport's Rules create respect for differing viewpoints, which in turn lessens the fear of judgment that can keep individuals trapped in place behind 'old' mindsets. Even though it does not guarantee success, active listening promotes the type of deeper learning we seek in discussing questions of RegenAg adoption (Argyris and Schön, 1978; Tosey, Visser, and Saunders, 2012; Flood and Romm, 1996), which ultimately has to involve a questioning of underlying assumptions in the hopes of transforming beliefs.

1.5.4 Limitations

While the findings of the study builds on work in RegenAg, there were also limitations. First, no PM workshop, even with the same stakeholders, is the same and this makes the presence of a 'control' group impossible. However, a workshop similar in intent with different stakeholders could have been interesting. In a similar fashion, a workshop focused on a more narrow practice of RegenAg (ex; cell grazing or NSF) could have provided additional insights and comparisons for a specific practice of adoption.

Additionally, this study was intentionally absent of conventional agriculture producers. While a purposeful choice to minimise disruptive and destructive conflict, those 'voices' were not considered in the depiction of the 'barriers' of RegenAg adoption. Indeed the

workshop was based on the assumption that more RegenAg is desirable, to which not all farmers might agree. However, the presence of a largely homogenous, pro-RegenAg group did allow some of the in-group distinctions and conflicting perceptions to arise. Future work can and should find ways to include more 'conventional' participants, which could add more representativeness and complexity to our understanding of what prevents and what draws people towards adoption of RegenAg practices.

It is also worth noting that the small sample size also did not allow for a 'full' representation of RegenAg, as it is not a homogenous group. RegenAg is an umbrella, covering a variety of practices and outcomes; it is important to note that there is not a consensus on what RegenAg is and what is not (Newton et al., 2020) As such, working with a different group of participants who also identified as RegenAg advocates could still have led to a completely different model. This does not negate the significance of our group's work, it simply places it in context.

The small sample size also limits the degree to which statistical analysis can find 'significance' in the strength of relationships on our model. Future work could combat this by creating individual maps with participants beforehand. In addition, sample size is a pervasive issue in PM, but one that has the potential to be overcome with virtual facilitation (even beyond COVID-19), as we used here. Under normal circumstances, COVID-19 and social distancing restrictions would have made this workshop impossible but we managed to pivot to a successful virtual delivery under lockdown and that same method could be used to expand sample sizes as geographical distance or the physical size of the room would no longer be limiting factors.

1.6 Conclusion

As advocates of RegenAg, we may often find ourselves in conversations with people who openly oppose our positions or, at the very least, are skeptical of RegenAg. Every one of these conversations can be unique, as it may occur with different individuals, in different settings, and at different points in their lives (both in experience, and in relation to other events in their life, i.e. haven't had coffee yet). And yet, it is critical to directly engage stakeholders, as adoption relies on the biophysical limits of the land they manage *and* it is a personal and social issue (Baumgart-Getz et al., 2012; Pannell et al., 2006; Prokopy et al., 2019; Triste et al., 2018). By further investigating the validity of the narratives and their implications, RegenAg advocates, like TMI, and researchers could identify additional actions to improve adoption and highlight additional barriers that were not apparent to our research participants. In particular, blindspots could be illuminated from input from and conversations with the voices and perceptions from conventional agriculture. By facilitating conversations to understand different (and at times opposing) stakeholder groups, RegenAg advocates could focus on those actions and policies upon which there is both broad consensus and a sufficient evidence base to operate.

This research helped to explore the idea of what constitutes an ideal learning environment for outreach. By accounting for the identities, emotions, social dynamics and narratives that

stakeholders bring with them, we can more effectively educate and communicate. 'Narratives' can assist in that process, as it can effectively align the insights developed from a participatory exercise with the way our mind best assimilates information. This format of research is compatible with the existence of various (and sometimes competing) narratives.—more than one may be present, and the 'priority' for any particular narrative may shift.

Taken together, the findings of this research have a number of important implications for RegenAg in Australia. In our case study, the co-construction of the FCM with stakeholders revealed the myriad of connections at play in the adoption of RegenAg in Australia, highlighting the reinforcing relationships that keep conventional agriculture as the dominant paradigm. To combat this, advocates must find a way to introduce 'balancing' relationships into the system, which will likely require coordinated efforts across sectors over the medium to long term. Such actions are necessary for RegenAg to play a greater role in Australia's agricultural paradigm, currently reliant on conventional agriculture with few internal incentives to change. The crisis of climate change and a degrading environment may be the ultimate reasons for change, but in the short-term, RegenAg advocates can also tailor communication, education, and outreach efforts to prompt transformative conversations and strengthen the grassroots dialogue for a healthier environment, healthier communities, and a healthier society.

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