

Are farmers empowered? The role of empowerment in farmer decision making about weed and invertebrate management

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Abstract This research investigates how empowerment affects Australia's broadacre farmers' decision making about weed and invertebrate management in the context of two strategies, Integrated Weed Management (IWM) and Integrated Pest Management (IPM). The research is informed by constructivist grounded theory and used in-depth interview, observation and document analysis to extract rich data. With the rise of chemical resistance, the agricultural industry has placed considerable emphasis on the need to accelerate and achieve farmer adoption of IWM and IPM, but our evidence suggests that greater emphasis should be given to understanding the socio-cultural factors that affect farmer decision making. Farmer empowerment emerged as a core concept from the data. We found farmers are typically empowered, which affected how they learnt, constructed knowledge and made decisions about weeds and invertebrates. This is important for extension to consider as it affects the dialogue between farmers and extension.

Keywords: extension, empowerment, IWM, IPM, decision making

Introduction

Background and research aim

The aim of the research in this paper is to understand the effect of empowerment on Australia's broadacre farmers' knowledge construction and decision making about weed and invertebrate management. The decision making is specific to two science-based agronomic strategies, Integrated Weed Management (IWM) and Integrated Pest Management (IPM), but it could apply equally to many complex agronomic contexts. The analysis provides insights that can improve the process of extension through more effective engagement with farmers.

A key purpose of IWM and IPM is to slow down the incidence of and better manage chemical resistance. The rising incidence and concern about chemical resistance in invertebrates and weeds has motivated agricultural research and industry groups to urge farmers to adopt IWM and IPM. Typically, these groups say that farmers' rate of adoption so far is too slow or sufficiently ineffective to avoid the untimely loss of important herbicides and insecticides (van der Meulen, Reeve & Sindel 2007; Nash & Hoffmann 2012; Parsa et al. 2014). This concern about the low adoption of IWM and IPM forms the basis of this paper's broad research problem.

Farmer decision making is a social process (Vanclay 2004; Ervin & Jussaume 2014), but there remains minimal analysis of the socio-cultural processes that affect farmers' knowledge construction and decision making, especially in complex contexts (see Ervin & Jussaume 2014). To gather the evidence to help understand these processes, it was necessary to understand farmer relationships and ask, how do farmers interpret the IWM- and IPM-based science, and how do they interpret the relevant risk and uncertainty? The importance of empowerment emerged from exploration of these questions and helped form the research question, how does empowerment affect farmer decision making about weeds and invertebrate pest management?

Understanding empowerment

Empowerment integrates power, knowledge and relationships and, in turn, affects farmer decision making (Bourdieu 1986; Bartlett 2008; Gerth & Wright Mills 2009). The consideration of empowerment in agricultural extension and its relationship with farmers is relatively new (Bartlett 2008), though Roling & van de Fliert (1994) argued that farmers' empowerment is necessary if we are to facilitate farmer learning or adoption of more sustainable agricultural practices.

Although there is no settled definition of empowerment, most definitions describe an empowered person as someone with the capacity to change or act, and the ability to define their own problems and opportunities. For example, Roberts & Coutts (2007) describe an empowered farmer as one who, within their own farm system, will define their own problems and opportunities, and seek ways to solve or take advantage of them.

There are competing philosophies that affect how empowerment is defined and understood (see Kabeer 2001). For instance, Bartlett (2008) describes two distinct discourses for empowerment: one centres on empowerment's instrumental benefits (instrumental discourse), the other on the intrinsic value of empowerment (intrinsic discourse). The instrumental discourse places empowerment in a context where it is a means to achieve goals set by research participants other

than the farmers such as government or research institutes. Any control a farmer has is predictable and non-threatening to others (Bartlett 2008). For example, Bartlett argues that many development projects have defined and specific objectives such as food security or to conserve natural resources. These are quantifiable outputs that are used as measures of success, but make rural people the object of production targets or adoption rates (Bartlett 2008).

In contrast, intrinsic empowerment involves a permanent change in how people (farmers) live their lives. It is what Bartlett considers true empowerment and it has three elements: *means*, *process* and *ends*. *Means* includes farmers' rights, access to and availability of resources (physical and social), capabilities and opportunities. *Process* (or *agency*) is seen in terms of making choices that involve ability to analyse, make decisions and act, all of which must be self-directed to be considered empowerment (see also Kabeer 2001). Bartlett's third element, *ends*, is people taking control of their lives (Bartlett 2008).

Relationships and empowerment

In the few instances where the empowered farmer is discussed in the literature there is a recognised value in understanding empowerment's effect on farmers' relationships, knowledge construction and decision making. Where the empowered farmer is realised, researchers are explicit in the need for extension to reconsider their role and approach to engagement with farmers. Nettle et al. (2015) provide a rare exception to a focus on attempts to empower farmers. They described contexts that recognised farmers as already empowered and the necessity to consider this in any engagement process. They emphasise the need to create the cultural environment to enhance and facilitate the empowered farmer. This includes their suggestion for collaborative RD&E designs to avoid information as the principal output and to think about how the process contributes to farmer empowerment (Nettle et al. 2015). This realisation shifts the role of researchers and extension to aid reflection and learning, create and facilitate networks outside social norms, and enable farmers to mobilise and act collectively (Nettle et al. 2015). Because there was only one farmer directly involved in Nettle et al.'s research, they acknowledge their framework needs to be tested and applied in more cases and contexts.

This research provides, at the social and cultural level, insights into the nature of farmer empowerment and its effect on relationships, knowledge construction and decision making.

Method

Risk and uncertainty are inherent in most decisions that concern weed and invertebrate management. The literature on farmer decision making that concerns risk and uncertainty is typically quantitative and focused on economic factors. Quantitative methods alone are inadequate to elucidate the complexity of risk perception (Renn 2008; van Winsen et al. 2013). The research specific to management of weeds and pests is also largely quantitative. For instance, it has measured rates of IWM/IPM adoption (de Buck et al. 2001), the variables involved in adoption (Llewellyn et al. 2007), and identifies factors that act as a barrier or facilitate adoption (Llewellyn et al. 2007; D'Emden, Llewellyn & Burton 2008; Parsa et al. 2014). Although these quantitative methods provide valuable knowledge about adoption that give an insight into the what and how, there is minimal insight into the why that comes from examination of the complex human phenomena of farmer decision making about weeds and invertebrate management.

Thus, there is scope for a qualitative approach to give a different perspective on the risks, uncertainties and social processes that influence farmer decision making about IWM and IPM. This research is informed by modified constructivist grounded theory, a method considered appropriate to understand such complex social phenomena (Charmaz 2006).

The modified grounded theory adapted for this research allowed us to contextualise and understand the nuances of the social processes that facilitate farmer decision making. Concepts were treated analytically, but not used to construct a theory. Regardless our approach follows the constructivist grounded theory principle as it avoids advocating a single, true answer and opens up our findings for wider interpretation.

Research process

Our research was an iterative process continually switching between data collection, analysis and consultation of the literature to understand and clarify concepts emerging from the data.

The first author gathered and analysed the data. Interview, observation and analysis of varied literature were used to triangulate the data. This was not to establish convergence of a single or predominant social phenomenon. Indeed, from these multiple data sources emerged a number of contradictions and inconsistencies. This not only provided a richer picture of farmer decision

making, but the iterative nature of grounded theory enabled exploration of these conflicting data sources to understand these social phenomena in greater depth (see Mathison 1988).

There were three main phases of data analysis: initial coding, focused coding and concept coding. NVivo was used to manage transcripts and the focused coding and concepts. The software was used as a searchable database rather than an analytical tool. All analysis was done manually. The initial coding described actions and revealed meaning and analytic ideas to pursue. These emerged by asking, what is happening here? Focused coding was the process of filtering the initial codes. It is where concepts began to emerge and new research directions were identified. For example, the initial code, 'Enjoying being a farmer', generated the focused codes, 'Freedom' and 'Vocation-cultural'. Concept coding helped refine and understand the relationships between the focused codes and established important concepts. There was significant reading of the literature, further interviews and immersion in the transcripts, and reflection during this phase. It was during this phase that empowerment and its significance eventually emerged as a core concept.

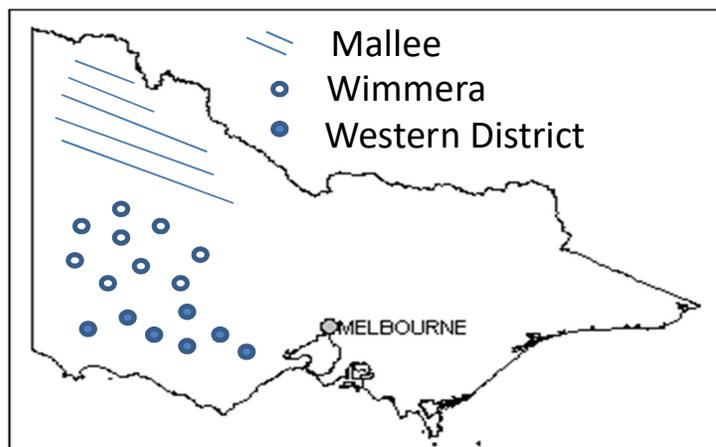
Sampling strategy

The interviews were conducted with four types of research participant:

- Farmers (F): The 28 farmers interviewed were either continual croppers or mixed livestock and cropping.
- Scientists (S): Nine scientists were interviewed based on the relevance of their research to the research problem.
- Agronomists (Ag-S[ales]; Ag-I[ndependent]): We interviewed eight sales and three independent agronomists. Sales agronomists were those attached to a local agricultural supply store. The store offered their agronomy service free or sometimes had varied fee-for-service options. Independent agronomists operated independently of any store or connection to industry. They were full fee-for service.
- Research agronomists (ResAg): The predominant role for the eight research agronomists interviewed was to manage research projects and trials for local farmer groups. Some also operated as independent agronomy consultants.

Farmers and agronomists were recruited via one of two methods. The first was through a snowball strategy that started with farmers known to the principal author. The author asked these farmers to ask other farmers and agronomists they knew if they would be willing to participate in this research. This was repeated with each new farmer and agronomist interviewed. The second strategy was to present an overview of the research to farmers and agronomists at professional development workshops and events run by the industry organisations and local farmer groups. A short survey was made available to farmers and agronomists at these events that included a question that asked whether they would be happy to participate in a face-to-face interview. Farmers and agronomists were interviewed from three Victorian broadacre farming regions: Western Districts, Northern Wimmera and East Mallee (see Figure 1).

Figure 1. Map of the state of Victoria showing the three cropping districts (Mallee, Wimmera, Western District) where participant farmers and agronomists reside.



Observation and document analysis

Observation involved participating in and observing a variety of events targeted at farmers and agronomists that could be loosely considered professional development. They ranged from the

formal conference with seminars and speakers, to informal crop walks organised by the local farmer groups where farmers would visit trial crop sites and discuss what they saw with the farmer group representatives and coordinators of the trial.

Farmer-targeted documents were analysed that included fact sheets, information manuals on IWM and reports. The authors of these documents were the GRDC, (Australian Herbicide Resistance Initiative (AHRI)), and the farmer groups such as Southern Farming Systems (SFS) and Birchip Cropping Group (BCG). Other documents analysed included articles from the Australian agricultural media.

What is happening? The role of empowerment and power

In this paper we argue that when it comes to decisions about weeds, invertebrates and many other complex farm management decisions all farmers participating in our research were empowered, though in different ways. As described above, empowerment is defined by a number of elements. Unique to each farmer and context, one or more of these elements could operate with variable influence. Regardless, empowerment was a powerful motivator and facilitator of their knowledge construction and decision making. Farmer actions that influenced their knowledge construction and decision making did not happen in isolation. They occurred within complex power-knowledge relations. The intimate link between power and knowledge meant any construction of farmer knowledge was reliant on their relations and vice versa.

This section outlines the elements used to define empowerment and power and then uses those elements to analyse and interpret the interview data and begin to understand the role of empowerment in farmer decision making.

Empowerment, power and the farmer

Empowerment is an abstract concept that farmers in this research didn't mention explicitly, but they did talk about maintaining control and ownership of any decision and carrying the burden of risk. They also discussed their process of analysis and reflection in any decision making. These concepts, evident in the farmers' comments below, align with the theory discussed in the Introduction to form the basis of how this paper defines empowerment.

F-2: ...once you have that independent advice, the information is yours and you are more in control of your situation. You are not just at the bottom of the food chain waiting for all these so-called experts to hand out info...All the time we are faced with these complex decisions...At the end of the day it is the farmer who carries the risk.

F-23: So how do I do this (make good decisions), I mix with who I think are the best operators and I refine that in my own mind.

From the theory, we use two of Bartlett's (2008) three elements that underpin what he called intrinsic or true empowerment. These two elements are, agency and ends. Although farmers in our research considered Bartlett's third element, means (a farmer's rights, access to and availability of resources), what emerged as more important for our research is how farmers accessed and used such resources and the motivations for doing so, and this is where the elements of agency and ends become relevant. Thus, we focused on them in this research as evidence of empowerment and describe them below.

Agency is the capacity to make choices (see Kabeer 2001; Bartlett 2008). We break it down to the following three components:

- analysis, critique
- reflection
- self-direction (self-defined objectives, action and evaluation).

Ends is people taking control of their lives and it is identified by the component control (i.e. self-defined choice, ownership of decision).

The following components of Bartlett's instrumental discourse are relevant to our data:

- Boundaries are defined by science or 'experts' and outcomes are predictable.
- Participation is where farmers are given a role, but they lack control of the agenda and objectives.

Understanding power

In this research, power-knowledge dynamics varied for each farmer relationship, but evident in all relationships that concerned weed and invertebrate management are farmers' autonomy and attempts to construct knowledge and make decisions. The dominant relationship for the farmer in the context of weed and invertebrate management was with their agronomist, but those with other farmers, scientists, community members and family were also important. The following

farmers all discussed their relationship with their agronomist. Evident are the concepts of autonomy and knowledge construction through farmers' choice to seek an agronomist for advice, yet still have control over how that advice is interpreted and used to construct knowledge.

F-4: I do not query the cost of having a so-called expert in their field to come and help me with my decisions, but to give me the info...It is always my decision in the end.

F-1: I have a great relationship with my agronomist. He'll look after the chemical... I plan the rotation, what I want, where I want it...but if I get a new bloke in I will question his advice with greater scrutiny.

In this paper, we analysed power in the context of two broad conceptualisations. One is a resource-based model where power is authoritative or coercive and exists via the means or resources that enable someone to meet their objective (Uphoff 1989; Gerth & Wright Mills 2009). Two resources emerged as important in our data and provide context to our argument. They were legitimacy and expertise, and are described briefly below (Raven 1992; Heizmann & Olsson 2015).

- Legitimacy: where the role of the person affords them some authority or respect.
- Expertise: where the person possesses knowledge or skills considered valuable.

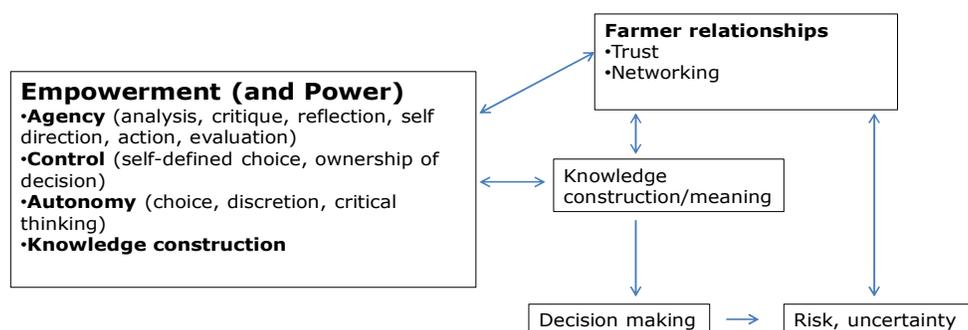
The second conceptualisation, and the one that fits best with how we interpreted the data in this paper, says that power exists through relationships. Knowledge and power are inextricably linked such that the relationship cannot exist without the relevant production of knowledge (Foucault & Gordon 1980). Power is not conceived as a resource to control or dominate. It does not emanate from an authority (Heiskala 2001; Schirato, Danaher & Webb 2012). Central to this concept of power is the ability to choose. This is autonomy.

We used the elements of autonomy and knowledge construction described below to interpret and explain the complex interactions of farmers' power-knowledge relations and their association with empowerment and farmer decision making.

- Autonomy: farmers act as autonomous agents of power to construct knowledge. They display choice, discretion and critical thinking.
- Knowledge construction: farmers filter and interpret competing knowledges. The knowledge may be co-constructed but it is largely constructed by farmers through the interconnected relations and farmers' varied and negotiated interpretations of meaning.

In the rest of this section, we used the above definitions of empowerment and power to analyse and interpret the interview data. Figure 2 models the relationship between farmers' empowerment, power, knowledge construction and decision making.

Figure 2. Empowerment model showing the relationship between empowerment, power and farmers' evolving knowledge construction and decision making



Finding farmer empowerment

For the farmers in our research, empowerment had an intimate link to power and knowledge as the state of empowerment itself influenced the dynamics of their power-knowledge relations and how knowledge was constructed. Conversely, it is the knowledge farmers constructed in these relationships that helped facilitate and maintain their state of empowerment. This section explores the evidence for farmer empowerment and how power-knowledge relations underpinned and facilitated that empowerment. This section also shows that the different elements that define empowerment were not all apparent or operating together in any one context. For example, a

farmer may be empowered when he or she exhibits control, but analysis and reflection may not be overtly evident. The level of control may vary also, but there is still choice and ownership of decisions. Each context for each farmer is unique.

The intimate link between power and empowerment meant that elements of both concepts could be reflected in a single participant comment. For example, Farmer 4 below exhibited agency when he sought expert advice yet did not passively accept it. Farmer 4 actively analysed and reflected on this advice. He exhibited autonomy and control when he said he needed to understand the agronomist's position and reason for his decision. It is Farmer 4 who decided how the agronomist's advice would be interpreted and used.

Farmer 4: ...but I know my paddock and I can say yes, it will be this (issue)...The agro[nomist] will suggest something and I will ask why am I doing that and not this...He (agronomist) is the expert, he has the training and the knowledge, but you need to know where he is coming from, what reasons he has for recommending a course of action. If a young agro still on a learning curve gave me the advice, I might question him more, or give him the benefit of the doubt just to see how his advice worked.

Because of the overlap of the defining elements of power and empowerment, we analysed farmer and agronomist comments under the following elements: Analysis, reflection; Self direction; Control; Autonomy, Knowledge construction; and Power and the agronomist.

Analysis, reflection Empowerment meant farmers ensured they were in a position to analyse and critique any advice or information they received or sought. A number of farmers' comments, such as Farmer 2's above, suggested that to be otherwise made you vulnerable and exploitable – disempowered. There were rare and isolated comments that portrayed farmers in our research sample as passive recipients of information, that they afforded power to another party. This perception changed when the comments were put into the context of the entire conversation.

For instance, Farmer 12 is typical of how most farmers in our research approached farm chemical use. Knowledge about farm chemicals was an expertise they did not have the time or the inclination to keep up with. In isolation, Farmer 12's comment, "the sprayer does not go into a paddock without talking to the agro" implies he devolved "expert" power to the agronomist. Yet Farmer 12 still had oversight that involved analysis and reflection. He had to walk the paddocks with the agronomist, point out problems and discuss potential actions. He also evaluated the advice through benchmarking his property against others. Such evaluation is indicative of self-direction (agency).

F-12: ...the sprayer does not go into a paddock without talking to the agro[nomist] beforehand. This is just to get a handle on the rates, sprays, etc...the herbicides are more about him [agronomist]...Most times I will go around the paddocks with him to have a look and we'll talk about what has to be done. If there are any issues I will bring them up and he'll adjust herbicide recommendations accordingly...I guess if you are getting the results in the paddock; you are seeing what other people are doing and if you feel like you are up with them. I know a lot of the other clients he has and they're good farmers.

When considered in the context of the whole interview, no farmer in our research appeared to afford power in any way reflective of the resource-based model. The farmers in our research actively sought expertise and information and exhibited agency and autonomy. They analysed and reflected on advice and information to help construct knowledge. From the farmer's perspective, there was no apparent domination, no authority as portrayed in the resource-based power model.

This analysis and reflection happened with advice from independent or fee for service agronomists, or from any considered expert. For example, Farmer 2 chose to use independent agronomist advice, and although highly valued, he still critiqued this advice, which he then used at his discretion (reflection, autonomy). Any decision he made based on knowledge constructed from that and other advice was his own. He made apparent his self-direction, control, autonomy and knowledge construction.

Farmer 2: He [agronomist] has a feel for how I like to operate and what crops I like to grow...There is always that robust discussion and I respect his opinion...You always have to question it [agronomist's advice]. You respect that the agro comes in with more experience and knowledge than you, but at the end of the day the farmer makes the end decision and spends the dollars ... That is the beauty of independent advice, you can use it at your discretion.

Further, nearly all farmers expressed the need to have an understanding of a situation to put them in a better position to question, analyse and reflect on any advice. Farmer 9 was explicit in this need. There was no passive acceptance of advice from his agronomist; there was oversight involving critique and reflection and where necessary rejection of advice, traits that are also indicative of control and autonomy.

F-9: You get a recommendation and you have got to have an understanding of it all and agree with the path you are going on because if the agro[nomist] is recommending something and you are thinking no, no that is not right, you have to go and restart what you are looking at again.

Self-direction Advice, once analysed and reflected upon, typically needed to be compatible with farmers' self-defined objectives. This emphasises empowerment's effect beyond agronomic decisions and that certain agronomic decisions, especially those requiring long-term investment or planning, or where there was risk and uncertainty, needed to be compatible with farmers' objectives for the family, farm system and farm business.

Farmer 5 used an independent agronomist. He was selective about how he used his advice and how his own objectives affected his interpretation of that advice and the meaning it had for him.

F-5: It is like all things, you get advice, but sometimes you have to nut it out and make adjustments to your own situation...you have got to make adjustments all the time anyway to suit your own needs.

Control "It is always my decision" (Farmer 4). Similar sentiments were reflected in many farmer comments where it was apparent they were in control of the advice they sought and from whom.

Control was also evident in the way farmers in this research used expert advice to inform their decisions rather than accepting it as a form of decision made for them. Thus, through analysis and reflection on competing knowledges, farmers made decisions and had ownership of those decisions (control). Farmer 5 (below) sought information, advice or opinion, but he had control over where that advice and information came from. Advice was actively sought, rather than passively received. Farmers' interpretation of that information would determine its value and meaning, which they used to help construct knowledge and make decisions compatible with their objectives.

F-5: So you get the best advice then you make a decision on that advice. You will select the bits that work for me and find ways around other things.

With a similar sentiment, Farmer 6 exhibited control through his acceptance of his agronomist's advice, but he interpreted it according to his management objectives (choice) and need to own and be responsible for his decisions.

F-6: But that is something with an agronomist, we shouldn't rely on them. We are still managers and the agronomist gives you advice on your ideas or they can introduce new ideas, but they are not your manager...With all due respect to any agro[nomist] we are responsible for our stuff aren't we.

Autonomy, knowledge construction Farmer 14 was indicative of all farmers in our research who exhibited autonomy, at least when discussing weed and invertebrate management. Their autonomy was expressed through their selection of expertise, the value they gave it and its use to construct their own knowledge and inform their decisions.

Farmer 14 had been assessing the data and worth of soil moisture probes in his region and perceived they helped with his weed management by determining if soil moisture is sufficient for effective herbicide application. He critiqued his agronomist's approach to weeds generally but still sought his opinion on the moisture probes and did his own thinking. Thus, he acted as an autonomous agent, comparing competing knowledges, including his own, to help construct new knowledge and inform decision making.

F-14: The agro has to learn again. Instead of coming out here and trying to make us spend dollars...So we have to re-educate ourselves. That is why we need these [moisture] probes in the area to be working for us...But it is challenging and I am really opening my eyes up. You've got to do your own thinking.

The above analysis outlines the farmer perspective, but what about the agronomists? How did agronomists perceive their relationship with farmers and did this affect how they engaged with them, and the advice they gave?

Power and the agronomist While all agronomists in our research considered themselves as a source of expertise and they provided advice based on that expertise, they were definitive about their role as advisor not decision maker for the farmer. They also acknowledged that each farmer is different, noting differences in risk perception, values and personalities. This affected the nature of their relationship and the advice given.

Ag-S-7: Every farmer is different so you have to establish a different relationship with each person depending on A: the size of their farm; B: their personality [and] the way they want to farm.

So far, this view aligns well with the farmers' position that the agronomist is there to provide advice, not tell them what to do. But Ag-S-8 identified an apparent contradiction with his perception that some farmers deferred the burden of decision making and risk on to them.

Ag-S-8: I have guys [farmers] say to me, I do not worry about it, that is your job. Well no it is not...I am here to give you an opinion. I am not here to make your decisions for you.

Two agronomists implied that all farmers were like this. Ag-I-01 was the most forthright in this assumption reporting that farmers were effectively passive recipients of agronomists' advice, that farmers did not want to know or understand the problem, they just wanted the solution.

Ag-I-01: ...they [farmers] want the agro to tell them what to do. They do not want to understand what is going on, they just want to know what do I use in this paddock right now.

Farmers from this perspective appeared to subject their decision making to an authoritative agronomist. This implies these farmers were disempowered, which contradicts the farmers' evidence. However, further to Ag-S-8's comment above, he and other agronomists interviewed for this research noted that farmers' deference of risk and responsibility to the agronomist applied to only some of their farmer clients. Ag-S-8's other clients were more like those he describes below, and which more closely reflected those participating in this research.

Ag-S-8: They [farmers] are the guys you like dealing with because they are taking on board what you say and balancing it against, as you say, their own experiences and talking to others or reading. And that way, good decisions are made.

To unpack and understand this apparent contradiction in more depth required further interviews to focus on this issue. As Ag-S-8 suggested, it emerged that the farmers Ag-I-01 described indeed appeared to be a small minority. There was further contradiction when agronomists talked about their relationship with farmers and the way advice was prepared and given to them. Although agronomists said they were there to offer advice not make the decisions for farmers, the following agronomist comments suggest some considered their expertise gave them a form of authoritative power (see Gerth & Wright Mills 2009). There is also evidence that they managed their relationship with farmers from the perspective of Bartlett's instrumental discourse. This was evident among sales, independent and research agronomists.

For instance, ResAg-6 talked about weed management and herbicide resistance and implied it is their role as experts to teach farmers about their system and thus empower them, which is indicative of the instrumental discourse. He further implied that farmers lacked the ability to understand complex contexts such as their farm system, at least not without their help. You also got the sense that in some way, ResAg-6 was defining the farmer's system and how to manipulate it, though it was not definitive how much of this was the agronomist defining the system and how much it was him helping farmers define it for themselves.

ResAg-6: Unfortunately, this is a complex topic and you cannot just say these are the answers and if you try to say this to farmers, that it is complex, they just won't accept the answers. So what you need to do is empower them... it won't happen overnight, but empower them to progressively understand the dynamic system they are in and what they can do to manipulate that system to their advantage.

A further example is Ag-S-13 who used 'we' in the context of the agronomy company he worked for. His language suggested he perceived he had legitimate authority; he was dictating *to* rather than discussing *with* the farmers what needs to be done and perceived that this was what the farmer needed or desired. He (or his company) was giving the farmer the knowledge to be 'proactive'. Although Ag-S-13 did work out a paddock plan with the farmer, he implied that while farmers participated in this activity, it is the agronomist that defined the boundaries of the management plan and any farmer action.

Ag-S-13: We do out paddock plans in January and February with our clients and put a plan in place. OK this is a weedy paddock, what are we [agronomy company] going to grow there, what management techniques are we going to use, so that when it rains they [farmers] are on to it, they know what they are doing. They are not scratching their heads when it starts raining going what are we doing. So being proactive in how they manage their problems

In one sense, the agronomists tried to control or manage the knowledge. This is indicative of Bartlett's (2008) instrumental discourse. But when it comes to decisions about weeds and invertebrates, all farmers in our research exhibited autonomy, control, critical thinking and reflection. This affected how they interpreted and used the agronomist's advice.

The discourse about power and empowerment is not a binary one where a farmer, or anyone, will fit precisely into either a instrumental or intrinsic camp, nor can they be either empowered or disempowered. That is, as our data shows, the elements defining empowerment and their influence differed with farmers and context. Empowerment needs context and has many forms. Further, people are not empowered in all situations, but they can choose the circumstances where empowerment is important or necessary (Roberts & Coutts 2007). Within this conceptualisation of empowerment then, we argue that when it comes to constructing knowledge and making complex agronomic and farm management decisions such as those for weeds and invertebrates,

farmers are typically empowered. Certainly, for the farmers in our research it was never apparent that they were disempowered in these contexts.

Further, our data is indicative there exist between farmers and agronomists varied forms of the power-knowledge relationship. Some agronomists had a more intimate understanding of the farmer and attempted to facilitate farmers' construction of knowledge, in effect a co-construction of knowledge. Others were closer to the instrumental discourse where there existed between farmer and agronomist often incompatible objectives, interpretations and meaning to problems, risk and advice. Ultimately, though, most agronomists in this research were explicit in their need to understand their clients' perspectives and motivations, and adjusted their advice accordingly, though this did not necessarily exempt them from a perception that they had legitimate authority to manage and deliver knowledge. This perception was prevalent among a number of agronomists in our research, at least where weeds and invertebrates were concerned.

Conclusion: Realise the empowered farmer

The status of the empowered farmer was the keystone to nearly all the principal findings from our research (see Figure 2). Empowerment itself affected the dynamics of such relationships or networks. Farmers' agency, choice and autonomy affected the nature of the discourse, how they interpreted information, what meaning it had for them, and hence how knowledge was constructed and consequent decisions made. It affected how they perceived and managed risk and uncertainty. Conversely, it was the knowledge farmers constructed in those relations that helped facilitate and maintain their state of empowerment. Empowerment requires context, but those conducting extension need be cautious of engaging farmers with the objective to empower them. They may already be empowered.

Nettle et al. (2015) consider the empowered farmer as critical for RD&E. Without empowered farmers, most technology-push options fail (Nettle et al. 2015). Thus, if extension is to encourage farmer participation in research, and they should, then they need to acknowledge the potential for farmers to be empowered, farmers who will have control and agency, and who will analyse, critique and reflect on information. This means farmers will help define the problem and a project's boundaries and objectives. Extension therefore needs to create an environment within their farmer relationships to facilitate and support this. Dialogue will be a key tool.

Farmers' interconnected relationships were the crucible for knowledge construction. But if extension is to build effective relationships with farmers, rather than attempt to manage the knowledge, extension has to focus less on the knowledge it wishes to impart and more on understanding the people with whom it needs to engage, the dynamics of that relationship and those with whom it interconnects. Wood et al. (2014) made a similar argument. They said that rather than focus on attempts to theorise about new ways to develop specialist facilitation between experts and non-experts (where farmers are considered non-experts), the effort should focus on finding and understanding the existing farmer-facilitated knowledge networks and how they sustain agricultural innovation.

Thus, we need not only to understand how farmers learn, think and interpret knowledge, and then construct their own, but to enable and facilitate the empowered farmer to do so creatively. Our data indicates that the empowered farmer proactively seeks research knowledge to strengthen agency and control. This does not mean change will occur or decisions made, nor does it mean that the farmers' objectives, interpretation, knowledge and decisions that emerge from power-knowledge relations are sound or rational, but in an effective relation they are at least subject to arbitration, as are those of others in the relationship (see Dunn et al. 2000).

While the emphasis in this paper is on the importance of the farmer-agronomist relationship, the evidence is largely from the perspective of the farmer. Further research is needed to improve understanding of the agronomist's perspective and influence, and to understand the dynamics of the farmer-agronomist relationship. This should include how this relationship interacts with others within a farmer's interconnected network (see Woods et al. 2014).

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