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RISKY BUSINESS – GROWERS' PERCEPTIONS OF ORGANIC AND BIODYNAMIC FARMING IN THE TROPICS

Dr Breda McCarthy, James Cook University.

ABSTRACT

Organic and biodynamic farming has emerged as a growing, niche sector in the agricultural industry. Research into stakeholders' risk perceptions of organic and biodynamic farming is surprisingly scarce. This paper uses qualitative data from a series of 32 interviews with growers and key respondents to illuminate how risk is interpreted in the agricultural community. This study showed that despite the diversity of the sample, there was broad consensus on the risks facing organic farmers. However, risk perceptions seemed to vary depending on personal values and institutional trust. Some of these farmers lacked confidence in agricultural institutions, were strongly opposed to the use of chemicals in farming on health and environmental grounds and perceived risk differently from their counterparts in conventional agriculture.

Keywords: risk, organic farming, biodynamics, sustainable horticulture.

INTRODUCTION

Sustainable farming methods have emerged throughout the developed world as a response to the perceived negative effects of conventional agriculture. Agro-ecological farming uses ecological principles to guide the design and management of farming systems (Gliessman, 1990). It is characterised by crop rotations, polycultures (featuring many crop varieties), continuous cropping, use of trees (agroforestry) and the integration of animals (i.e. cattle, swine, poultry) into farming systems. The aim is to maximise the synergies between the farm and the ecosystem (Altieri, 1999); the farm resembles nature by conserving and recycling resources, requiring minimal external inputs and thus minimising waste and pollution (Altieri & Nicholls, 2012).

Organic farming is seen as an ideology or a holistic approach to farm management and is based on four key principles: the principle of health, ecology, fairness and care (IFOAM, 2014). A fundamental principle of organic farming is to minimise environmental impacts as much as possible (Hansen et al., 2001). The organic movement's resistance against genetically engineered food serves to distance them from established agribusiness and food supply systems (Flaten, Lien, Ebbesvik, Koesling & Valle, 2005). Biodynamic and organic farming are similar in that both methods are based on a holistic approach to nature and do not use artificial fertilisers or chemicals (Reganold, 1995). The main difference between organic and biodynamic farming is that biodynamic farmers add preparations to their soils, crops and composts. Homeopathic remedies, instead of vaccines, are encouraged in biodynamic farming. Biodynamics is based on metaphysical principles and it is believed that the moon and planets affect the soil and the farm (Reganold, 1995; Biodynamic Agriculture Australia, n.d). Taking care of the soil is one of the cornerstones of the biodynamic ideology (Kaltoft, 1991). In Australia, ~~however,~~ biodynamic and organic farmers remain in the minority (Paull, 2013). Table 1 outlines the key differences between conventional farming, ~~and~~ organic and biodynamic farming, such as application of

chemical fertilisers, use of genetically modified organisms, spraying of insecticides and herbicides and administration of antibiotics to animals.

Table 1: Key differences between conventional farming, ~~and~~ organic and biodynamic farming

Conventional	**Organic and biodynamic**
Application of chemical fertilizers to promote plant growth.	Application of natural fertilizers, such as manure or compost, to feed soil and plants.
No prohibition on the use of products or by-products that are derived from genetically modified organisms.	Organic and biodynamic p~~Organic p~~roduction prohibits the use of products or by-products that are derived from genetically modified organisms.
Spraying of insecticides to reduce pests and disease.	Use of beneficial insects and birds, mating disruption or traps to reduce pests and disease.
Use of herbicides to manage weeds.	Rotation of crops, tilling, hand-weeding or mulching to manage weeds.
Animals are given antibiotics, growth hormones and medications to prevent disease and spur growth.	Animals are given organic feed and allowed access to the outdoors. Preventive measures — such as rotational grazing, a balanced diet and clean housing — are used to help minimize disease. Antibiotics can be~~are~~ administered to animals in organic farming but withdrawal periods apply before meat can be sold. Homeopathic remedies, instead of vaccines, are encouraged in biodynamic farming and antibiotics are prohibited.

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Sources: Australian Certified Organic (https://aco.net.au/), the Biodynamic Association (~~a~~https://www.biodynamics.com) and the UK Soil Association (http://www.soilassociation.org/).

The objective of this paper is to explore the perceived risks associated with organic and biodynamic farming. Conversion to organic farming constitutes a complex system change and it implies a high risk (Padel, 2001). It is a learning process and implies uncertainties about labour requirements, weed and pest control, marketing conditions, environmental policy and production levels (de Buck, van Rijn, Roling & Wossink, 2001). Risk perceptions can range from seeing no risk at all to seeing high risk (Trujillo-Barrera, Pennings & Hofek, 2016). It is argued that since alternative farming systems appear to be highly exposed to risk, it is important to examine the types of risk management strategies adopted by growers (Tzouramani, Alexopoulos, Kostianis & Kazakopoulos, 2013).

The adoption of organic farming, including the values, motivations and demographic characteristics of organic farmers, has been studied extensively (Koutsoukos & Lakovidou, 2013; Lawrence, Lyons & Lockie, 1999; Lockie Lyons & Lawrence, 2000; Lyons & Lawrence, 1999). Organic farming is not simply following the standards set out by a certification agency;

for some, it involves avoiding monocultures, and for others, it involves adopting an ethic of environmental and social responsibility (Lawrence et al., 1999). However, risk perceptions have been largely overlooked in the literature, with a few exceptions (see Lockie et al., 2000; Toma & Mathijs, 2007; Trujillo-Barrera, Pennings & Hofek, 2016). Likewise, studies on biodynamic farming are scarce (Turinek, Grobelnik-Mlakar, Bavec & Bavec, 2009) and studies on the risk perceptions of biodynamic growers are not available, probably because biodynamic farming is a highly contested method of farming and has been dismissed as being unscientific (Kirschmann, 1994). This present study examines organic and biodynamic farming using the theoretical lens of risk perception. It is located in the discipline of strategic management and the purpose of this research is to discern the horticultural community's perceptions of the risks associated with farming sustainably.

LITERATURE REVIEW

There is an extensive literature on risk in the social sciences. Risk can be broadly defined as a chance of danger, damage, loss, injury or any other undesired consequences (Harland, Brenchley & Walker, 2003). Mitchell (1995, p. 116) defines risk as "…the probability of loss and the significance of that loss to the organisation or individual".

Perceived risk amongst individuals is often at odds with objective assessments of risk (Slovic, 1992). Perceptions of risk are socially constructed and transmitted, and differences in worldviews, personal experiences, experiential learning, trust in institutions, and other factors, can influence how individuals view risk and cause over- or under-estimation of risk (Slovic, 1999). In an increasingly globalised society, what Beck (1992) Giddens (1990) terms a 'risk society', people are increasingly dependent on abstract or expert systems to manage risk (Giddens, 1990). Trust in institutions has a significant influence on perceptions of large-scale risk (Freudenburg, 1993; Kahan, Jenkins-Smith & Braman, 2011). In the field of rural sociology, recent research has evoked personality in terms of farmers' capacity to deal with stress and risk factors in farming (Shrapnel & Davie, 2001). Some research (Guehlstorf, 2008) posits that farmers' acceptance of risks, such as GM technology, is a signal of their confidence towards institutions and acceptance of information from trusted sources. Research by Lockie (1997) found that although Australian farmers profess high levels of anxiety about using agricultural chemicals, their concerns are alleviated by institutions in the agri-business and agri-science area that promote intensification.

Studies of risk in agriculture are primarily located in the discipline of agricultural economics. This leads to a rather narrow focus on identifying general risk factors, such as pests and disease and price volatility (Aimin, 2010), along with risk management strategies such as consultancy and disease prevention (Flaten et al., 2005b). In relation to organic farming, ways of managing risk include crop rotations, learning networks, cooperatives (Hanson, Dismukes, Chambers, Greene, & Kremen, 2004) as well as liquidity (keeping cash in hand), controlling the costs of production, using insurance (Flaten et al, 2005a), producing at the lowest cost and seeking professional consultancy (Tzouramani, Alexopoulos, Kostianis & Kazakopoulos, 2013). A study by Trujillo-Barrera et al., (2016) found that risk perception has a negative effect on adoption of sustainable practices, particularly when one's livelihood is at stake. Studies have found that organic farmers are more risk prone than conventional farmers (Flaten et al., 2005b; Gardebroek, 2006) and risk-

averse farmers are less likely to convert to organic farming (Acs, Berentsen, Huirne & Van Asseldonk, 2009).

There are several limitations with the current literature on risk in agriculture. Firstly, the focus has been on conventional farming (see Flaten et al., 2005b for a review of literature). Secondly, there is a lack of academic research on this topic in an Australian context. Thirdly, risk has been studied from the rather narrow lens of agricultural economics, and studying risk from a socio-economic perspective is necessary in this field.

METHODS

Research questions and research methodology

This research attempts to discern the horticultural community's perceptions of the risks associated with farming sustainably. The research questions are as follows:

- What are the perceived risks present in organic and biodynamic farming?
- To what extent does trust, or lack of trust in institutions, explain variations in risk perceptions?

A qualitative research methodology was chosen since standard risk evaluations that emphasize quantitative techniques often fail to address all the concerns of the individual (Guehlstorf, 2008). Qualitative approaches may help generate theory (Bryman, 2004) and add depth and richness to the data (Rubin and Rubin, 2005). One of the most common methods used to generate data in qualitative research is an interview, and a series of semi-structured, depth interviews were conducted on a one-on-one basis with key respondents.

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Sample

The sampling units were conventional, organic and biodynamic farmers and agricultural professionals. A decision was made to interview conventional growers who were interested in organic farming, certified growers and growers who were transitioning to organic or biodynamic farming. The literature highlights the need to move beyond the conventional/organic binary (Sutherland, 2011; Campbell, Rosin, Hunt & Fairweather, 2012) and a diverse sample could generate interesting and divergent responses. Approximately, a third of the sample consisted of key informants (Tremblay, 1957). They were defined as agricultural professionals (such as extension officers, scientists, academics and members of natural resource management groups) who conduct research and/or provide advice to horticulturists. Given that agri-science institutions have the potential to shape growers' perceptions of risk, it was important to include them in the sample. Respondents were identified and recruited through desk research; the authors' professional networks; attendance at a trade conference (AUSVEG) and through snowball sampling (Dragan & Isaie-Maniu, 2012). Appendix 1 offers a profile of the respondents. As the table shows, there were 20 growers, broken down into seven (7) conventional growers, six (6) organic but not certified growers, four (4) certified organic growers and three (3) biodynamic growers of which one was certified. The list of approved certifying organisations from the

Department Of Agriculture, Fisheries and Forestry was used to verify whether the grower was certified organic (DAFF, n.d).

Respondents came from the Tablelands and surrounding areas in Northern Queensland. This region produces a diverse range of horticultural produce and has a growing reputation for organic and biodynamic produce (Advance Cairns, n.d; Tablelands Council, 2012). The study was restricted to horticulture since the vegetable growing industry makes an important contribution to regional economies in Australia (Valle, Caboche & Lubulwa, 2014) and furthermore, fruit and vegetables tend to have the largest market shares in the organic market (Dettman & Dimitri 2009).

Survey methods: depth interviews

Face-to-face interviews took place with growers on their farms in order to build trust and make it easier for the grower to participate in the interview. The duration of the interviews ranged from 50 minutes to one hour and 45 minutes. All the interviews were audio-taped and transcribed word for word. In keeping with interview conventions, the interviews included a set of 'grand tour' questions (McCracken, 1988). Participants were asked to talk about themselves, give reasons for becoming an organic/biodynamic farmer, express views on risk factors in farming in general, risk associated with their particular farming practices and their risk management strategies. Demographic data on the farmer and the farm was also gathered (see Appendix 1). The interviews with key respondents were conducted over the telephone to save time and money. The primary data collection phase started in March 2014 and finished in February 2016.

Analysis of data

Large amounts of data are normally produced during qualitative research and it is very difficult to analyse it (Patton, 2002). Furthermore, objectively identifying themes from vast amounts of text can be challenging. Being self-aware of one's own values and assumptions, looking for contradictory data and being open to alternative interpretations, is critical (Ogden, 2008). The authors followed the coding process outlined by Miles & Huberman (1994). Codes are tags, or labels, which are assigned to whole documents or parts of documents. Kvale (1996) describes this process as one of determining the natural 'meaning units' in the text. The codes were developed using a combination of inductive (from the ground up) and deductive (theory-based) approaches. Once each individual text was coded, the texts were systemically analysed for themes. As Braun & Clarke (2006, p. 82) suggest, a "theme captures something important about the data in relation to the research question, and represents some level of patterned response or meaning within the data set". However, particular care was taken to avoid prejudging the themes. Within-case analysis and cross-case analysis took place (Miles & Huberman, 1994). Frequency analysis was conducted with the aid of Leximancer software. As Miles & Huberman note, the qualitative researcher who does not use software will be hindered in comparison with those who do. The advantages of using software include easy access to material and the ability to handle large amounts of data. Leximancer is a software tool that automatically analyses text documents to identify concepts, their importance and proximity (Leximacer, 2017). This software was used to organise the data and generate initial concepts. Using the themes derived by the software, the researcher then went back to engaging directly with the data in order to further

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explore, and interpret, the meanings of the text. Qualitative researchers are advised to 'get closer' to the data since this process enables more elaborate story-telling (Sotiriadou, Brouwers & Le, 2014). The quantification of qualitative data is reflected in the growing literature on the use of computer-assisted qualitative data analysis software (Crofts & Bisman 2010; Leech & Onwuegbuzie, 2011 Sotiriadou, Brouwers & Le 2014). Typically, software can be used to facilitate 'constant comparison' analysis. Software automatically identifies key words or key words in context (Fielding and Lee, 1998). A word count is a very common way of quantifying qualitative data. As Miles and Huberman (1994) note, there are at least three reasons for counting in qualitative data analysis: (a) to identify patterns more easily, (b) to verify a hypothesis, and (c) to maintain analytic integrity. In this case, a frequency count of key words and phrases in relation to risk was conducted to understand differences between participants. Some commentators (Harwood and Garry, 2003) argue that frequency counts and rankings produced by content analysis are a 'soft' form of quantitative research. While this is a justifiable argument, frequencies nevertheless provide an indication of the importance of elements in text (Breton & Côte, 2006).

FINDINGS

The following section discusses risk factors and key themes arising from the data.

Risk factors

Eight major risk factors were identified which are summarised in Table 2. These risks were as follows: health and environmental; change and lack of knowledge; financial; yields; certification; market; supply chain and social. Nearly all of respondents commented on the adverse consequences of using chemicals – health risks, damage to soil, wildlife, water pollution and 'run-off'. The second type of risk faced by growers was termed 'change and lack of knowledge', meaning that conversion to organic farming necessitated profound changes in farming practices. Most respondents spoke about financial risk, including high debt levels, low margins and being a price-taker. The risk of poor yields due to pest damage and disease was emphasised. Several respondents spoke about the risks of having (and not having) certified organic status. A surprising number of growers were not certified, but still farmed by organic principles. The non-certified organic growers gave several reasons why they did not obtain certification or had let it lapse, such as costs, paperwork, the rigidity of the system or lack of need. Customer/market risk was an issue for some respondents and the organic food market was seen as niche and non-local, and it was felt there was a limit to the price that Australian consumers would pay for organic produce. Supply chain risk was interlinked with financial risk. Growers had to deal with the risk of late payment from agents, the risk of agents going bankrupt and some were concerned about exploitation by intermediaries and not getting a fair price for their produce. The last type of risk was termed 'family and social risk'. Some respondents mentioned negative social attitudes and family resistance to organic farming. There was some evidence of inter-generational conflict where parents (the father in particular) were reluctant to agree with a conversion to organic farming.

Table 2: Perceived risks associated with horticulture

Risk factor	Description	**Frequency of responses**
Health and Environmental	Adverse health and environmental risks associated with the use of agricultural chemicals	25
	Positive or neutral view with regard to chemicals	7
Change and Lack of Knowledge	Knowledge-intensive, complex, time consuming, learning by trial-and-error	26
	Lack of support/extension services, move to 'paid' 'for profit' services/private consultant	13
	Conservative nature of farmers, agronomists and industry associations – no desire to take risks.	13
	Lack of knowledge on how to reduce dependence on inputs, such as chemicals and artificial fertiliser (used to add nutrients to soil and promote plant growth) and improve soil health	10
	Lack of research and development	9
	Lack of farm trials, farmers not permitted to collect their own data.	5
	Wrong priorities or short-term focus of industry associations	4
Financial	High costs: labour, insurance, energy and freight	21
	Financial stress due to low profit or high-debt levels; pressure to cut costs, 'get big or get out' of farming	17
	Price-takers - price for commodities driven by supply and demand; no contracts and no certainty over prices.	16
Yields	Requirement for blemish-free food/importance of cosmetic appearance	14
	Potential for lower yields / risk of crop failure with adoption of organic farming methods	11
	Strong focus on increasing productivity to detriment of sustainability	9
Compliance/ Certification	Ambivalence towards certification schemes – too dogmatic or not strict enough, not innovative enough	14
	Costs of accreditation/compliance costs	12
	A long conversion period resulting in reduced yields and lower financial returns	8
	Accreditation companies not doing enough	5
Customer/ Market	Consumers are price sensitive; unwilling to pay premium prices for organic food	13
	Niche market for organics, but growing	12
	Distance from large population centres which increases freight costs but market access is critical given large amounts of produce	8
	Lack of a food culture, low interest in healthy, nutritious food, disconnect from nature. Cheap food relative to current income levels	5

	Competition from cheap organic imports, or certified organic products having the USDA label with less stringent regulations	2
Supply Chain	Lack of power in the supply chain	13
	Power of agro-chemical industry and disempowerment of farmers	11
	High cost of certified organic (biological) inputs and lack of local availability	4
Family and Social	Lack of family support for conversion to organics	4
	Stereotypical views of organic farming	4

Personal values, ethics, environmental concern, distrust of institutions.

The organic and biodynamic group of farmers were strongly opposed to the use of chemicals. However, their perception of the market and financial risks associated with organic farming was quite low. They appeared to have a different world-view from the conventional growers. They felt that going organic would allow them to reduce costs and gain price premiums.

Personal health concerns – the risk of getting cancer from applying chemicals – was widely mentioned by the organic growers as a reason for engaging in organic farming. Environmental concerns – the risk of chemicals damaging the soil, water quality and wildlife – were also mentioned frequently in the interviews. Some resented the spraying of chemicals by neighbouring farms and disliked the smell of chemicals. They were inclined to use pejorative terms such as 'chemical farming' and 'tractor farming' to describe conventional farming, claiming that conventional farmers did not want to get off the tractor to weed or observe what was happening in the field. One grower spoke about the pesticide treadmill and the need for conventional farmers to use more and more chemicals each year due to destroying the soil with chemicals. It was believed that chemicals were a "quick fix" or short-term solution. In the longer-term, some respondents felt that chemical use would damage the soil, prevent the growth of particular crops or else prevent sale of produce due to the presence of residual chemicals.

Hence, the organic/biodynamic approach to farming demanded innovation in terms of seeking alternatives to chemicals. It was the antithesis of chemical farming with its focus on building up soil fertility, moving away from a monoculture, development of one's own inputs rather than buying them in from the outside and the use of biodynamic preparations. As for weeds, organic growers did not see weeds as a major problem. The biodynamic group tended to have a diverse enterprise mix and had various crops, livestock and poultry, which they felt made the farm more resilient, self-sustaining and holistic. All of these cultural practices helped minimise the risks associated with chemical-free farming. In the words of one respondent, it took time for the soil to improve but the rewards in the long-term were significant:

> "It takes time to improve your soil - it takes time to get organic matter - it takes time to build soil, the microbes; that are going to work for you…So what we are trying to do is to build up soil health, microbiology…if you use Round-Up it knocks them on the head! What we are trying to do is to build up the humus in the soil - the nutrients can attach to that and build up the soil. Before, putting on synthetic fertiliser and chemicals, it was dirt,

> it wasn't even soil. It was just something to hold the chemical inputs until they got washed out into the reef and wetlands."

One respondent spoke with some despair about the current farming model:

> "The big operators look profitable now, but that's because they are burning up ecological capital, biological capital and social capital – and that doesn't come through. It's just like the coal industry – burning up fossil capital and causing a lot of damage. That's a primary part of my thinking…."

The organic/biodynamic group of respondents appeared to be searching for innovative solutions to problems. They saw conversion to organic or biodynamic farming as being a way of securing the future of the farm, regenerating the land, improving land values in the long-term, growing "nutrient-dense" food and safeguarding one's health. They spoke a lot about environmental stewardship and conservation issues.

Many respondents showed a deep distrust of the "chemical industry" and agricultural associations and agronomists, that accepted, or promoted, the use of artificial fertilisers and chemicals in farming. Vested interests and the power of the agro-chemical sector were put forward as a barrier to the transition to more regenerative forms of agriculture. It was stated that conventional growers were "locked in" to a cycle of using artificial inputs.

Use of social networks, farmer self-empowerment

Several respondents believed that the risks associated with organic farming were reduced by participation in networks. The community of bio-dynamic growers, in particular, appeared to be part of a close network and they were quite positive and enthusiastic about some workshops and private consultants in the area. Government advisory services for organic farming were seen as inadequate, hence growers had to proactive in terms of gaining knowledge and availing of specialised expertise. They seemed to have embraced a 'self-help' approach in the absence of government support. These new networks replaced conventional sources of information, such as the agronomists, agents selling conventional inputs and horticultural (industry) associations. Learning from one's peers was very helpful in reducing risks. One respondent remarked that networks were critical in helping farmers make the transition to regenerative agriculture; it was "very powerful" when farmers talked to other farmers and this provided them with "a safety net and the confidence to move forward". Several respondents spoke about the need for field trials, farm visits and research and development in order to demonstrate the outcomes associated with organic farming and inspire growers. Several growers were interested in learning about organic farming practices in other parts of the world, such as Latin America, Germany, Bhutan and Nepal.

Discussion and conclusion

The purpose of this study was to explore how risk is perceived by a niche sector in the agricultural community.

The research revealed that there were many types of risk in relation to organic and biodynamic farming. These risks are largely uncontroversial. They support the literature on organic farming and farming in general (Aimin, 2010; Flaten et al., 2005b; Hanson et al., 2004; Kimura & Antón, 2011). It is clear, despite the risks associated with farming organically, growers are adamant that artificial chemicals should be eliminated from farming. The more specific questions for this paper are as follows: What does this tell us about risk perceptions? What does it tell us about trust in mainstream institutions? Sovic (2009) states that the perception of risk is a subjective process. Risk is experienced and interpreted by individuals in a socio-cultural context, i.e., the same objective risk – such as health risks due to use of chemicals or yield risks due to non-use of chemicals – can be perceived in many different ways. As outlined in the paper, risk is everywhere in farming. However, risk involves far more than the straightforward risk of pests, financial loss and so on. How farmers approach farming and think about risk speaks a great deal about who they are and what personal values they hold. This study suggests that understanding risk is fundamental to understanding the expression of farmer agency or empowerment. Human agency may be understood as free will and the capacity to exercise creative control over one's thoughts and actions, which is, however, subject to social influences (McGettigan, 2003). Our study suggests that some farmers lack confidence in institutions, such as agronomists, horticultural associations and state bodies. They reject the mainstream view that chemical usage is a not a problem and this motivates them to take action and solve problems in unconventional ways. As Morgan & Murdock (2000) note, organic farming has the potential to redistribute knowledge, power and agency to producers. This research supports other studies that posit an individual's perception of risk is a signal of their confidence, or lack of confidence, toward their political institutions (Giddens, 1990). The notion of farmer empowerment supports the marginalisation thesis, which states that the marginalised recognise the economic and political context of their struggle. Farmers who get involved in organic farming, or direct marketing, unwittingly epitomise the goals of political ecology, by challenging the dominant agricultural methods of production and marketing (Fielke & Bardsley, 2014).

Our findings are in harmony with a number of other studies. Research in the US has found that aversion to chemicals is a motivation for farming organically (Hanson et al., 2004); several case studies on pioneers in organic farming lend support to this finding (SARE, 2001; Thrupp. 2002). Studies on conventional farmers show they trust institutional guidelines on chemicals (Lockie, 1997), but not the organic growers. Our study showed that the decision to engage in organic/biodynamic farming was strongly influenced by the personal values of the grower. Campbell et al., (2012) found that organic farmers tend to attach more weight to environmental values than other groups of farmers. Kuminoff & Wossink (2010) conclude that conventional farmers are motivated by profitability, not ideology, particularly when one's livelihood is at stake.

This study suggests that access to networks helps reduce the perceived risks associated with organic and biodynamic farming. In the literature, it is recognised that sustainable farming methods are knowledge-intensive and transitions demand strong linkages between stakeholders, farmers and advisors (Hochman et al., 2013; Lamine, 2011). Some research suggests that the organic conversion process demands a radical shift in thinking and the 'forgetting' of much of the knowledge acquired in intensive production (Morgan & Murdock, 2000). Studies show that social networks are critical to the practice of sustainable agriculture (Campbell et al., 2012;

Manson, Jordan, Nelson & Brummel, 2014), and, it might be added, in helping organic and biodynamic farmers develop risk management strategies. The highly interactive nature of decision making may mean that farmers who have concerns about their farming practices will be inspired by their peers.

~~To summarise, risk is a perception, and the construction of risk in organic farming reflects the farmers' personal values, influence of social networks and farmer agency. This study has limitations that motivate further research. The sample size is small, so caution is needed when generalising its outcomes.~~ From a policy perspective, the needs and priorities of organic farmers appear to centre on soil management techniques and this suggests areas of focus for private consultants and industry associations. As Zikeli, Rembiałkowska, Załęcka & Badowski (2014, p. 104) state, "…organic farming research is scarce and currently declining, special extension services for organic farmers are often missing, and the positive environmental externalities of organic farming are not taken into account. Consequently, these conditions are slowing the development of the Australian organic sector". In terms of policy implications, this study shows that ~~Furthermore,~~ the movement of some growers away from certification may be of concern to the certified organic associations and they may need to consider how retention rates could be improved. However, t~~T~~his study has limitations that motivate further research. The sample size is small, so caution is needed when generalising its outcomes.

In conclusion, sustainable farming methods have emerged in Australia, and around the world, in response to the perceived negative effects of conventional agriculture. Organic and biodynamic farming is seen as an ideology or a holistic approach to farm management. However, conversion to these types of farming ~~To summarise,~~ entails r~~r~~isk, which is likely to have a negative effect on the adoption of more sustainable practices. The purpose of this research was to discern the horticultural community's perceptions of risk and the risk management strategies adopted by farmers. The findings show that risk is a perception, and the construction of risk ~~k in organic farming~~ reflects the farmers' personal values, influence of social networks and farmer agency.

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Appendix 1: List of Respondents

No.	Respondent	Type	Description of farm/organisation
1	Grower	Conventional grower	Black pepper, 2 hectares.
2	Grower	Conventional grower	Tropical fruits, 89 hectares.
3	Landcare	Regional Land Care Facilitator	Aim is to support Landcare and production groups to adopt sustainable farm and land management practices and to protect Australia's landscape.
4	Horticulture Innovation Australia	Scientist	A not-for-profit, grower-owned Research and Development Corporation (RDC) for Australia's horticulture industry.
5	GrowCom	Communications Officer	Growcom is a not-for-profit organisation that provides training and services to the Queensland horticulture industry.
6	Farm Extension Officer	Advisor	Technical support service for farmers administered by the Department of Agriculture, Forestry and Fisheries (DAFF).
7	Reef Catchments	CEO	Mission is to work collaboratively with the community to improve the condition of the region's natural resources.
8	IGA	Manager	A supermarket in Australia.
9	University	Professor of Agricultural Science	Regional University.
10	Landcare	Director	A not-for-profit organisation responsible for raising awareness and funding for the Landcare movement to support its role in restoring the productivity and value of Australia's natural environment.
11	Grower	Organic, not certified organic	Vanilla, 5 hectares.
12	Grower	Organic, not certified organic, proprietary eco-label	Bananas, 47 hectares.
13	Grower	Certified organic (Australian Certified Organic, formerly BFA)	Bananas and other vegetables. 54 hectares.
14	RegenAG	Co-Founding Director	Enterprise committed to helping regenerate Australia's farms, soils, communities and on-farm livelihoods via the provision of education and training opportunities.

15	RegenAg	Co-Founding Director	See above.
16	Grower	Conventional	Bananas, avocados, coffee and sugarcane. 70 plus hectares.
17	Grower	Conventional	Business partner in above farm.
18	Terrain NRM	Staff member	A community-based, not-for-profit organisation supporting natural resource management (NRM) in the Wet Tropics.
19	Grower	Conventional	Potatoes. 70 plus hectares.
20	Grower	Certified organic, (AusQual Organic)	Pineapple and pumpkin (certified organic), and sugar cane (conventional). 70 plus hectares with 5 hectares devoted to organic.
21	Grower	Organic, not certified organic	Value-added juice product, 600 trees.
22	Grower	Certified Organic (NASSA)	Bananas, 72 hectares.
23	Grower	Certified Organic (Australian	Zucchini (or courgettes), pumpkins, snowpeas, sweetcorn, tomatoes, cucumbers. Three farms
24	Grower	Certified Organic/BFA) Organic, not certified organic	in FNQ and NSW covering 600 acres. Small, local, a range of vegetables such as zucchini, tomatoes, pumpkins.
25	Grower	Organic, not certified	70 hectares, native foods such as Davidsons plum, lemon aspen, tamarind and Syzygium spp (lilly pillies); value-added products such as pastes, pickles and chutneys.
26	Grower	Conventional	Zucchini. 100 hectares.
27	Grower	Biodynamic, not certified.	Animals – cows, sheep. Vegetables such as broccoli, snow peas, cabbage, lettuce. 200 acres.
28	Grower	Biodynamic, not certified	Exotic fruit, 120 hectares with 16,000 fruiting trees.
29	Grower	Organic, formerly certified organic	16 hectares, tropical fruit such as mangosteen, rambutang.
30	Grower	Conventional	75 hectares. Limes.
31	Tablelands Biodynamic & Organic Farmers Co-op	Respondent	Farmers' Co-Operative
32	Grower	Biodynamic, certified	Corn, 70 hectares.