"The influence of values and attitudes towards family, land, water, community, lifestyle and profit on farmers' behaviour"

by

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THESIS DEDICATION

This thesis is dedicated to my father, Cyril Kuehne.

For thirty years I worked with my father, twenty-five of those as a wheat-sheep farmer at Coonalpyn in South Australia. My father is a fourth generation farmer. His great-grandfather migrated from Germany with the Lutheran migrations of 1853 and settled in the Barossa Valley before moving on to the farmland of Horsham, Victoria, where my father began his life and his career as a farmer.

True to the prevailing view of German Lutheran farmers, my father worked hard. During my childhood he cleared a thousand acres of mallee scrubland. When I started to work with him on the farm we further developed this land, removing the scattered limestone and the roots of the mallees and putting in fences and roads. We made it into a farm.

When the time came for me to sell the farm, that we had both lived and worked on, my father supported the decision. For him this must have been very difficult. He didn't need to do this, but he recognised that there was another life I sought different from the struggle of a small family farm. He saw that I was capable of, and wishing for, a different life.

He has enthusiastically supported me through my University studies and was one of the first to encourage me to consider undertaking PhD studies.

More than just idly curious, he is familiar with and interested in my research. He was interested enough to want to spend time with me while I was conducting personal interviews with the irrigators of the Namoi Valley. We spent many hours travelling between Armidale, Tamworth, Quirindi, Gunnedah, Narrabri and Wee Waa. We shared coffees in all of these places and conversations in the time between.

He has always been willing to help me celebrate even my smallest milestones or achievement with a coffee or a beer.

I cannot express how thankful I am that he has made this possible.

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Acronyms and Abbreviations

ATB – Across-the-board reductions
The Cap – The Murray Darling Basin Cap on extractions
CoAG – Council of Australian Governments
DIPNR – Department of Infrastructure Planning and Natural Resources
HOE – History of extraction
HOU – History of use (replaced by history of extraction)
KMO – Kaiser-Meyer-Olkin measure of sampling adequacy
MDB – Murray Darling Basin
MDBC – Murray Darling Basin Commission
ML – Megalitre
NCC – National Competition Council
NCP – National Competition Policy
NSW – New South Wales
NWI – National Water Initiative
WBDG – Web based discussion group
WSP – Water sharing plan
WUE – Water use efficiency
SPSS – Statistical Package for the Social Sciences

Abstract

Policy makers and others have often appeared to treat farmers as though they are primarily motivated by profit-maximisation, but this is often not their sole motivation. Failing to recognise that they are motivated by a wider range of influences other than just profit-maximisation can lead to the development of policies and programs with unintended and undesired consequences.

Researchers have identified influences other than profit-maximisation, but because of the complexity of farmers' behaviour their work has often, necessarily, been limited in scope. Past work, while useful, often only partially explains farmers' behaviour.

This thesis builds on past work and seeks to add another dimension to the existing understanding of farmers' management behaviour. It does this by exploring whether a useful typology of farmers can be constructed by classifying the values and attitudes that they hold with regard to family, land, water, community and lifestyle as well as profit, and how this might explain or even predict their management behaviour.

The context of the research is the implementation of the New South Wales Water Sharing Plans (WSP) that were developed to ensure sustainable groundwater extraction for the groundwater irrigators of the Namoi Valley.

An exploratory mail-out survey of 151 groundwater licence holders gathered personal, business and property specific information, and also asked open-ended questions to identify planned management responses prior to the implementation of the WSPs. Quantitative analysis of the mail-out survey was conducted using descriptive statistics and multivariate analyses; qualitative analysis was done by using a simple cut and sort technique.

Seventeen personal interviews were conducted to discuss issues identified from the mail-out survey regarding the implementation of the WSPs and to begin to uncover farmers' values. They were analysed simply by coding direct to the transcript.

A telephone survey was administered to 212 ground water licence holders to identify the value constructs that they held regarding, family, land, water, community, lifestyle and profit, and explore the relationship between the value constructs and irrigators' management decisions. The survey instrument was designed to gather information from respondents about their: 1) business, property and personal characteristics; 2) ratings on fifty value and attitude statements regarding family, land, water, community, lifestyle and profit; 3) management actions and intentions with regard to land and water.

Factor analysis was applied to the value and attitude statements from the telephone survey to reveal the underlying value constructs among licence holders. Three value constructs which were described are:

1. *Succession*; combining strong values toward family, land and profit

2. *Caretaking*; combining strong values toward land, lifestyle and community

3. *Commerce*; combining strong values toward profit.

Cross tabulation and chi-square tests were used to examine and describe the relationship between the value constructs and property and personal characteristics, and management responses.

These analyses were useful for uncovering the underlying values and the interaction between them. Because mutual exclusivity does not exist with the factor analysis results, cluster analysis was chosen to develop the groups of the final typology. Cross tabulation and chi-square tests were used to examine the relationship between the cluster groups and value and attitude statements, property and personal characteristics and management responses. The three cluster groups forming the typology are:

1. *Traditionals*; who are family oriented and make decisions that are moderated by their desire to provide a viable business for their family successors; but are not strongly motivated by profit.

2. *Investors*; who are profit oriented and attracted to financial opportunities and not by concerns for family succession.

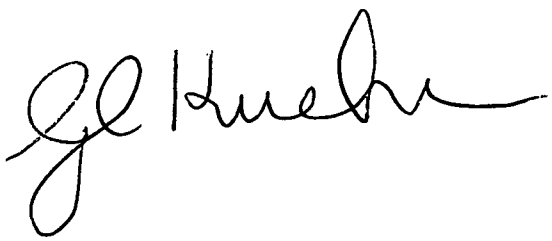
3. *Expanders*; who are motivated by family succession as well as their goals of profit.

The value of this study is that it shows that the values that farmers hold regarding family, land, water, community, lifestyle and profit, do influence their management behaviour.

Declaration

I declare that this thesis does not incorporate without acknowledgment any material previously submitted for a degree or diploma in any university; and that to the best of my knowledge it does not contain any materials previously published or written by another person except where due reference is made in the text.

Geoff Kuehne
[Signature]



22 July 09
[date]

Previously Published Material

The following papers have been published or presented, and have material in common with this thesis. I am the principal author of these papers and have contributed the majority of the intellectual input and writing. They were all produced under supervision during the period of candidature -

Refereed Journal Articles:

Kuehne, G. and Bjornlund, H. (2006): "Frustration, confusion and uncertainty: qualitative responses from Namoi Valley irrigators" *Water* 33(3) pp. 78-82 (the Journal of the Australian Water Association)

Kuehne, G. Bjornlund, H. and Cheers, B. (2007): "There's more than one type of farmer: acknowledging farmers' diversity – an Australian perspective" *International Journal of Interdisciplinary Social Sciences* 2(2) pp.179-186

Kuehne, G. Bjornlund, H. (2008): "The influence of farmers' attitudes and objectives on their decision making" *Hydrological Research Letters* (2) pp. 27-31

Kuehne, G. Bjornlund, H. (2008): "Time and timing: exploring farmers' reluctance to use web-based discussion groups" *International Journal of Interdisciplinary Social Sciences* 3(5) pp. 153-160

Kuehne, G. Bjornlund, H. and Cheers, B. (2008): "Identifying common traits among Australian irrigators using cluster analysis" *Water Science and Technology* 58(3) pp. 587-595

Book Chapters:

Kuehne, G. and Bjornlund, H. (2006): "'Custodians' or 'Investors' – classifying irrigators in Australia's Namoi Valley". In Lorenzini, G. and Brebbia, C.A. eds. *Sustainable Irrigation Management, Technologies and Policies*. Southampton: WITPress, 225-236.

Refereed Conference papers:

Kuehne, G. and Bjornlund, H. (2006): "Exploring Farmers' Attitudes and Behaviours in Australia's Namoi Valley" *Proceedings from the 3rd conference of the Asia Pacific Association of Hydrology and Water Resources,* Bangkok, 16-18 October.

Kuehne, G. and Bjornlund, H. (2006): "Identifying Farmers' Management Responses to Reduced Water Access – Lessons from the Namoi Valley" *Proceedings from conference of the South Australian Branch of the Australian Water Association*, Victor Harbor, July.

Kuehne, G. and Bjornlund, H. (2007): "One size does not fit all – Recognising heterogeneity in Australian farmers" *Proceedings from USCID's Fourth International Conference on Irrigation and Drainage*, Sacramento, California, 3-6 October.

Kuehne, G. Bjornlund, H. Cheers, B. (2008): "Developing Irrigator Types from Clustered Values" *Proceedings from IWA World Water Congress and Exhibition,* Vienna, Austria, 7-12 September.

Kuehne, G. Bjornlund, H. Cheers, B. (2008): "The contribution of Values and Attitudes to Irrigators Decision Making" *Proceedings from Water Down Under 2008*, Adelaide, Australia, 15-17 April.

Kuehne, G. Bjornlund, H. Cheers, B. (2008): "Classifying, Clustering & Clumping; defining groups of irrigators in Australia's Namoi Valley" *Proceedings from IWRA World Water Congress*, Montpellier, France, 1-5 September.

Poster presentations:

Kuehne, G. and Bjornlund, H. (2006): "'Custodians'or 'Investors' – classifying irrigators in Australia's Namoi Valley". Poster presented at the 3rd International Symposium on Integrated Water Resources Management in Bochum, Germany, September (Recipient of the most outstanding poster award).

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CHAPTER ONE

1 Introduction

The problem

During the last century the population of the world has grown from 1.65 billion to 6 billion. It has doubled since 1960 when it was 3 billion and is expected to continue expanding until it reaches around 9.1 billion in about 2050 (United Nations Department of Economic and Social Affairs/Population Division 2005). This continued growth in population, combined with an increasing expectation of a higher standard of living among much of the global population, is now putting the world's natural resources under increasingly serious pressure.

In Australia, this pressure on natural resources, especially water, is a recent phenomenon. Up until around 1970, supply exceeded demand (Freebairn 2005), so much so that the price of water was almost zero. But, since then, water resource management has changed from demand-side management to supply-side management as "many of the river systems in Australia are over-allocated and degraded, suffering from the excessive demands brought about by their proximity to our agricultural and residential zones." (Rural and Regional Affairs and Transport References Committee 2006, Sec 1.66). The overuse of water is not confined to surface water but is also demonstrated by the 30% of groundwater systems within Australia that are either approaching or are beyond sustainable use (Boyd & Brumley 2004, p. viii; Beeton et al. 2006).

Throughout Australia individual irrigators have become prosperous from the use of the water but the wider community has borne the cost in the form of a damaged and exploited resource. Although just about all early irrigation settlements in Australia ended in financial collapse, irrigation prevailed due to a strong political will, and a determination to settle parts of Australia. This was done despite concerns raised by economists. In most of these instances farmers in Australia were encouraged to irrigate, the State Government establishing infrastructure and providing the water for free. The Namoi Valley is a little different. While the infrastructure and water were provided for free, and irrigation was encouraged by the State Government, it did not suffer the financial collapses of other irrigation areas. Irrigation prospered with irrigation communities sharing in the rewards.

The adoption of irrigation in Australia has caused damage to the environment such as declining groundwater reserves, rising water tables, increasing salinisation and the like.

Connel expands the list of water management issues in the Murray-Darling Basin to include:

> Acidification of soils, nutrient pollution, carbon depletion, changing patterns of rainfall, run-off and recharge, loss of native vegetation, threatened biodiversity, declining connectivity between floodplains and stream channels, changes to the seasonal pattern of flows, thermal pollution downstream of dams, Indigenous issues, degraded amenity, the social impacts of economic and environmental change, climate change and more (Connell 2007, p. 211).

Water markets for groundwater and surface water have been a central tenet of Australia's water reforms since being initiated by State and Federal Governments through the Council of Australian Governments (CoAG) reform process from 1992 onwards (CoAG 1992, 1994). Markets were expected to be of use in transferring water from low value broad-acre uses to higher value uses such as crop production, horticulture and dairying (CoAG 1994). The other component of the early water reforms was the introduction of the Murray-Darling Basin Cap (the Cap) in 1996, which limited extractions from the Basin to 1993-94 levels (Murray-Darling Basin Ministerial Council 1996). This was only a first step and was aimed at preventing the further growth of diversions. Because the data on sustainable levels of extraction were not yet available the implementation of the *Cap* was not designed to address the problem of returning extractions to sustainable levels. The role of markets and the need to secure sustainable environmental outcomes has since been further emphasized by the 'Living Murray' process and more recently with the two intergovernmental agreements: the National Water Initiative (CoAG 2004) and Addressing Water Over-allocation and Achieving Environmental Objectives in the Murray-Darling Basin (CoAG 2004). These policies are evident in the Namoi Valley in the form of the Water Sharing Plans (Department of Infrastructure Planning and Natural Resources 2004). Achieving sustainable use of the resource has required cuts to irrigators' entitlements in all but three of the twelve zones (Powell et al. 2003a), in the most extreme cases of ninety-four per cent. Because of the severity of reduction to water access, the implementation of this policy, even allowing for the potential adjustments likely to be achieved by water trading, will invariably involve at least some of the licence holders experiencing significant economic pain.

The potential for economic pain among the ground water licence holders within both the Namoi Valley and the other groundwater areas of New South Wales has been recognised

and acknowledged by the Federal and State Governments who have responded by developing the "Achieving Sustainable Groundwater Entitlements" (ASGE) structural adjustment package (McDonald 2006). Despite fifty-five million dollars of the package being directed towards the groundwater licence holders of the Namoi Valley, it is seen by the licence holders as a token gesture, that neither counters the economic effect on them or their communities. There was, however, a reason that irrigators would have preferred the payments described as compensation and that was to avoid the taxation that would be levied on structural adjustment payments (Parliament of NSW 2006). This was later remedied with the ruling that although the payments were structural adjustment they would not be treated as income (Australian Tax Office 2008). The National Water Initiative is silent on the issue of who is to carry the burden of the initial cut in entitlements, but is explicit in how the burden is shared in the case of further reduction due to increased knowledge or changing policy objectives. Entitlement holders are not eligible for compensation and are required to bear the risk of reductions arising from improved knowledge of sustainable extraction levels up until 2014, after which the risks are shared (CoAG 2004).

Irrigators who are faced with reductions in their long-term access to water have a number of possible management responses: buy more water; become more efficient with their water use; sell some or all of the rest of their water; change to dry land farming; sell the farm; or some combination of these. In recognition of the magnitude of the cuts in the most severely affected zones the reductions in water entitlements will be phased in over a number of years. This phased process, together with the support offered by the Achieving Sustainable Groundwater Entitlements package was designed to allow farmers time to adjust. Water markets are expected by policy makers to play an important role in facilitating and influencing this process of adjustment (Bjornlund 2005).

This thesis is concerned with how the values, attitudes and goals that farmers hold towards family, land, water, community and lifestyle, as well as profit, influence their behaviour in response to these adjustment policies. The study group were farmers from the Namoi Valley of Northern New South Wales. This research was conducted during a period of change as they responded to substantial reductions to their water entitlements.

This study has wider implications than the Namoi Valley, which are made evident by the Howard Government's release in January 2007 of the $12 billion "National plan for water

security" (Commonwealth of Australia 2007). This plan was superseded by the Rudd Government's $12.9 billion "Water for the future" plan in April 2008 (Wong 2008). The current plan involves an expenditure of $3.1billion for the purchase of entitlements from willing sellers.

The initial focus of this study was limited to the Namoi Valley groundwater irrigators and their responses to the WSPs. However, with the acceleration of the water reform process in Australia during the course of this study, the findings have increasingly clear implications and growing relevance for policy makers and professionals working with irrigators in other parts of the Murray-Darling Basin, and other parts of Australia.

A study of the influence of values other than those of profit-maximisation on irrigators' behaviour is needed so that their behaviour can be better understood and more readily predicted. On the basis of such knowledge policies and programs can be better targeted at the actual behaviours of irrigators. The audience for this research includes those who are developing policy or wishing to gain the participation of resource users and therefore require an understanding of how they might respond to policy changes. It also includes those seeking to understand why previous policies and actions may have failed. The intended audience includes government departments, advisory bodies, institutions, researchers and people working with, or attempting to influence irrigators, or farmers more generally. In addition, a study of the influences on irrigators' behaviour is needed because similar processes to those undertaken in the Namoi Valley will happen elsewhere with water, but also with other resources requiring similar reforms.

This study was conducted as a part of the Australian Research Council (ARC) Linkage grant "Water scarcity and rural social hardship—Can water markets help alleviate the problems?" To some extent the aims of the PhD have been determined by the need to satisfy the requirements of this grant, and the methodologies chosen for the research have been influenced by the available financial resources. The aim of the ARC project was to investigate irrigators' management responses to reductions in water entitlements and the socio-economic impact of such reductions.

This research needed to be done:

1. because it has not been done before. Studies using a single criterion can tend to highlight arbitrary distinctions between types (Gasson & Errington 1993), but

research such as this, which has six different criteria does not suffer from this problem.

2. because it adds to our understanding of the range of influences on farmers' behaviour. This is important because by improving the interactions betweens farmers and policymakers there should be less friction, confusion, uncertainty and losses of economic opportunities.

3. because we need to know more about the likelihood of irrigators actually using markets and better understand irrigators' management responses to the WSP.

Shucksmith and Herrmann describe the future research needed on this topic:

> [A]griculture is no longer a homogenous sphere and farmers' motives and priorities differ considerably. To comprehend their motives and diverse behaviours we need to gain an insight into farmers' own ways of seeing the world (Shucksmith & Herrmann 2001, p. 39).

Earlier, Kerridge (1978) suggested that further research into farmers' values should also gather data on family background, type of schooling received, stage in family life cycle, and their use of extension materials.

It is clear that farmers do not often solely base their management behaviour on profit maximization alone but that they take other influences into account as well. In a sense, they are making their decisions in order to maximize their utility from irrigation and that utility consists of many factors other than profits, such as family tradition and aspirations, culture, life style and community belonging. The prominence of these other non-profit-maximising influences is demonstrated by irrigators choosing not to embrace water markets, even when they can be expected to have positive financial benefits (Bjornlund 2004b).

Even if policymakers accept that farmers diverge from the neo-classical outcome they still need to develop a greater understanding and awareness of why and how farmers make the decisions the way they do. Koontz, for example, suggests that:

> [U]nderstanding the primary reasons motivating land owners to undertake activities is important, as it allows the creation of policy interventions to better affect behaviour (Koontz 2001, p.62).

Koontz also emphasises the importance of:

> looking beyond financial returns, as well as looking across diverse owners and activities. Clearly, more research is needed to further our understanding of what motivates different land owners considering different activities (Koontz 2001, p.62).

Lawrence (1994, p. 14) suggests that this research is also needed because "Virtually nothing is known about the socio-cultural determinants of farm business decision-making. Few resources are directed at a better understanding (of) the social bases of farm life". The other problem is that, "[i]n large part the literature on business decision making is dominated by rationalist perspectives and focused on sets of rules that people should follow rather than how decisions are actually made" (Gallimore, Hansz & Gray 2000, p. 602).

The problem with assuming that farmers will make profit maximising decisions rather than attempting to understand the non-economic influences on their management behaviour is understood by the Namoi Valley irrigators who have clearly expressed concerns over the:

> [A]ssumptions about the decision making behaviour of farmers ...assuming farmers are profit maximising... lack of differentiation between farmers especially with respect to their levels of knowledge and expertise, and their financial ability to invest and change production (Letcher & Jakeman 2003, p. 83).

Others describe how farmers have a more complex set of considerations that incorporates family goals in their management behaviour:

> The argument here is not that family farms do not behave in a business orientated way but that their logic is more complex. Rational decisions are made within a framework that embraces intrinsic values in farm work, the values of autonomy and family continuity as well as maximising profitability (Gasson & Errington 1993, p. 112).

Even farmers operating in very homogenous circumstances can demonstrate quite heterogeneous characteristics (Gomez-Limon & Riesgo 2004; Vandermersch 2006). This diversity is what van der Ploeg (1994, p. 7) describes as the "overwhelming and often confusing heterogeneity of agriculture". A greater understanding of some of the

influences on the behaviour of farmers will add to the effectiveness of government policy formulation and enhance the effectiveness of the implementation of policies that are, in turn, better suited to their respective targets.

Existing knowledge

Perhaps understandably it is often economists (Savenije & van der Zaag 2002) who suggest that farmers are solely motivated by profit maximising. Non-economists also support the idea that farmers are motivated by profit-maximising but they are also most likely to refute the notion that profit-maximising is the sole goal of farmers (Dale & Dixon 1998; Vandermersch 2006).

The study of farmers' non-profit-maximising motivations is not new (for an overview see table 1). Ashby (1926) states "if the desire for profit or the greatest possible material gain for the least possible effort is not the only or the chief motive actuating farmers it is desirable to enquire what other impulses may be". Taylor (1944) found that the existing literature did not reveal the real attitudes of farmers. Writing during the Second World War (and in doing so, illustrating the importance of timing), he suggested that the decisions that farmers made were influenced by the things that they valued, which he proposed were homes, morals and national security. Gasson (1973) revived interest in the topic in more recent times, by describing an ordering process where farmers choose between instrumental, intrinsic and social goals; later adding personal goals to these (Gasson & Errington 1993).

Table 1: The evolving literature regarding farmers' non-profit-maximising values

Ashby (1926)	Among the first to identify influences other than profit-maximising.
Taylor (1944)	First tentative steps in trying to understand the motivations of farmers other than profit-maximising.
Gasson (1973)	Construction of the first typology of how farmers prioritise goals.
de Haan & van der Ploeg (1991)	Described the 'farming styles' approach.
Fairweather & Keating (1990)	Developed management styles according to farmers goals.
Salamon (1995)	Described the bipolar 'ideal types' of *Yeoman* and *Entrepreneur*.
Austin et al. (1996)	Suggest Salmons' *Yeoman* and *Entrepreneur* are not mutually exclusive. Farmers have more complexity than what can be described by dichotomous classification.
Howden et al. (1998)	Question van der Ploeg's conceptualisation of farming styles, (at least in an Australian context).
Willock et al. (1999a)	Suggest that farming variables, socio-economic and psychological factors influence farmers, with the most important influence being psychological.
Thompson (2002)	Use 'farming styles' to describe farmers' diversity.
Maybery et al. (2005)	Classify farmers into three groups according to their values for their landholdings: *Economic*, *Lifestyle* or *Conservation*.

Maybery et al. (2005) identified a gap in the knowledge, suggesting that future research should attempt to replicate the structure that they found and examine the overall construct validity of the instrument they had developed. The existing literature does not effectively address the combination of possible dimensions such as family, land, water, community and lifestyle, and how they might interact with profit. Nor does it allow for interaction between dimensions or the explication of the interrelationships between dimensions.

Emtage (2007) observes that effort is being made to measure landholders productive capabilities, but suggests that "the measurement of landholders' values is more contentious and less advanced". Emtage (2007) goes on to propose that further research should "investigate the optimal means of incorporating personality, attitudinal and cultural factors in models of NRM [natural resource management] behaviour" (Emtage 2007).

Focus of the thesis

This thesis fills the above mentioned gap in the literature by exploring the non-profit-maximising values held by farmers, specifically those relating to family, land, water, community and lifestyle as well as profit; and how they interact with each other and influence farmers' behaviour. The thesis does this by examining and analysing a group of farmers who are faced with making decisions about how to respond to reductions in their water entitlements. These reductions are associated with the introduction of the Water Sharing Plans (WSP) for the groundwater licence holders within the Namoi Valley of New South Wales.

Thesis aims

- Investigate and compare the influence of non-profit-maximising values and profit-maximising values on farmers' management behaviour.

- Construct a typology that illustrates how farmers' management behaviour differs according to the values that they hold.

Thesis questions

- Why does the influence of profit-maximization fail to adequately describe farmers' behaviour? What might provide a better alternative?

- Can farmers be categorized according to the way that the values that they hold towards family, profit, land, water and community influences their behaviour?

Argument of the thesis

The argument is that, "irrigators' behaviour is better predicted by considering the combination of values they hold toward family, land, water, community, lifestyle and profit, rather than the extent to which they are motivated by profit-maximisation alone". This thesis will enable us to better understand why farmers respond to public policy initiatives in the way that they do.

Outline of research methods

Research design

The research takes the widely used behavioural approach focusing on "the motives, values and attitudes that determine the decision making processes of individual farmers" (Morris & Potter 1995, p. 55). Defining the behavioural approach is difficult because it is "not based on any strictly defined methodology or theoretical school and papers that may be termed 'behavioural' emerge in a variety of disciplines, in particular geography, but also economics and sociology" (Burton 2004, p. 360). This behavioural approach has been criticised for taking an overly simplistic view of human behaviour, disregarding the complexity arising from the effects of the external and the structural impediments to action, and ignoring social and cultural influences. While the behavioural approach has been criticised it is appropriate for this research because the criticisms are only valid if the external and structural constraints are not acknowledged (Morris & Potter 1995; Burton 2004). As discussed in the section on Assumptions and Limitations of this thesis, this study accepts that these constraints are important and have therefore influenced this research.

The behavioural approach to conducting research with farmers has been defined as one that seeks to:

> (a)...understand the behaviour of individual decision-makers, usually the farmers or land managers directly responsible for the land, (b) focus on psychological constructs such as attitudes, values, and goals but also commonly gather additional relevant data on farm structure, economic situation, successional status, etc., and (c) employ largely quantitative methodologies, in particular psychometric scales such as Likert-type scaling procedures,

> for investigating psychological constructs. In general, such approaches view behaviour as a combination of motivational factors and structural/economic features that constrain, facilitate and, at the same time, reflect the motivational preferences of the farmer/farm family ... Using psychometric scaling techniques, researchers are able to gain a quantitative measure of non-economic factors that contribute to decision making (Burton 2004, p. 360).

This approach was chosen for the present research because of its compatibility with the research goals and its ability to provide answers to the research questions.

Methodology

The initial aim of the research was to explore the influences acting on farmers when they made their decisions in response to the water sharing plans. As knowledge was gained over the course of the study the research aim was modified to an investigation of the non-economic influences on farmers' behaviour, which was eventually further refined and is reflected in the thesis title "The influence of values and attitudes towards family, land, water, profitability and community on farmers' behaviour".

The sample frame was the contact list of groundwater licence holders provided by the then New South Wales Department of Infrastructure Planning and Natural Resources (DIPNR). The original 771 entries on the list were reduced to a population of 659 when multiple licenses in the same ownership had been consolidated into one record and licenses which had changes of ownership (and consequently becoming unable to be contacted) were removed. The sample frame consisted of the population of farm businesses with a groundwater license within the study area.

The research design was a multi-method approach that included a mail survey, personal interviews and a telephone survey. The 151 responses from the exploratory mail-out survey of groundwater licence holders gathered personal, business and property specific information. Open-ended questions aimed at identifying planned management responses prior to the implementation of the WSPs were also incorporated into the survey. Seventeen personal interviews were conducted to discuss issues identified from the mail-out survey regarding the implementation of the WSPs and to begin to uncover irrigators' values. A telephone survey was administered to 212 ground water licence holders to identify the value constructs that they held regarding, family, land, water, community,

lifestyle and profit, and explore the relationship between the value constructs and their management decisions.

The research involved three stages of data gathering:

- An exploratory self-completed questionnaire was mailed to those in the sample frame (659 groundwater licence holders of the Namoi Valley);

- Two visits were made to the region to discuss, through unstructured personal interviews, the proposed research with water authorities, farmers, community groups and business groups in the form of unstructured personal interviews. The intent of the seventeen interviews conducted during these two visits was to further develop an understanding of the problem presented by the restrictions to water access prescribed in the WSP. The interview aim was also to discover how the problem was experienced by farmers, and also to develop a broad understanding of the study area. The interviews were used to build on the issues identified in the mail-out survey;

- A telephone survey of 212 licence holders was conducted to gather demographic information, property and person specific information, as well as past management actions and future management intentions. Much of the survey consisted of a series of value and attitude statements that were designed to be rated on a five-point Likert scale.

This study achieves the research aim of "investigating and comparing the influence of non-profit-maximising values and profit-maximising values on farmers' management behaviour", by developing a set of value constructs that can be used to explain farmers' management behaviour.

It also achieves the research aim of constructing a typology that illustrates how farmers' management behaviour differs according to the values that they hold, by classifying them according to their values and attitudes towards the dimensions of land, water, family, profit, community and lifestyle.

Being multi-method it had the advantage of being able to use triangulation (Esteves & Pastor 2004); as it relied on two or more methodological approaches, data sources and types of data analysis. Because it is an amalgamation of different methods that possess

"non-overlapping weaknesses at the same time as exhibiting complementary strengths" (Brewer & Hunter 1989, p.17) the research was likely to deliver more reliable results and richer data, than if it had been conducted using a single-method approach.

The research process was iterative in that each subsequent stage built on, and further refined the understanding gained from the research activities of the previous stage. This methodological approach (see Table 2) shares some similarities with a large landholder research project undertaken in the Murray River catchment area of NSW (Crase 2002). Crase used a small mail-out questionnaire followed by in-the-field interviews, focus groups and then a larger mail-out questionnaire.

Table 2: Methodological approach of the research

	Questionnaire	Semi-structured personal interviews	Telephone Interviews
Data Type	Qualitative/quantitative	Qualitative	Qualitative/quantitative
Research type	Exploratory/descriptive	Exploratory/ descriptive	Descriptive
Sample size	Population 771 Sample frame 659	26	212
Participants	Total responses 270 119 Refused to participate 151 Returned completed questionnaires	17 licence holders 9 industry, community and business representatives	122 unable or unwilling to participate 212 agreed to participate
Rationale for group size	Entire groundwater licence holder population	Number limited by time and expense	Number limited by expense

Web-based discussion groups

When designing the research methodology it appeared that web-based discussion groups (WBDGs) would be an innovative and potentially effective approach (Kuehne & Bjornlund, 2008). This approach allows time for participants to think the issues through and offer considered opinions. The respondents to the mail-out survey commonly suggested that they felt that their opinion was either not listened to, or was drowned out by the more powerful, the more vocal or the more articulate. It was expected that WBDGs would have been embraced as an ideal technology for allowing this group a voice.

Four discussion groups were formed with a minimum of ten participants in each (see Appendix A). The groups were formed by dividing the sample according to the degree of impact that they were expected to experience from the reductions in water entitlements. The aim of the discussion groups was to encourage a rich dialogue between participants using the following questions:

- How big is the cut to your entitlement?
- How big a cut in actual water use are you likely to suffer from this?
- What are your concerns about the process?
- What are you thinking about doing in response to the WSP?
- What's your reason for doing it?
- What factors did you take into account?
- Who did you talk to?
- Why would you consider doing different things to others?
- What are your concerns about the way cuts to entitlements are being made?
- How do you perceive that the WSPs are going to impact on the wider community?
- Anything else you think might be important or relevant.

It was intended that successive posters would build on the contributions of the original visitors, leading to a developing interchange of opinions about these topics. For the WBDG to operate successfully it was hoped that the group members would commit to commenting at least weekly. This would have required a response rate of nearly 60% of all the emailed addresses in the first week. With the expectation that not everyone would wish to participate, seventy people were emailed in total. The initial email invitation to participate contained a username and password to be used when logging onto the discussion groups. As a prerequisite for involvement, participants were asked to fill in a survey to provide socio-economic and property-specific information. After completing the survey, participants were automatically directed to the discussion group page, where they were able to view and comment on a discussion paper relevant to the area of interest of each group, and also respond to the comments of others.

Given that this method of conducting research is relatively untried with farmers it was anticipated that problems would occur. It was expected that the main problem would be maintaining participants' engagement as their interest diminished due to fatigue, boredom or other demands on their time. Another potential problem was that logging in could easily be postponed. It was expected that irrigators could be reluctant to participate in the WBDG due to lack of familiarity with the technology or time constraints, but that this could be countered somewhat by designing the software interface so that it was intuitive and had a high level of usability. An incentive for regular participants was included with the second email reminder, but had little effect on the participation rate.

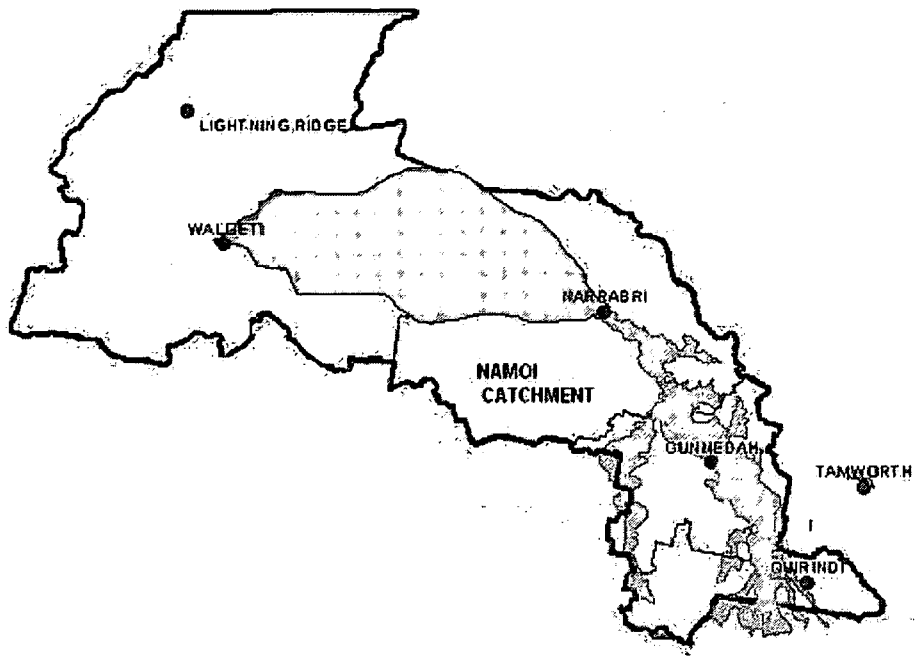
Email addresses used for the WBDG were gathered from the initial mail-out survey. Survey respondents volunteered their addresses on the understanding that they were agreeing to be involved in further research. An email was sent several months prior to the WBDG launch to check for email address validity. A reprint of a published article from the initial research (Kuehne & Bjornlund 2006b), and a cover letter describing the purpose of the WBDG research were mailed to all potential participants a week prior to the launch.

The response rate that was achieved following the WBDGs launch was less than a quarter of the minimum considered to be successful. With this low response rate it quickly became apparent that it was not going to be possible to generate a successful discussion. Consequently the WBDG as a methodology for this research was abandoned. Results gained from the web-based discussion groups have been of limited use and have not contributed to this thesis.

Study region

The Namoi Valley is in the 'New England – North West' region of NSW; approximately midway between Sydney and Brisbane (see Figure 1). The valley extends inland and westward from the Great Dividing Range, and includes rich farming land, but also land that, in the absence of irrigation, is only suitable for grazing.

Figure 1: Map of the Namoi Valley Catchment

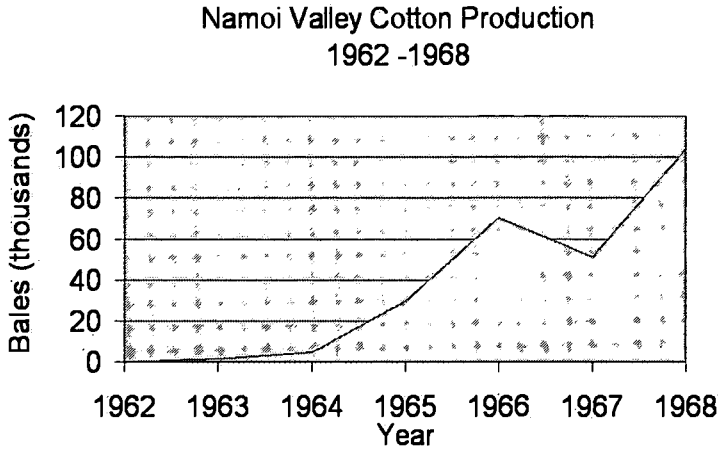


Map from (Powell et al. 2003a)

History of irrigation development

The Namoi Valley developed as a traditional farming and grazing region from the mid-1800s onwards. Farmers initially only saw irrigation as an insurance against drought, rather than as an activity to support an ongoing increase in production. Despite this conservative approach to irrigation the modern irrigation industry developed rapidly from the 1961-1962 season when cotton was successfully trialled by Californian irrigators (International Engineering Service Consortium 1969). The expansion was so rapid that within seven years there were about sixty-five cotton growers in the region (see Chart 1).

Chart 1: Growth of the Namoi Valley cotton industry



Current irrigation industry

The irrigation industry in the Namoi Valley experienced continued growth from the time of its cotton led resurgence so that by 2000-01 it covered an area of 119,040 hectares. This change in the nature of irrigation from just drought security to a necessity in most years caused an increase in demand on the resource. Of the irrigated area approximately 40,000 hectares are irrigated using groundwater, although this does depend on seasonal conditions. In dry years, when surface water flows are low, or non-existent, irrigators seek out alternative sources of water. This creates a greater demand for the more reliable, but also more expensive to pump, groundwater supply (Kuehne & Bjornlund 2006b).

Cotton accounts for seventy-eight per cent of the total irrigated area, varying according to the expected availability of water and the returns from cotton relative to alternative crops (Powell et al. 2003b). The area devoted to cotton has increased by over forty per cent during the four-year period from 1996-97 to 2000-01. The increased area is not only the result of more water being used but also because of an improvement in water use efficiency following the voluntary reductions to entitlements of ten to thirty-five per cent accepted by irrigators in the 1996-97 season (Powell et al. 2003b). Since the time of the voluntary reductions irrigators appear to have developed a more conservative approach to water, with its value becoming increasingly recognized. Irrigators, during the course of the personal interviews, suggested that it is from this time that they first started making changes to improve their water use efficiency; many of them suggesting that they have made all the possible changes that they can to improve their WUE and that there are now few options left for further efficiency gains.

Issues faced by the industry

With the expected economic shock to the region resulting from the lower levels of production associated with the reduction in water entitlements, which in some cases resulted in reduced water usage, it appeared initially that the prosperity generated by the irrigation industry and from the cotton industry in particular could be threatened (Powell et al. 2003b). Any further economic stress was unwanted as the region had suffered a number of other economic shocks in recent times with closure of coal mines, abattoirs, and a decline in the prices of agricultural commodities (Powell et al. 2003b). However within three years these earlier pessimistic predictions had been overtaken by the reality of increasing investment, rising capital values and higher consumer spending, along with the return of coal mining and its' associated developments (Powell, Chalmers & Bentham 2006). The economy of the Namoi region is vulnerable in that over forty percent of it is reliant on agriculture, which suggests that the current drought could have significant regional impacts. Even so, Powell et al. (2006) suggest that the Namoi Valley has the potential to experience a period of growth not experienced since the early eighties.

Structure of the thesis

Chapter One introduces the problem, explains the need for the research, and highlights the existing knowledge. It describes the focus and aims of the thesis, the questions it addresses and the argument of the thesis. It also outlines the research methods and the methodology employed. The research method of web-based discussion groups that was tried and abandoned is described. The study region is also briefly described.

Chapter Two explores the policy background. This is important because the policies represented by the MDB Cap, CoAG water reforms, National Water Initiative and the National Competition Policy set the direction for the implementation of the current Australian water reforms. The development of water markets are an integral part of these reforms. In NSW these reforms have led to the development and implementation of the NSW Water Sharing Plans, which are also discussed.

Chapter Three describes the study region. A brief history of the development of the region is provided as well as its socio-economic profile and an exploration of some of the problems that are unique to the area.

Chapter Four is the literature review; it is titled "Critique of the Economic Approach and Discussion of Alternatives". In this chapter a critique of orthodox economic theory is presented. This is followed by definitions and discussions of values, attitudes and goals; both individually and in relation to farmers. The categorization of farmers according to values is discussed as are the methodologies for researching farmers used by others. The literature review summarizes and evaluates the most relevant and most useful literature. It shows the progress that has been made towards understanding farmers' values, attitudes, goals and objectives; and highlights where further work is still needed.

Chapter Five describes the research design and methodology, and discusses the challenges of conducting research with farmers. It explains the reasons for choosing the irrigators of the Namoi Valley for this research. The methodology and the timeline of the research are also described, as are the sources of data, the data collection techniques and the method of data analysis. The assumptions, strengths and limitations of the research are discussed as are the ethical considerations. Some of the unique factors involved with conducting research with the irrigators of the Namoi Valley are discussed. Some of the more important reasons licence holders may have had for non-participation in this research, such as their perceptions of fairness and uncertainty as a result of the WSP consultation process are also discussed. The factors influencing irrigators' management responses are also discussed.

Chapter Six presents the analyses and results of the mail-out survey, the personal interviews and the factor analysis of the telephone surveys. This chapter also describes the development of the value constructs.

Chapter Seven presents the results from the cluster analysis of the telephone surveys and provides a summary of the results from the entire study

Chapter Eight presents the conclusions and recommendations from this study, and also offers suggestions for further study.

Closing comments

This chapter presents the introduction to the problem and explains why the research is needed. The existing knowledge of how non-profit-maximising values influence farmers was discussed. The focus, aims and argument of the thesis were presented as were the questions answered by the research. The research methods and design are outlined and

discussed. The study region is introduced with discussions of the history of irrigation development, the current irrigation industry, and issues currently faced by it. Finally the structure of the thesis is outlined.

The next chapter grounds the thesis in a contemporary policy context by discussing the various and ongoing water reforms of the Murray-Darling Basin. Understanding these policies is important because of the impact that they have on irrigators. These are the policies that have led to the introduction of the Namoi Valley groundwater WSPs. Taking a national view they stress the use of water markets as a method for achieving redistribution of water to the environment and to higher value uses. This study examines the influences on irrigators when they consider how to respond to these reforms.

CHAPTER TWO

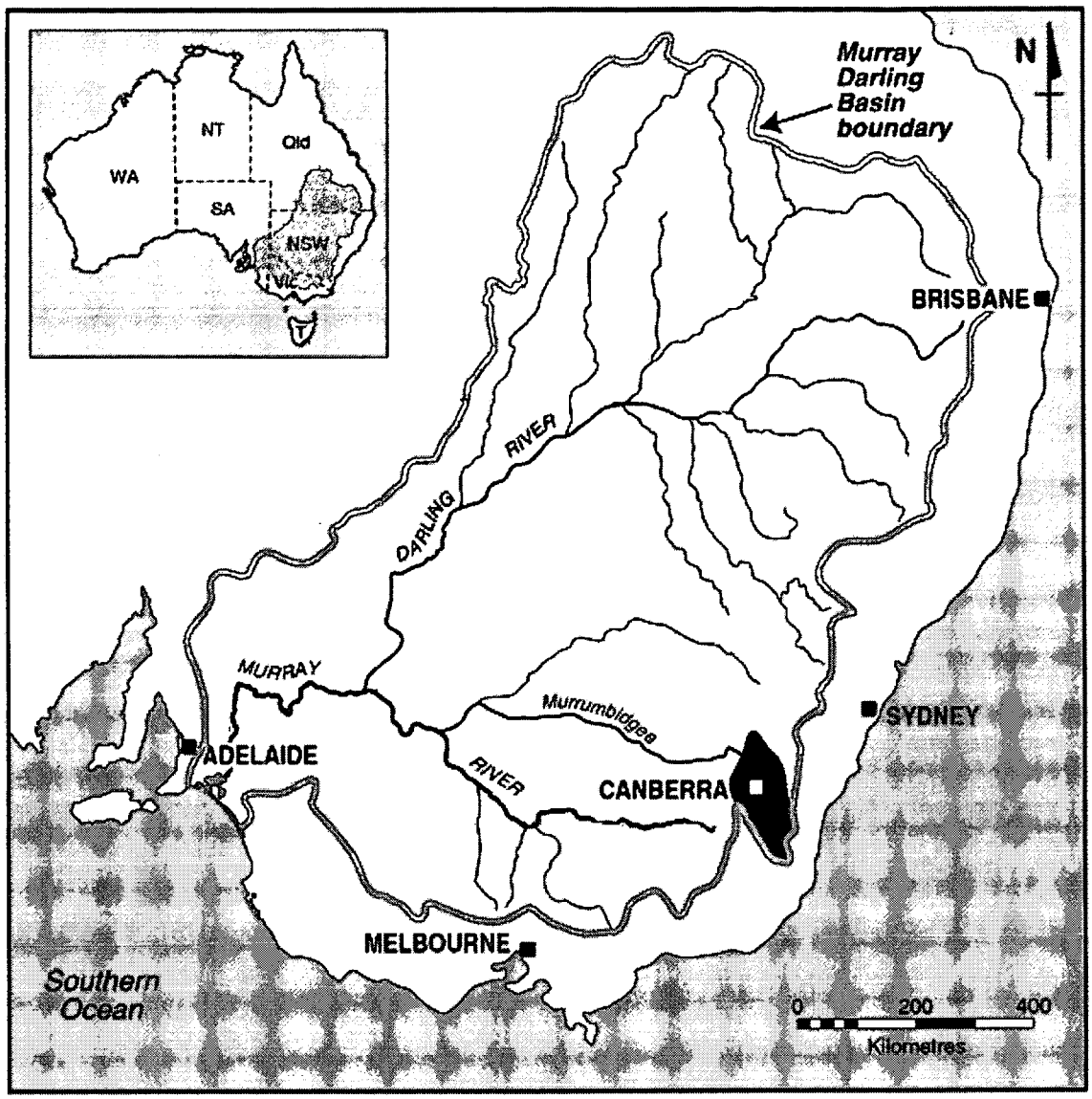
2 Policy Background

Introduction

The MDB Cap, Living Murray, COAG Water Reform Agenda, the National Water Initiative, and the current "Water for the Future" national water plan are all policy processes aimed towards reducing the extractions and use of water to sustainable levels. They provide the Federal and Basin wide context within which the development and introduction of the NSW water sharing plans need to be seen. These policy documents rely on water markets as instruments that will help irrigators to manage the process of policy reform and adjust to the resulting reduction in the access to water for consumptive use. Water markets are also expected to play a part in reducing the overall socio-economic impact of the reductions by facilitating a reallocation of water to more efficient and higher value users.

Water policy reform in the Murray-Darling Basin (which the Namoi Valley falls within, see Figure 2) has been difficult to initiate and hard to maintain. Often initiatives have been thwarted by pressure to maintain State autonomy and pressure for fewer controls rather than adopting measures that would achieve meaningful outcomes (Connell 2007). The water reforms proposed by the Howard Government in January 2007 indicated a possibility that future decisions made in the Murray-Darling Basin might be made for the benefit of the whole of the Basin and not just powerful interest groups (Connell 2007). Increasing acceptance of the need for real and effective water reform has been encouraged by the increasingly visible and hard-to-ignore problems that the MDB has experienced as a result of the record low inflows of 2006-07 and 2007-08.

Figure 2: Map of the Murray Darling Basin



Map adapted from (McVicar et al. 2002)

CoAG reform process

Pigram (2006) argues that the first two drivers of water reform in Australia were 1) 'The Brundtland report' (1987) arising from the Bruntland Commission which was convened by the United Nations; and 2) 'The World Conservation Strategy' (1980) which was published by the International Union for Conservation of Nature and Natural Resources, United Nations Environment Programme and the World Wide Fund for Nature. Within Australia, the reform process was further boosted by the United Nations Conference on Environment and Development (1992) and Agenda 21 (which came from that conference), as well as the release of the report by the Commonwealth Government's

Industry Commission on Water Resources and Waste Water Disposal (Industry Commission 1992).

This combination of influences led to the CoAG meeting of December 1992 (CoAG 1992) adopting the National Strategy for Ecologically Sustainable Development. While it is popularly thought that water reform began with the CoAG meeting of 1994, it was the 1992 meeting that committed the participants to prepare a report to progress considerations of "...issues such as water pricing and transferability of water entitlements between users..." (CoAG 1992, p.4) to be presented at the 1993 CoAG meeting. After the report was delivered (CoAG 1993) it was decided to establish a working group of officials to develop a strategic framework for the sustainable reform of the water industry. The working group was also asked to define the role of the individual members of CoAG in this reform process and construct a timeline for implementation of the reforms and then report back to the CoAG meeting in 1994.

These reforms represent a change in approach from the command-and-control style of water management to a water allocation and management approach (Tisdell 2001; Tisdell & Ward 2003). This change gave government authorities less lee-way for direct management of water resources and placed a greater reliance on market-based instruments, such as pricing reform, tradable water entitlements and the associated water markets to achieve the same goals (Pigram 2006).

The CoAG meeting of 25 February 1994 (CoAG 1994; Pigram 2006) raised the level of concern when the report of the working group responsible for developing the strategic framework was presented and the agreements for water reform were put in place. The overarching objective of the CoAG 1994 agreements was that "water be used to maximize its contribution to national income and welfare, within the social, physical and ecological constraints of the catchments" (CoAG 1994, p. 2). From February 1994 the CoAG participants were committed to:

- reforming pricing of water, and moving towards full cost recovery with the removal of cross subsidies
- providing clearly defined rights to water and the separation of water property rights from land titles, together with the recognition that the environment is a legitimate user of water

- making the trading of water possible, as well as cross border trading where it was physically, socially and ecologically sustainable
- institutional reform with a greater emphasis on integrated natural resource management and a separation of the roles of standard setting, regulatory enforcement and resource management, and the devolution of the responsibility for management of irrigation areas back to water users
- greater emphasis on education and public consultation when changes were to be made
- a greater emphasis on environmental concerns.

The first tangible actions were taken as a result of the CoAG meeting of 1994. The process of reform had commenced, but recognition of the need for water to be allocated to the environment as a legitimate user occurred more slowly. The most significant of the 1994 reforms was the separation of land title and water rights. The actual separation of land and water first took place in South Australia with the introduction of the Water Resources Act 1997 (SA Government 1997), followed by New South Wales with the Water Management Act of 2000 (NSW Government 2000) and Queensland with the Water Act 2000 (Queensland Government 2000). In Victoria the unbundling of water entitlements from property title only took place from July 2007 as a result of the white paper "Securing Our Water Future Together— Our Water Our Future" reform process (Victorian Government Department of Sustainability and Environment 2004). As a result of these reforms intra-state trading of water became an increasingly accepted practice but interstate trading of water is still lagging behind (Rural and Regional Affairs and Transport References Committee 2006).

The 1994 CoAG meeting also requested that the management arrangements relating to groundwater allocation, pricing and use, be considered by the Agriculture and Resource Management Council of Australia and New Zealand, (ARMCANZ) and be provided to CoAG by early 1995 (CoAG 1994; ARMCANZ 1996). The CoAG meeting of 1994 included reference to water needing to be priced at its actual cost. However some suggested that water pricing arrangements were severely compromised by the lack of a reform timetable (Rural and Regional Affairs and Transport References Committee 2006).

The 1995 CoAG meeting (CoAG 1995) sanctioned the introduction of the National Competition Council (NCC), an organization that was formed to act as a policy advisory body for the implementation of the National Competition Policy. From April 1995 the National Competition Policy was used as a tool to ensure that progress was made in achieving the CoAG reform targets (Rural and Regional Affairs and Transport References Committee 2006). The policy was aimed at encouraging micro-economic reform and increasing competition in all jurisdictions. It had an overall aim of improving Australia's competitiveness as well as looking after the interests of Australian consumers who were expected to benefit from lower prices for services traditionally provided by government-controlled monopolies.

The significance of the National Competition Policy reforms was that competition was now expected when governments undertook business activities (Pigram 2006). Recognising that the states would lose income due to these reforms the Australian Government provided substantial compensatory National Competition Policy payments to the states. Due to the separation of powers between Federal and State Governments the Australian Government had little ability to enforce the CoAG agreements with regard to water, but one mechanism at its disposal was the possibility of withholding these payments (Rural and Regional Affairs and Transport References Committee 2006). The National Competition Council was to assess the State Governments' progress in achieving the reforms specified in the National Competition Policy according to the agreed timetable and then to make recommendations relating to the withholding of competition payments if necessary as a penalty for any state's non-compliance (National Competition Council 1998).

The CoAG water reforms had some success, but states varied in their approach to complying with the reforms. For example Queensland appeared to retain a desire to develop its water resources further, and consequently has not strictly followed the CoAG agreement (Pigram 2006).

Murray-Darling Basin water policy reforms

At the Murray-Darling Basin Ministerial Council meeting of 25 June 1993 (Murray-Darling Basin Commission 1993) the Murray-Darling Basin Commission—the operational arm of Murray-Darling Basin Ministerial Council (Crase 2008)—was directed to conduct an audit of the water resources in the Murray-Darling Basin. This

water audit (released in June 1995) was conducted in response to growing community concern and increased evidence of deterioration in the rivers of the Basin. It found that there was a pressing need to determine a suitable balance between consumptive uses of the Basin's water and non-consumptive (effectively environmental) uses so that the health of the system could be maintained. The audit was solely focused on surface water and did not consider the impact of groundwater extractions (Murray-Darling Basin Ministerial Council 1995). This audit found that water extraction from the Basin between 1988 and 1994 had increased by 8% and was continuing to grow by more than 1% a year, potentially resulting in disastrous environmental and financial consequences (Murray-Darling Basin Ministerial Council 1995).

It was therefore proposed to cap water extraction for consumptive use at the 1993-94 level of development. Approved in 1996 (Murray-Darling Basin Ministerial Council 1995) the final *Cap* agreement left states to determine how to achieve this objective, but it was recommended that all existing entitlements should be recognized regardless of whether the resource had ever been used, or had only ever been partly used. The Independent Audit Group (IAG) (1996) recommended a six level hierarchy of property rights in water including a continued acceptance of previously unused entitlements. They argued that the acceptance of unused entitlements was to satisfy the equity and consistency issues that they were required to consider under the terms of reference. The *Cap* was a major achievement in the context of its time (Connell 2007) the lack of direction on how to implement it, and the problem of dealing with unused or partly used licenses, contributed to the confused process encountered in the Namoi Valley. If a Basin-wide agreement had been made to resolve the *Cap* issue by cancelling unused licenses and then reducing partly used licenses based on history of extraction (HOE), then the Namoi Valley WSP process would have caused less distress than it did within the community (Kuehne & Bjornlund 2006b). This decision has also been a contributing factor to declining seasonal allocations in many parts of the Basin and has resulted in discontent among active irrigators who find that they now have to buy water from the farmers that have never invested in developing their properties to utilise their entitlements. Active irrigators see this situation as an inequitable wealth transfer (Bjornlund 2005). When determining the allocation of water the IAG expected that "those with a history of use should have precedence over those with no history of use" (Murray-Darling Basin Ministerial Council 1996, p. 4). This expectation formed the basis of much

debate in the Namoi Valley as ground water licence holders argued over the fairest and most appropriate method of entitlement reduction.

The audit found that if water management arrangements were not reformed there would be significant problems with over-use of the resource as irrigators would eventually activate inactive entitlements. The reasons given for entitlements remaining inactive were that there was limited irrigation infrastructure, limited channel capacity, limited on-farm storage, a predominance of permanent plantings in the southern part of the basin unsuited for opportunistic watering, low returns from many irrigated activities, and an undeveloped market for trading water entitlements (Murray-Darling Basin Ministerial Council 1995). It was expected that most of these barriers would eventually be overcome, resulting in detrimental effects on the environmental health of the basin as the inactive entitlements were eventually activated.

The audit only described the situation at the time it was conducted. It did not attempt to specify the balance that would be needed between consumptive and environmental uses of water to achieve sustainability (Murray-Darling Basin Ministerial Council 1995). When the *Cap* was introduced in June 1995 it was also decided that the balance between consumptive and non-consumptive uses of water from the MDB had to be specified. The *Cap* was designed to restrain the growth in diversions while the precise details of the balance between extractive and non-extractive uses of water were being determined (Murray-Darling Basin Ministerial Council 1996).

The *Cap* was just a device to restrain further extractions: "The *Cap* per se is only a means to an end. It is not the end in itself" (Murray-Darling Basin Ministerial Council 1996, p. viii). The goals of the *Cap* were to be achieved by "identifying environmental water requirements and flow regimes and by establishing a supporting management and institutional framework, including trading of water" (Murray-Darling Basin Ministerial Council 1996). Before the *Cap* was implemented there was little incentive to trade water because any extra demand was met simply by increasing the amount allocated (Goesch 2001; Roper, Sayers & Smith 2006). A permanent cap, defined as "the volume of water that would have been diverted under 1993-94 levels of development", was introduced for Victoria, New South Wales, and South Australia on 1 July 1997. In South Australia, the *Cap* defined a fixed allocation for country towns, a non-tradeable allocation for metropolitan Adelaide, and water for irrigators equivalent to 90% of their entitlements

(Murray-Darling Basin Ministerial Council 1997). The argument for this different treatment was that SA was the only state, through the introduction of volumetric licenses, to actually have reduced existing licensed amounts (Bjornlund 1999).

Each of the Basin states was required to develop proposals relevant to their own jurisdictions. An Independent Audit Group (IAG) was constituted in 1996 (Murray-Darling Basin Ministerial Council 1996) to coordinate the expected range of approaches for arriving at the *Cap* for each state while also ensuring consistency and equity for each state. Even though the interim *Cap* was introduced in June 1995 the full Murray-Darling Basin *Cap* was slow to be implemented by all states; for example NSW only agreed on a cap in the Barwon-Darling system in July 2005 (Knowles 2005; Pigram 2006). Queensland intended to complete the "Water Allocation and Management Planning" (WAMP) process that had already commenced before it would commit to the *Cap* (Murray-Darling Basin Ministerial Council 1997) but by June 2007 it still hadn't formally committed to the *Cap* (Murray-Darling Basin Commission 2007).

The CoAG water reform process called for an evaluation of the environmental requirements for stressed rivers by 1998 (Murray-Darling Basin Ministerial Council 1996). The *Cap* was only ever designed to restrain diversions to 1993-94 levels it was not designed to reduce extractions to sustainable levels.

At an individual valley level the final allowed diversions, taking into account the need to allocate water to increased environmental flows was possibly below the *Cap* (the 1993-94 levels of diversion). The compliance with the *Cap* was to be measured on a State-by-State basis (Murray-Darling Basin Ministerial Council 1996).

The two main objectives driving the *Cap* were a desire to "maintain and, where appropriate, improve existing flow regimes in the waterways of the Murray-Darling Basin to protect and enhance the riverine environment" as well as a commitment to "achieve sustainable consumptive use by developing and managing the Basin's water resources to meet ecological, commercial and social needs" (Murray-Darling Basin Ministerial Council 1996, p.7). The *Cap* was designed to restrain diversions from the basin but not as a constraint on development. It was envisaged that new development should be allowed but with water that was gained either from achieving water use efficiency improvements, or through the trading of water entitlements (Murray-Darling Basin Ministerial Council 1996).

The Senate interim report of 2006 puts the problem facing Australia's water resources in context and describes some of the compromises needed to achieve sustainable water use. The report also describes the desired outcome, and highlights the consequences of inaction:

> Managing our water resources is a difficult balancing act. We are a growing nation living on a dry continent with extremely variable rainfall patterns, and recent years have brought water supply security problems to a number of our cities, agricultural industries, and major rural centres. The challenge for policy makers is how to best balance competing demands for a limited precious resource in a manner that ensures the sustainability of the resource, equity among competing users, predictability and security of supply for our industries and populations, and still guarantees the survival of treasured environmental assets. The issue is made more difficult by the complexity and uncertainty of the science of assessing the resource, and predicting the impacts of drought and increased climate variability. Ultimately we need to be able to make good decisions on the basis of incomplete information that can guide us safely into an uncertain future. We need flexible and adaptable water management systems that can deliver equity and certainty to all users. At stake is the viability of our cities and towns, our industries and ecosystems, our very way of life (Rural and Regional Affairs and Transport References Committee 2006, SEC 1.12).

The National Water Initiative

After the encouraging initial advances from the CoAG, and following the election of the Howard government on 11 March 1996 the speed of water reform lost pace. A review of the first 10 years of CoAG reform was initiated in 2002 (CoAG 2002) and presented at the September 2003 meeting (CoAG, 2003). The report identified significant progress but also found two major areas where reforms were still inadequate: 1) markets failed to

reach their full potential due to barriers to trade, lack of uniformly defined property rights and secure water registers; and 2) the speed of progress in ensuring that sufficient water was provided for the environment and adaptive management practices. To refresh a slowing rate of reform the 2003 CoAG meeting (CoAG 2003, p.1) agreed to develop a National Water Initiative (NWI). The finalised NWI was agreed to at the 25 June 2004 CoAG meeting. The NWI demonstrated a continuing concern for water reform from both the Federal and State Governments but still contained a tension between environmental and consumptive use (Connell 2007). Simultaneous with the establishment of the NWI was the setting up of the National Water Commission (NWC). The function of the NWC, an independent statutory body, was to play an oversight and driving role for the national water reform agenda (CoAG 2004; National Water Commission 2005). Water reform objectives were expected to be more clearly defined and a timetable of actions was to be developed (Rural and Regional Affairs and Transport References Committee 2006).

The NWI was aimed at providing: (1) planning processes that defined the consumptive pool of the resource; (2) nationally compatible water access entitlements defined as shares of the consumptive pool; (3) improved recognition of environmental requirements; (4) clearer definition of risk following changes to access for irrigators; (5) water markets that would operate nationally where practical; (6) the return of over-allocated and over-extracted systems to sustainable levels of use; and (7) reform of urban water usage (Bjornlund 2006).

The Productivity Commission (2003) undertook a comprehensive review of water rights in Australia, finding that the significant variation between jurisdictions was a detriment to complying with the CoAG obligations (Rural and Regional Affairs and Transport References Committee 2006).

To avoid delaying the reform process while definitions were debated, the Commonwealth Government encouraged the development of the NWI without insisting on a single definition of water property title. The complexity of the Australian water entitlement system is indicated by the 255 types of regulated surface water entitlements (Shi 2005). This has been a key factor in discouraging more widespread trade in entitlements (Rural and Regional Affairs and Transport References Committee 2006). The level of investment in irrigation infrastructure is significantly higher in areas where water entitlements are more secure. Resolving the issue of property right was therefore an

important prerequisite for encouraging the necessary investments to achieve a more efficient and higher value of production from water.

The NWI is explicit in its detail with regard to what is expected from the states (Rural and Regional Affairs and Transport References Committee 2006). It expected that "nationally compatible markets, regulatory and planning based systems for managing surface and groundwater resources for rural and urban use that optimizes economic, social and environmental outcomes" would be the result (Rural and Regional Affairs and Transport References Committee 2006, p. 6).

Apart from re-energising the water reform process the NWI considers the connectivity of groundwater sources and surface waters, something which the *Cap* does not address (Connell 2007). The connectivity of these water sources is especially of importance when considering Namoi Valley issues.

The NWI takes the view that water should go to its most productive use, and through its promotion of statutory water planning processes defines environmental water needs (Connell & Hussey 2006). Facilitated by water markets, the NWI aims to develop a balance between extractive and non-extractive uses of water resulting in environmental sustainability, rather than continued decline as is currently the situation (Connell 2007). To achieve this, individual states were required to prepare water reform implementation plans (Connell & Hussey 2006). Even though the states were already pursuing water reforms that were broadly in line with those of the NWI, in 2004 both New South Wales and Victoria released plans for water reform (Roper, Sayers & Smith 2006). The New South Wales State Government has been criticised for having a one-sided and selectively applied approach to the implementation of the NWI principles, lack of co-ordination between government agencies and departments, and the movement of agency staff from being involved with the development of scientific or policy arguments to the role of advocates for a particular cause (Rural and Regional Affairs and Transport References Committee 2006).

In all of the CoAG policies, water markets are expected to facilitate reallocation of water from inefficient low-value users to more efficient high value users, and thereby help to alleviate the negative socioeconomic impacts of reduced access to water for consumptive use. In its interim report, the Rural and Regional Affairs and Transport Committee (2006, p.12) suggested that the desired system of water markets should be "flexible, adaptive,

transparent and equitable. It should deliver security and economic efficiency, along with low trading and administrative costs." A by-product of the push for water markets (unexpected by some) is that the actual overall amount of water diverted for consumptive purposes is likely to have risen (Connell 2007).

Namoi Valley Water Sharing Plans

The development of the NSW water sharing plans (WSPs) has to be seen in the context of the water reforms developed by CoAG (CoAG 1994, 2004) and the major micro-economic reforms associated with the National Competition Policy. States were required to give specific water entitlements to the environment, and to return all water sources to sustainable levels of water extraction through a catchment management process involving local communities and stakeholders. The development of the WSPs—one of the key provisions of the Water Management Act 2000 (NSW Government 2000)—therefore is aimed at fulfilling NSW's obligations under the CoAG agreement of February 1994 (CoAG 1994). The Water Management Act (NSW Government 2000) is significant because it is the first Australian water act that recognises the environment as a priority user of water.

The process of developing the WSPs is therefore firstly to define the environmental need of the resource, and then to implement a system of water access shares to the volume of water deemed available for extractive use. In the Namoi Valley, it is the acknowledgement of the environment, and the need to share what is left for extractive use, that has been responsible for many of the conflicts over the water sharing plans.

The NSW Water Management Act (NSW Government 2000) formally introduced the separation of water rights from property title. It also laid the foundation for the development of Water Sharing Plans which specified how water was to be shared between consumptive uses and the environment for a ten-year period.

The NWI required that water plans for over-allocated systems should be provided before 2008 and for systems that were not over-allocated before 2010. The subsequent development of the WSPs throughout NSW has been built on those that were first developed in the Namoi Valley (Rural and Regional Affairs and Transport References Committee 2006). The NSW Government, more than any other State Government, had over-allocated water entitlements; and especially so with the ground water resource of the Namoi Valley. Due to the need to reduce the over-allocation of entitlements the

development of the WSP for the Namoi Valley, the 'Water Sharing Plan for the Upper and Lower Namoi Groundwater Sources Namoi Valley' (Aqualina 2003) was very contentious, causing much friction between licence holders and the government as well as between active and inactive licence holders (Kuehne & Bjornlund 2006b). Perceptions of the process varied, with the New South Wales Irrigators Council suggesting that the development of the WSPs was detrimentally affected by "Sydney-centric bureaucrats, a move which disenfranchised many groups" (Rural and Regional Affairs and Transport References Committee 2006, p. 6). Cotton Australia suggested that the development of the WSPs involved "surrealistic baseless scientific negotiation" (Rural and Regional Affairs and Transport References Committee 2006, p. 10). For a fuller discussion of the development process of the Namoi Valley WSPs, see Kuehne and Bjornlund (2006b).

The WSPs set the rules for the sharing of water between the environment and other uses such as irrigated agriculture and urban areas for a ten-year period. In most cases, returning the catchments or aquifers to sustainable levels of extraction required reductions to be made to existing water entitlements. An important part of the development of the Namoi Valley ground water WSP was therefore to define the method of entitlement reduction. The two options considered were History of Extraction (HOE) or Across-the-Board (ATB). The HOE method weighted the reductions to take into account past usage, and favoured active users. ATB favoured the inactive or low user by requiring an equal reduction in entitlement from all licence holders regardless of usage. ATB was the option favoured by the Independent Audit Group (Murray-Darling Basin Ministerial Council 1996). Irrigators with a high history of use argued that HOE maintained economic activity within the community, reduced the effect of stranded assets (a situation where their investment in infrastructure would become worthless without water), and avoided a period of uncertainty and restructuring while they rearranged their water access to ensure continued production. Irrigators with a low history of use argued that because they had been frugal and responsible with their water usage, the adoption of HOE would unfairly disadvantage them. 'Inactive' users expressed concern that cuts based on HOE would unfairly affect their property values. When developing the Namoi Valley ground water WSP the Namoi Groundwater Management Committee was unable to arrive at a consensus decision with regard to the method of entitlement reduction that they would recommend.

Licence holders overall did not favour HOE although, perhaps not surprisingly, irrigators with a high history of use did. Based on early statements made by government agencies, irrigators had an expectation that the NSW Government would choose HOE (Nancarrow, McCreddin & Syme 1998). ATB was chosen in August 2001, although the intention to change to HOE was announced in June 2004, legislated in December 2005, and eventually implemented in November 2006.

Closing comments

This chapter has examined the policies associated with returning Australia's water use to sustainable levels. Since the early 1990s, as these policies have become increasingly defined and coinciding with one of Australia's worst drought periods, they have delivered increasingly significant impacts on irrigators. As a consequence of the NSW Water Sharing Plans some of the groundwater irrigators of the Namoi have experienced severe reductions to water entitlements (in some cases of up to 94%). Therefore, most of the ground water licence holders of the Namoi Valley need to respond to the WSPs in some way.

The history of development, the socio-economic profile, and some of the complexities of the Namoi Valley are discussed in the next chapter. This is a very relevant discussion for this research as farmers' responses to policy changes are also influenced by local conditions.

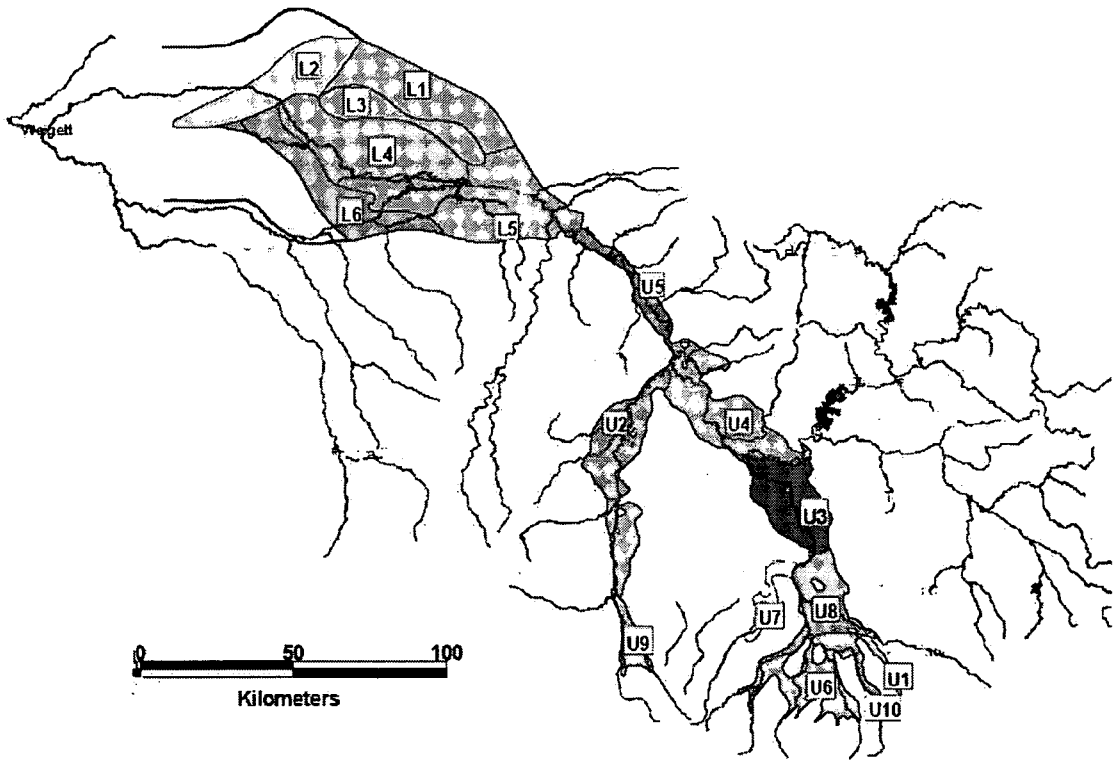
CHAPTER THREE

3 Study Region

Introduction

The Namoi Valley in the North West of New South Wales remains one of the most interesting agricultural regions in Australia. It stretches from Quirindi and Tamworth in the east and inland to the towns of Wee Waa and Walgett in the west (see Figure 3). Irrigated agriculture is of great importance to the region, with much of it dependent on ground water sources. The region is an attractive choice for this research due to the implementation of the severe cutbacks defined in the WSPs as discussed in the previous chapter.

Figure 3: Map of the Namoi River Catchment



(NSW Remote Sensing / GIS Unit 2006)

History of Namoi Valley irrigation

The substantial growth of the irrigation industry since the 1960s in the Namoi Valley is a result of irrigators responding to an offer from the State Government to use the water provided by the Keepit Dam on the Namoi River when it was completed in 1961 (Pigram 2006).

Although the idea of irrigation in the Namoi Valley first arose in the last years of the nineteenth century (Pigram 2006) it did not have a great deal of appeal at the time, because farmers thought that the existing rainfall was sufficient; and at that time there was still a strong focus on grazing activities. The area already had a natural advantage over much of Australia's farmland because of the rich alluvial soils found in the flood plains of the Namoi River and its tributaries.

In 1944 the total area that the Government had authorized for surface water irrigation in the Namoi Valley was only 2,000 ha. But because this land was associated with relatively small volumetric licenses which may not have been developed, the irrigated area may have been much less. In any event the water source was a variable unregulated river and the development of large-scale irrigation would only become a possibility with the completion of Keepit Dam in 1961. Originally seen as a water conservation activity, the dam allowed the variable flow of the Namoi River to be controlled so that water was available at times when it was useful for irrigation (Pigram 2006).

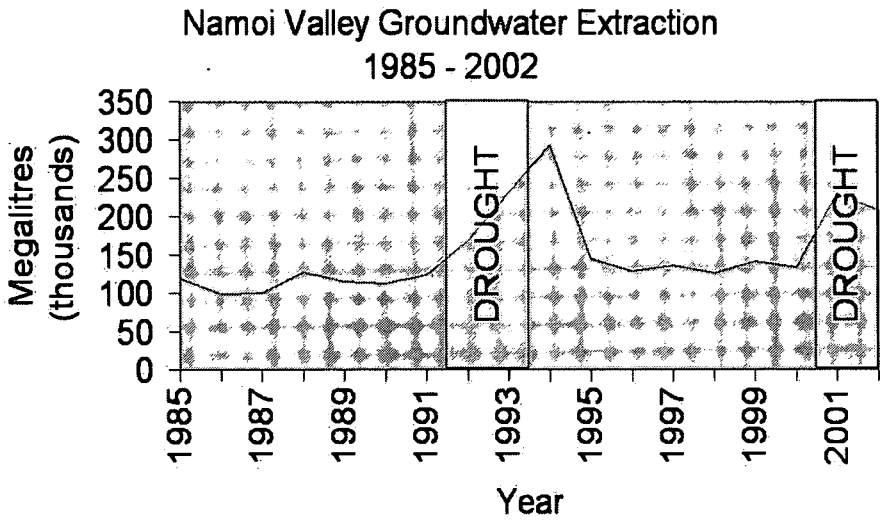
The growth of irrigation in the Namoi Valley is interrelated with the growth of the cotton industry. The Namoi Valley provided "suitable soils, correct temperature conditions and adequate water" (Pigram 1970, p.4). The region is also favourable to the growth of the cotton plant with high temperatures, long hours of sunshine and low humidity during the growing season. Overall it is also a region that is unique among Australian irrigation districts because of its high level of private investment, lack of government planning and rapid development (Pigram 1970). These factors, when combined, have meant that the region, unlike many of the other irrigation areas within Australia, has fewer small irrigation farms.

Even though the Namoi Valley has some unique features, as an irrigation region it shares at least two common characteristics with other irrigation areas developed by the governments within the MDB: 1) the resource was developed without sufficient knowledge about its sustainability (Pigram 2006); and 2) irrigators were strongly encouraged to take up the opportunities for irrigation to such a level that overuse was unavoidable.

In 1966 (during the prolonged drought of 1965-67) the Namoi Valley Water Users Association raised the possibility that the water from Keepit Dam was already over-allocated (Pigram 1970, 2006). However, development continued until 1976 when the

issuance of further licenses was stopped. Restriction of access to increased quantities of surface water, in combination with water scarcity during drought years, cause irrigators to turn their attention towards groundwater as an alternative water source (see Chart 2).

Chart 2: Ground water extraction peaks due to drought



In 1983, concerns about the over-development of the ground water resource led to access licenses being converted from area-based to volumetric-based. Prior to this there was no restriction on the amount of water that could be used per unit of land; the only restriction was on the area of land that could be irrigated.

Development of the groundwater resource

Irrigation has been an important undertaking in the Namoi Valley for about 40 years; developing concurrently with the cotton industry. Irrigation has expanded to cover an area of 119,040 hectares (Powell et al, 2007), with approximately 40,000 hectares being irrigated using groundwater, depending on the seasonal conditions.

Averaged across the more than 700 groundwater licenses in the valley, the extraction is about 224 ML per licence. Using the same per licence average, the estimated annual aquifer recharge is 268 ML. Total use of groundwater, averaged across all licenses, all zones and over time is not unsustainable. However, this conceals three problems: 1) there is variation between different areas; 2) there is great variation between years; 3) if all licenses were fully activated usage would be profoundly unsustainable. The problem facing these licence holders is that each licence entitles the holder, on average, to extract 608 ML from the aquifer (Namoi groundwater management committee 2001). The

implication of this over-allocation is that if all licence holders activate their licence and withdraw what they are legally entitled to use, they would be using more than double the sustainable yield.

While the valley as a whole is not currently using more than the sustainable yield, there are problem areas. The Upper Namoi has twelve hydrogeological zones and the Lower Namoi has seven zones, although the seven zones are treated as one. "A hydrogeological zone is a geographical area with distinct hydrogeological characteristics in terms of its response to recharge and extraction rates" (Namoi Groundwater Taskforce 2000, p. 13). Zone 1, the most severely over-allocated, requires reductions of 94% to licensed entitlements to reach sustainable levels.

The Upper and Lower Regions of the Namoi Valley are distinct areas in terms of their hydrology and their use of groundwater. Throughout the Upper Namoi groundwater is the primary source of irrigation water, although some irrigators have access to surface water from the Mooki River and Cox's creek. In the Lower Namoi many irrigators have surface water licenses on the Namoi River in addition to groundwater licenses. Due to the higher pumping cost, groundwater has been a less preferred source of water for irrigation except during drought when no surface water was available (Powell et al. 2003a).

The resource is not over-used in total but there are considerable variations in usage between groundwater zones (see Table 3). The reallocation of entitlements specified in the water sharing plan is designed to remove the risk of inactive users activating their licenses leading to unsustainable use of the resource (Powell et al. 2003a).

Table 3: WSP entitlement reductions and proportion of licence holders within each ground water zone

Zones	Allocation status	Reduction	Share of entitlement
6,9,10	Allocation below recharge, not fully developed	0	5%
7,11,12	Allocation above recharge, HOU below recharge. Scope for water trading	41-75%	5%
1,2,3,4,5,8	Allocation above recharge, HOU near or above recharge. Less scope for water trading	45- 94%	54%
Lower Namoi	Allocation above recharge, HOU below recharge	51%	36%

Table adapted from (Powell et al. 2003a).

Socio-economic profile of the Namoi Valley

The most comprehensive review of the socio-economic situation in the Namoi Valley is the report titled "Socio-economic analysis of the impact of the reductions in groundwater allocations in the Namoi Valley". Authored by Powell, Thompson, Chalmers, Gabbot, Stayner, and McNeill (2003a) it was commissioned by the Australian Government's Department of Transport and Regional Services to provide guidance for the formulation of its structural adjustment package.

The terms of reference of the report were to:

- Identify and assess the likely economic and social impacts of the WSP in the Namoi Valley over the ten years following its implementation.
- Assist in determining the amount and nature of the structural adjustment funding that was required to compensate for the effects of the WSPs.

The conclusions of the report appear, at best, sympathetic to the irrigators of the region and, at worst, biased towards them. Despite these criticisms, the report is based on well-funded and properly conducted research. It is a comprehensive document examining the socio-economic conditions prior to the implementation of the WSP and predicting the effects of the WSP after it is fully implemented. Due to the importance and relevance of this report it will be discussed in greater detail over the next few pages.

The report (Powell et al. 2003a) suggested that the region had fallen behind the NSW average with respect to employment, mean taxable incomes and welfare benefits received vs. taxes paid. Some of this is because the Namoi Valley region suffered a number of economic shocks through the 1990s with coal mines closing, the Gunnedah abattoir closing, poor commodity prices and a severe mid-decade drought. The clear message of the report was that in 2003 the economy of the Namoi was in a fragile state and vulnerable to any further shocks, such as those expected from the introduction of the WSP. These shocks were expected because agriculture is the core activity of the Namoi Valley, responsible for 57% of the Gross Regional Product. Groundwater irrigation contributes 56% to the Namoi Valley's Gross Value of Agricultural Production (Powell et al. 2003a).

The report does not question the need to implement the WSP but suggests that the region does not have the strength to withstand the socio-economic shock from its introduction without the provision of structural adjustment assistance (Powell et al. 2003a).

The report identifies the factors influencing management flexibility as being:

- the existing level of development of the farm
- whether access to surface water is available
- whether HOE = current use
- historical factors, such as previous management choices
- individual financial situations.

Non-profit-maximising individual influences were not identified as an influence on management flexibility.

Groundwater is the most commonly used irrigation water source in the Upper Namoi but it has a less dominant and more of a supportive role to surface water in the Lower Namoi (Powell et al. 2003a).

The study (Powell et al. 2003a) aimed to:

- investigate variations in effects from the WSP across zones
- assess the socio-economic impacts among irrigators
- examine expected individual responses to the WSPs
- estimate the expected overall socio-economic impacts on the region.

This was done by:

- contacting all irrigators with a set of questions regarding how they proposed to respond to the WSPs
- developing a set of farm models
- running the models (incorporating farmer responses) and comparing them to baseline data

- aggregating the expected responses to determine economic impact on the region
- assessing the possible impact of water trading
- surveying inactive licence holders to gauge their response to WSP.

The report (Powell et al. 2003a) suggested that businesses at risk shared some of the following characteristics:

- had large entitlement reductions
- had fully developed their irrigation potential
- didn't have a long history of use; which meant that with entitlement reduction based on history of use calculations they could receive substantial reductions to their water entitlement
- had no alternative access to surface water, or were unlikely to purchase other water
- were operating with relatively high levels of debt
- were smaller operators.

Individual farm impact was determined by phone survey. Licence holders indicated that they intended to:

- scale back irrigated crops and/or expand dryland production
- change to fodder production to support livestock production
- invest in a changed enterprise mix.

Some other responses to the WSPs were suggestions of additional investment to capture overland flows, unregulated surface water and also improvements to on-farm water distribution and application technology (Powell et al. 2003a).

The report (Powell et al. 2003a) suggests that active irrigators:

- expected to reduce irrigation area in line with reduction of entitlement
- have only moderate interest in the purchase of more water entitlements

- have low interest in the sale of entitlements
- are interested in growing high water use efficiency crops
- have low interest in investment associated with infrastructural and management changes to support improved water use efficiency
- have low interest in the development of alternative enterprises.

The report suggests that inactive licence holders are not likely to be net sellers of water entitlements but also cautions that these responses may reflect irrigator uncertainty and discontent with the WSP.

Considerable variation exists between zones because of the size of the entitlement cuts (see Table 4), the nature of the existing enterprises, the expected responses from irrigators to WSPs, and whether opportunities exist for licence holders to take ameliorative measures. The authors suggest that initially a low level of water trading could be expected, with reductions of irrigation activity expected in the zones with low water trading potential: zones 2 and 3 and possibly zones 1, 4, 5, 8 and the Lower Namoi (Powell et al. 2003a). Temporary trading of water was expected to occur rather than permanent sale and the markets were expected to be thin and illiquid.

Table 4: Post WSP licenced amounts as a proportion of history of extraction and the proportion of irrigators receiving it

Post WSP licensed amount as % of history of extraction	100%	80-100%	60-80%	40-60%	20-40%
Percentage of irrigators receiving the amounts above	57%	13%	14%	12%	3%

Table adapted from (Powell et al. 2003a)

Summarising the impacts of the WSP the authors predict:

- Namoi Valley agricultural production reduced by 5-10%.
- Namoi Valley gross regional product reduced by 2.7%.
- Smaller owner-operated farms to be hit harder than larger corporate farms; with impacts expected to be more severe in Gunnedah and Boggabri.

- Cotton will decline by 20% but still dominate Namoi Valley agriculture after introduction of the WSP.

- Significant adjustments will need to be made by 43% of active irrigators as a result of the WSP.

- Impacts were not expected to be readily apparent at first and would mostly affect fully developed owner-operated farms.

Complexity of the region

Water reform in the Namoi Valley, and groundwater licence holders' responses to these water reforms, is a complex issue. This complexity arises in part from a divisive and protracted development process combined with the unique variability found in the people, land and the climate of the region as well as changes that occur over time. "Social science deals with complex phenomena in that its data (which may not be directly observable) are dependent on time and place" (Steele 2004, p. 1025). Human interaction is so detailed and complex that it is difficult to understand all the events that arise from it. While it is difficult to understand, it is not that patterns of human behaviour are indiscernible, but it is by the "complexity of his rationality, economic man is essentially unpredictable" (Steele 2004, p. 1026). It is the intellectual drive of humans, which attempts to overlay behaviour with patterns that can describe and test that behaviour scientifically, that must be relied upon to understand this complexity (Steele 2004).

Complexity is evident in the behaviour of individuals, but there is also complexity in the physical environment. This complexity is what van der Ploeg (1994) refers to as "the overwhelming and often confusing heterogeneity of agriculture".

There are thirteen hydro-geologically distinct zones in the Namoi Valley which adds to the geographical complexity. The history of development has been influenced by each of these zones being hydro-geologically distinct. Each zone requires an individual approach to understand the current situation. Apart from the individual nature of the zones, each farm is physically different to others, varying among other things by shape, size and soil types. Each individual characteristic has an influence on the range of management options available to the farmer. For example, the shape of a farm determines what type of irrigation can be profitably employed on the farm. An irregularly shaped farm may not be suitable for mechanized irrigation such as centre pivot or lateral move irrigators.

The Namoi Valley also varies climatically from one end to the other; for example the climate of Wee Waa in the west (mean annual rainfall 492 mm, mean maximum temperature for January 35C) is dryer and warmer than Quirindi in the east (mean annual rainfall 683 mm, mean maximum temperature for January 32C).

The geographical location of the farm also has an influence on the irrigation choices available; some farms have access to surface water only, some are solely reliant on groundwater, while others have both available.

Each farm business is at a different stage in its business life-cycle. The properties were purchased at different times and developed at different rates, by owners with differing goals. Some are fully developed while others still have potential for further development. Their position in the business cycle affects how decisions will be made.

Closing comments

The study area has some of Australia's most productive agricultural land and water resources. Being ideally suited to cotton growing, it is the area where Australia's cotton industry was first developed. The region provides an example of Australia's journey from having a plentiful supply of low-valued water to water scarcity and increasingly higher valued water.

In response to the reckless over-allocation of groundwater entitlements the area is also subject to some of the country's first and most severe water reforms. It is a process of water reform that is likely to be repeated throughout many of Australia's irrigation districts in the years to come. The Namoi Valley is an excellent area for this study as the regions ground water licence holders are experiencing a period of turmoil, as they make complex and difficult choices in response to the reductions in water entitlements associated with the introduction of groundwater WSPs. The next chapter discusses the literature regarding influences on farmers' behaviour, shows how others have addressed this complexity and focus on what we already know as well as what we need to know.

CHAPTER FOUR

4 Critique of the Economic Approach and Discussion of Alternatives

Introduction

This critical literature review establishes and elaborates on the need for this study. It does this by critically reviewing previous research and theory related to the topic, and identifying existing knowledge gaps. The literature review shows that the aims of this research are novel and that research such as this has not been done before. It also shows that there is a significant degree of interest in the research problem, which further indicates its importance.

The aims of this thesis are to 1) investigate and compare the influence of non-profit-maximising values and profit-maximising values on farmers' management behaviour, and 2) construct a typology that illustrates how farmers' management behaviour differs according to the values that they hold. These aims are being pursued by focusing on water management but the overall aim of the study is to develop an understanding of farmers' values, attitudes and goals that are more widely applicable than just to water.

Questions to be answered by the thesis are 1) why is the assumption of profit maximization unsuitable for explaining farmers' behaviour and what might provide a better explanation? and 2) can farmers be categorized according to the values that they hold concerning family, profit, land, water and community and, if so, how?

The literature review offers a critique of orthodox economic theory; defines values, attitudes and goals; and then discusses these in relation to farmers. The literature on categorizing farmers according to their values is discussed, as is the literature on the influence of values and attitudes on farmers' behaviour. Research methodologies used by others when working with farmers are also discussed.

Critique of orthodox economic theory

There is much literature that is critical of orthodox economic theory as a complete and thorough way to describe motivations for farmers' behaviour; and there have been many advances made in the modelling of non-profit-maximising behaviour in the last 15-20 years (Berg 2003). However, even though advances have been made, they haven't yet "[reached] the imagination of policy makers and [begun] influencing popular debate about leading issues in public policy" (Berg 2003, p. 412). The combined failure of orthodox economic theory to adequately describe farmers' motivations, and the continued reliance on it by policy makers, is evident in the ways that Australia's environmental

policies have been designed in recent times. Often these policies use an economic approach relying on financial incentives in the form of market-based instruments; and involve the implicit expectation of the voluntary participation of farmers. The problem is that this assumes that the most important motivating factors for farmers are those of the self-interested actor, with utility and profit-maximisation forming the overriding influence on their decision making behaviour (Crase & Maybery 2004).

Motivations other than profit-maximisation are found among farmers in countries other than Australia. Joe Zink, a co-owner of Colpitts Ranches on the edge of the city of Calgary, Alberta, Canada, makes a statement expressing a sentiment that is also common to Australian farmers:

> We're not interested in selling our land... The value of our land has definitely increased, but this isn't just about money for us. Colpitts Ranches is a family farm and we love this land. It is our family and our way of life. We want to preserve it for as long as possible (Olsen 2007, p. A16).

Statements such as these provide examples of how orthodox economic theory fails to "appreciate the diversity and complexity of triggers that motivate decisions in agriculture" (Maybery, Crase & Gullifer 2005, p. 61). Another problem with assuming that individuals behave in a profit maximising fashion is that it also implies that they are homogenous, all reacting in a similar fashion to any policy instruments incorporating financial incentives. This is unlikely to be the case. Even where farmer behaviour could be expected to be more uniform, such as the farming areas that are homogeneous with regard to their soil types and types of crops grown, distinct heterogeneity is found among farmers (Ilbery 1982; Gomez-Limon & Riesgo 2004).

Economic theory accepts that farms vary in size and structure, but does not recognise that farmers themselves vary. Instead, it assumes that they all act as rational profit maximisers (Dent, Edwards-Jones & McGregor 1995). The presumption of economic rationality has worked in favour of markets as a policy prescription but as market activities become harder to test, and with a lack of immediacy of feedback, the assumption of rationality "becomes more and more strained" (Vanberg 2004, p. 21). Others describe rationality differently, suggesting that because a person's behaviour is the result of inputs from all of the senses, the rationality of a person does not need to show conscious reason (Steele 2004). For instance, Viner (1925, p. 373-374) sees less evidence of any influence from

rationality in human behaviour and suggests that it is "the product of an unstable and unrational [sic] complex of reflex actions, impulses, instincts, habits, customs, fashions and mob hysteria".

The assumption that farmers are motivated solely by profit-maximisation is widely criticised or discounted (Dent, Edwards-Jones & McGregor 1995; Austin et al. 1996; Tauer & Stefanides 1998). Even though this assumption is subject to ongoing criticism, it still lingers. Gasson (1973, p. 522) suggests that although the idea is "often challenged and qualified it remains firmly embedded in the sea of economic thought like the Rock of Gibraltar".

Willock clearly criticises the assumption of profit-maximisation (1999b, p. 6) when she suggests that "[f]armers' decisions are not always or ever necessarily aimed at the unique goals of profit". This criticism suggests that an exclusive focus on profit maximising is unlikely to be useful for explaining farmers' behaviour but neither is an exclusive focus on any other kind of individual goal. Searching for simplistic explanations, which is an attraction of the profit-maximisation hypothesis, ignores the complexity of the influences on farmers' behaviour. Because single-criterion models, such as profit-maximization models, are no longer particularly convincing at explaining farmers' behaviour they may have to be withdrawn completely (Ilbery 1982; Beedell & Rehman 2000). Instead, a more useful way of explaining their behaviour may be to see them as balancing multiple goals. Even if the profit maximization motivation of orthodox economic theory could be accepted as the dominant influence on farmers' behaviour, it is still hard to justify as farmers need to decide among complex alternatives for profit to be maximised. The profit-maximisation hypothesis has other problems because there are many ways to look at profit (Gasson 1973). For example, it needs to be determined whether it is related to real income, cash income, income in-kind, income before or after tax, or even income into the future (Gasson 1973). Distinctions can also be made between types of profit—one aimed at maximising gross margins and the other at maximising return on capital, which is usually the most important for the farmer (Sumpsi, Amador & Romero 1997).

Simon (1977) suggested that profit-maximisation is an unrealistic hypothesis because it is not possible to gain perfect information. Ilbery (1982) suggests that Simon's concept 'satisficing behaviour' is central to any discussion of the goals and values of farmers. This concept recognises that the individual does not pursue the best possible choice

among alternatives but, when making decisions, only continues searching until the first satisfactory option is found. Gasson (1973) suggests that this concept could be used to replace the idea of profit maximising. But the problem with this theory is that it does not identify the influences impacting on farmers' behaviour, even though it does a good job of explaining the way that decisions are made as a result of those influences.

An exclusive focus on profit-maximisation is not an adequate explanation for farmers' behaviour, although it would seem that their behaviour, to some extent, can still be explained using an economic approach. Even the term 'rational economics' has been criticised: "[T]he appropriation of the word 'rational' to describe the basic postulates of orthodox economic theory was a propaganda coup of the highest order" (Ormerod 1994, p. 111). In economics the meaning of the term "rational behaviour' is that individuals maximize some target function subject to the constraints that they face in pursuit of their self-interest. This is their utility function and is described in the theory of (subjective) expected utility (Savage 1954). Using this approach many apparently non-economic goals can be redefined as economic goals. Petrini cited in (Gasson & Errington 1993) gives an example where a seemingly non-economic goal such as an increase in leisure could be redefined as minimisation of effort. Gasson maintains that "for the purpose of explaining farmers' behaviour, economic theory is intellectually satisfying but not particularly convincing" (1973, p. 524). Gasson (1973, p. 522) offers further criticism of the economic approach suggesting that the sophisticated models of human behaviour are "built on an heroic assumption about human motivation and to this extent are removed from reality". Vanberg (2004, p. 4) also suggests that these models are "in such apparent conflict with behavioural reality that it is rarely ever claimed to be descriptive of actual human behaviour". Simon offers an explanation for the reliance on economic models when he states:

> We might ask why economists don't take the next step and test these hypotheses, go out and see what the world is like. You can talk to union people, and ask them what they understand about the economy. There are all sorts of skills for asking people about their beliefs, attitudes, hopes and lots of other things. You can ask businessmen how they go about making their decisions. You can ask what they think is going to happen in the next three months. By and large the economics profession has been very leery about going out and posing these kinds of questions... But most economists have found that empirical work of that kind is rather arduous and messy and that it's more fun to play with theory (Simon 1997, p. 407).

Even with these criticisms the notion of *Homo-economicus*, or 'economic man', described in the orthodox economic models does have something to offer in that it is an "ideal type, useful for purposes of argument but not encountered in real life" (Gasson & Errington 1993, p. 89). The 'ideal types' postulated in these models do not capture the diversity of farmers' behaviour; instead they rely on the behaviour of farmers in aggregate to represent the type (Gasson & Errington 1993). Ormerod criticises this approach suggesting that orthodox economic models are not able to adequately describe the behaviour of individuals because:

> [T]he behaviour of the system may well be quite different from what might be anticipated from extrapolation of the model of behaviour of individuals. Individual behaviour does not take place in isolation. On the contrary there are impacts on the behaviour of other individuals, which in turn cause feedback elsewhere in the system, and so on and so forth. Behaviour is altogether too complex to be captured by a mechanistic approach (Ormerod 1994, p. 37).

The complex decision-making processes of farmers are not easily modelled by the traditional methods used by agricultural economists. They do not take into account that farmers' behaviour is influenced by socio-economic as well as psychological factors (Willock et al. 1999a). An illustration of the importance of psychological influences is found in interviews that took place with irrigators in Northern Victoria (Bjornlund 2005; Tisdell & Ward 2003). These farmers were reluctant to sell their water entitlements because they have always viewed the water as being connected to the land. This belief could be a historical artefact (because it was always like that) or as a result of a more deeply felt cultural and psychological beliefs. Solano et al. (2001) suggests that the available empirical evidence shows that both economic and non-economic goals can co-

exist in the farmer's mind but suggests that the existing research is inconclusive as to whether economic or non-economic goals are the predominant influence on farmers.

It could also be that it is the person's goals interacting with the constraints of the environment that have led to their behaviour (Gasson 1973). Even though it might seem as controversial in economics, the context of the behaviour does matter (Berg 2003). The problem with trying to model farmers' behaviour is one of oversimplification, caused by excluding "[t]he institutional setting, the historical experience and the overall framework of behaviour" (Ormerod 1994, p. 14).

This oversimplification is one of the main reasons for the popularity of the orthodox economic approach; it is inherently simple and easy to understand, especially for busy politicians, their advisors and the voting public. Orthodox economics is intuitively plausible and able to be accepted without the acknowledgement of the complexity of human psychology and sociology required for other approaches (Vanberg 2004). It frames farmers foremost as 'business' people—not as people running a business in the context of their lives. In this sense, then, the economic focus is quite legitimate. It appears as though those constructing the orthodox economic models may not be as concerned with describing or explaining the variety of behaviours of their subjects as they are with the elegance and simplicity of their models. When developing policy prescriptions and interventions for farmers their expected behaviour can more accurately be predicted using an interdisciplinary approach that integrates social, psychological and economic factors.

Despite these and other criticisms, the rational economic approach is still a useful, well-designed tool for answering a range of questions or solving a range of problems. It is a useful tool for addressing strictly economic issues and the economic side of broader issues, but it is not universally applicable because it is limited in its explanatory power by failing to incorporate non-economic factors into its models and theories (Shucksmith & Herrmann 2001; Berg 2003). These models are useful for predicting some aspects of farmers' behaviour in aggregate, although when this is done it is at the expense of recognising variations in the behaviour of individuals. The concern is that individual variations can be extremely important when discussing things such as farm incomes or impacts on the environment. In addition assumptions about behaviour in orthodox economic models are often simplistic and even unrealistic. They can be useful for predicting outcomes, but not for processes; and they are not able to perform either of

these functions very well at times when policies are changing (Shucksmith & Herrmann 2001). Orthodox economics does not attempt to describe how the world operates but rather why it operates the way it does. For example, when economists have attempted to deal with issues such as the diversity of farmers' management behaviour they have focused on how decisions are made rather than why (Gasson 1973), meaning that the orthodox economic approach is trapped in a mechanistic and idealised view of the world that does little to explain the realities of individuals' behaviours (Ormerod 1994). Thompson (1986, p. 41) moves beyond discussing the relative advantages and disadvantages of orthodox economics, suggesting that it is "a modern conceit that agriculture has no moral purpose beyond the economic goals of production and efficiency" and that the most appropriate answer will never be found just "in the right set of economic policies".

Musgrave succinctly describes why profit-maximisation is not of prime importance to most farmers, suggesting that:

> Non-cash benefits gain particular significance in the case of those farmers who stay on in farming despite every (financial) indication that they would be better off out of the industry. For many such people the higher cash benefits outside agriculture are no compensation for the loss of lifestyle that is involved (Musgrave 1990, p. 250).

The literature shows that when orthodox economic theory is applied to farmers it: 1) assumes that profit-maximisation is of prime importance, 2) restricts the definition of profit, 3) ignores the diversity of farmers and their situations, 4) ignores the complexity of human behaviour, 5) ignores non-economic external influences on farmers' behaviour, 6) ignores the influence of other individuals on farmers, 7) assumes single-criterion influences and 8) uses a mechanised and idealised view of the world that ignores the complex interrelationships between influences on behaviour. In defence of orthodox economic theory, it is useful as an ideal type that can describe and, to some extent, explain purely economic phenomena. It is capable, within limits, of predicting responses in aggregate and is simple, easily understood and intuitively plausible.

Values, attitudes and goals

This literature review has suggested that the profit maximization hypothesis has limited usefulness for explaining farmers' behaviour. The values held by farmers towards non-profit-maximising values such as family, land, water, community and lifestyle must also

be considered as important influences on their behaviour. The literature relating to values, attitudes and goals and their influence on farmers' behaviour are therefore examined and discussed as is the literature that categorises farmers according to these values, attitudes and goals.

Values

In a sociological context the Macquarie dictionary defines values as "the things of social life (ideals, customs, institutions, etc.) towards which the people of the group have an effective regard" (Delbridge & John 1998, p.1295). They are related to an individual's core beliefs (Crase & Maybery 2004) or to their "conceptions of the desirable" (Kerridge 1978, p. 62). Garforth & Rehman (2005) simply say that values are what is important to an individual, while Hofstede (1998) suggests that they are the state of affairs that one would prefer. Renner (2003, p.127) defines values as "cognitive constructs that explain an individual's preferences in life goals, principles and behavioural priorities". Values also form "simplifying emotional guides to action based upon long-term processes of conditioning" (Friedman 1987, p. 39). These definitions of values vary according to the extent that they address the two functions that Rokeach (1973) suggests that values serve; one as standards to measure by and the other as motivating forces.

For this research values were simply defined as those things that are important to the individual and related to their core beliefs. It is important not just to define values but also to understand more about how values are formed. It appears that what we value is often derived from how we have acted, as well as vice-versa (Lockwood 1999), while others argue that they are products of our culture rather than actually chosen by us (Garforth and Rehman, (2005).

O'Brien describes how values are formed, suggesting that:

> Values are an enduring concept of worth; they are formed out of a social process of dialogue and debate and influenced by the social, cultural and historical and geographic relationships between society and the individual. They are constructed between individuals and institutions and are informed by ethical and moral judgements and by creating priorities in ideas and belief systems (O'Brien 2003, p. 5).

Understanding values is important for comprehending why farmers behave in the way that they do:

> [t]o understand, therefore, why and how an individual acts in a certain way, his or her values have to be explored. An understanding of these values, that is what is important to an individual, leads to an appreciation of the motives and rationale of the actions taken by that individual (Garforth & Rehman 2005, p. 2).

It is accepted that values lead to behaviour but how this happens is not easily understood. It is suggested that:

> Identifying values most cherished by an individual should enable a reasonable prediction of that individual's action. Yet precisely how individuals come to have the values they do, how these values are ordered, and how they inform action have never been quite clear. At the root of the problem lies the difficulty in identifying values independently of the actions they are supposed to inform (Friedman 1987, p. 56).

When discussing the relation between farm operator values and attitudes to their economic performance, Hobbs (1964, p. 4) suggests that values are "not the concrete goals of action, but rather values are the criteria by which goals are chosen".

Using an onion as a metaphor there are layers or depths of values; on the outer are the values that satisfy the demands of society, while the tightly held, less likely to be shared values, specific to the individual, are on the inside. The outer skin is the one most commonly expressed publicly, but these are not necessarily the values that influence decision-making (Gasson 1973; Ilbery 1982). People may not have distinct reasons for the values that they hold but they have beliefs that contribute to the ordering of those values (Garforth & Rehman 2005). They do not exist by themselves but are organised into hierarchies, or "value orientations". It is this arrangement of values relative to one another that guides how an individual may behave in any given situation (Gasson & Errington 1993). The notion of layers, with public and readily shared values on the outer and private, or hidden values on the inner layer, is explained more in terms of a balance between individual and societal values by Grube, Mayton and Ball-Rokeach who suggest that values are:

> Cognitive representations of individuals' needs and desires, on the one hand, and of societal demands on the other... they are translations of individual needs into a socially acceptable form that can be presented and defended publicly (Grube, Mayton & Ball-Rokeach 1994, p. 155).

Not only are values layered but they are also abstract; they can only be studied indirectly or through verbal responses to questions, which means that identifying values for research purposes is difficult (Gasson 1973). Another problem encountered with the verbal expression of values is that the verbal response may be unreliable. In an interview the interviewees may respond in the manner that they think is acceptable to the interviewer (Kerridge 1978).

In summary, values are limited in number and more permanent than goals (Crase 2002), and have an important role in that they underpin both goals and attitudes (Kerridge 1978; Grube, Mayton & Ball-Rokeach 1994; Willock et al. 1999a).

Attitudes

The Macquarie dictionary defines an attitude as a "position, disposition or manner with regard to a person or thing" (Delbridge & John 1998, p. 62), Hofstede (1998) simply suggests that they are how a person feels about a situation.. This definition was accepted for this study. Attitudes are different to values. Although they flow from values, attitudes are more prescriptive. Attitudes are how a person feels towards a particular issue, problem or practice (Ajzen & Fishbein 1980). This means that it is quite likely that an individual can hold many attitudes (Maybery, Crase & Gullifer 2005) but only a limited number of values (Grube, Mayton & Ball-Rokeach 1994). Unlike values, which are relatively fixed, attitudes can be relatively easily changed. But unless an attitude is changed in the direction of the value underlying it, the attitudinal change may not be enduring (Grube, Mayton & Ball-Rokeach 1994).

Toogood (2003) places a strong emphasis on the influence of values in the formation of attitudes rather than other factors but Willock (1999a) suggest that other factors such as family situations, farmers' goals and the type of farm all play a part in influencing attitudes.

Attitudes by themselves are poor predictors of behaviour. This problem exists because of the over-simplistic modelling of the relationship between attitudes and behaviours. Burton (2004) questions whether it is even appropriate to study the relationship between attitudes and behaviour when it is known to be unreliable. Admitting that the relationship between attitudes and behaviour is complex, and far from a perfect correlation, Willock (1999a) suggests that the attitudes and values held by a person are good predictors of behaviour when used together. The attitudes held by a person will lead to behaviour but is

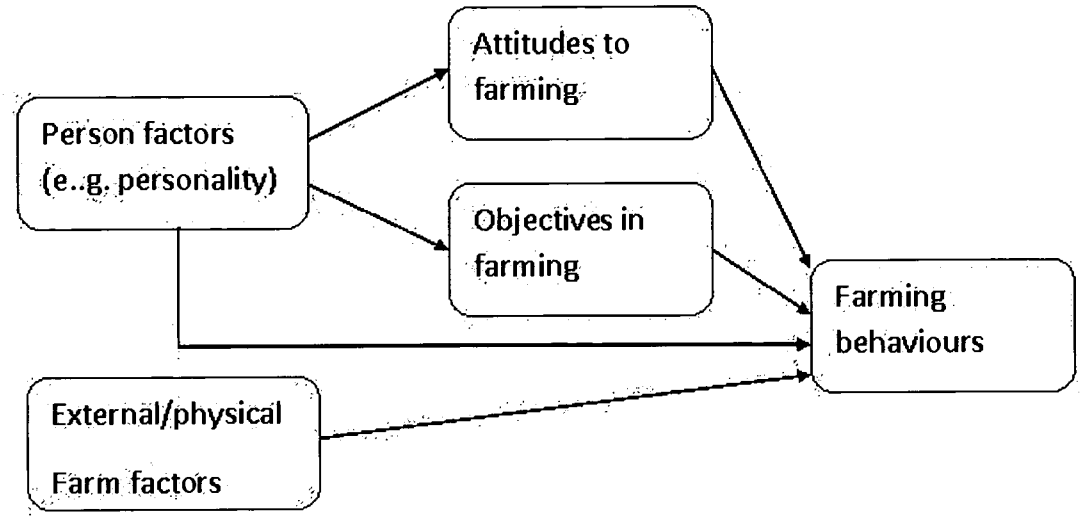
modified by "norms, habits and expectations regarding the outcome of such behaviours" (Willock et al. 1999a, p.288). Ajzen (2001) does not see the need for the combined consideration of attitudes and values, suggesting instead that it is widely understood that attitudes contribute to understanding and predicting social behaviour.

Fishbein and Ajzen's (1975) 'Theory of Reasoned Action' suggests that a person's behavioural intention depends on two things; 1) their attitude towards the behaviour, and 2) their subjective norms (whether the people important to the individual think that the behaviour should be performed). The theory was later revised and developed into a 'Theory of Planned Behavior' (Ajzen 1991) to take into account those times when people intend to carry out a behaviour but are unable to because of their perceived control over that behaviour. According to this theory behaviour is related to three things 1) the persons' subjective norms 2) their attitude towards the behaviour, and 3) the level of behavioural control perceived by the individual. This theory is criticised by those who suggest that some attitudes may also directly influence behaviour (Willock et al. 1999a).

Previous studies of farmers' attitudes have examined their attitudes towards risk aversion, innovation, diversification, off-farm work, environment, production, management, legislation, stress, pessimism and satisfaction from farming (Willock et al. 1999b). These studies have all been conducted with the goal of examining how attitudes relate to profit or production maximization (Willock et al. 1999b). They have not been conducted with the aim of determining the broader role that attitudes might play in influencing farmers' behaviour.

In summary, attitudes are the dispositions that a person has towards a person or thing. They are relatively easily changed and because they are built, in part, on values, they are more numerous than them. Combined with values they can be a good predictor of behaviour. Willock et al. (1999b) (see Figure 4) illustrate how attitudes and objectives are intervening variables that both have an influence on behaviours.

Figure 4: Schematic relationship among individual differences in personality traits, attitudes, objectives and behaviours



(Willock et al. 1999b)

Goals (and objectives)

Objectives have been defined as "...ends or states in which the individual desires to be, or things he wishes to accomplish" and goals have been described as "the tangible expression of objectives" (Gasson & Errington 1993, p. 89). Kerridge (1978, p. 62) defines goals as "conditions or states that an individual wants to achieve". Willock suggests that goals help to establish priorities and focuses attention on the relevant information (Willock et al. 1999b). The Macquarie dictionary defines a goal as "that to which effort is directed; aim or end" (Delbridge & John 1998, p. 477). The Macquarie dictionary definition for objective is "that end towards which efforts are directed; something aimed at" (Delbridge & John 1998, p. 791) and is effectively the same definition as that given for a goal. Although goals and objectives are quite similar they are not quite the same. However, for this study there was no advantage in defining the nuanced differences between goals and objectives. Goals and objectives were therefore treated as being interchangeable and defined as "that end that an individual wants to achieve".

Similar to the onion analogy for values, where personal values are suggested as being on the inside and societal values on the outer (Gasson 1973), goals are also layered. On the surface are social norms, then layered below these are sub-group goals, family goals, with

the deepest and most difficult to elicit being the goals of the individual (Kerridge 1978). Goals may change in response to external events, but it is most likely to be the external goals that change (Gasson & Errington 1993). It could be that it is this layering of goals which is responsible for farmers generally not using objectives in a "clear and structured way" (Willock et al. 1999b, p. 11).

Previous research on farmers' values, attitudes and goals

There has been much work done on investigating the influences on farmers' behaviour. (See Table 5 for some of the more significant contributions). Early recognition of the need to study influences on farmers' behaviour other than profit maximization was made by Ashby (1926, p. 7) who stated that "if the desire for profit or the greatest possible material gain for the least possible effort is not the only or the chief motive actuating farmers it is desirable to enquire what other impulses may be".

Table 5: Previous research into farmers' values, attitudes and goals

Date	Author	Nature of Research
1926	Ashby	Motivations of farmers
1944	Taylor	Comparison of farmer vs. non-farmer attitudes
1973	Gasson	Value orientations
1986	Potter	Identification of intervening variables between socio-personal variables and actions
1994	Perkin & Rehman	Relationship of monetary and non-monetary objectives to farmer characteristics
1994	Fairweather & Keating	Ranking of goal statements to form farming styles
1994	van der Ploeg	Farming styles
1996	McGregor et al.	Link between psychological variables and decision-making
1996	Austin et al.	Interaction between attitudes, objectives regarding farming and personality on behaviour
1999	Willock et al.	Psychological investigation of farmers attitudes
2005	Maybery, Crase & Gullifer	Classification of producer's motives in terms of economic, conservation and lifestyle values
2005	Garforth & Rehman	Survey of influences of values, attitudes, goals and objectives on management decision-making

Table adapted from Garforth and Rehman's (2005) literature review.

Taylor (1944) found that previous research had failed to reveal the real attitudes of farmers. He suggested that farmers are 'provincial' but not 'isolationist', suggesting that the decisions that they made were influenced by the things they valued, such as their homes, morals and national security. These were interesting observations but because they were made shortly before the end of the Second World War, they are also an illustration of the importance of contextual influences on values and attitudes. These attitudes were most likely strongly influenced by the values prevailing during a time of war.

After a period of dormancy, Gasson (1973) renewed interest in the study of farmers' values, attitudes and goals. Her research findings described an ordering process where farmers balance instrumental, intrinsic and social goals, later adding personal goals (Gasson & Errington 1993). Instrumental goals relate to maximising income while intrinsic goals relate to the value of the work. For example, a social goal could be to maintain family tradition, while a personal goal might be to be recognised by others as being a good farmer.

Potter (1986) suggested that attitude surveys, like that done by Gasson (1973), provide one window by revealing farmers' rationalizations, but without examining the linkage between attitudes and behaviour the research was incomplete. He suggested that farmers' actions in maintaining and protecting the landscape were under-researched compared to the work done on understanding their values and attitudes towards the landscape.

Like the earlier work of Gasson, Fairweather et al. (1994) also suggested that farmers aim to balance business and personal goals. Also like the work of Gasson this study only focused on farmers' values without reference to their actual behaviour. They devised a typology of management styles: *Dedicated Producer*— dedicated to producing a quality product, the *Flexible Strategist*—a marketer that is engaged with the external world, and the *Environmentalist*—an environmentally motivated farmer. Each of these types is described according to the most important goal for that type. They found that family was central to all three types, and that profitability was not as central as they expected. They suggested that each type had different understandings of how to balance their business and way of life goals (Fairweather & Keating 1994).

Perkin and Rehman (1994) examined the nature of farmers' objectives and described three composite dimensions; *monetary*, *lifestyle* and *independence. Monetary* related to expansion and growth and developing the family farm income, *Lifestyle* related to the ability to spend time away from farming and take regular holidays, *Independence* related to being one's own boss, not being over committed to banks, and keeping the business in family hands. They suggested that farmers' ranking of objectives depended on the method of elicitation and on the analysis.

Van der Ploeg (1994) took a different approach and developed the idea of 'farming styles', each style being a complex set of notions, knowledge, norms and experiences that informed farmers about how to carry out their activity in a particular area. He suggested that farmers' behaviour can not be understood without understanding the relevant 'farming style'. However, Howden and Vanclay (2000) found that they were unable to support the idea of 'farming styles' in an Australian context. They suggested that the styles didn't just emerge from the research but instead that the conceptual iteration of the styles was influenced by the research process. They suggested that when given the opportunity, farmers adopted the styles as a type of heuristic, but that they didn't identify the styles prior to being given that opportunity.

To explain the influences on farmers' behaviour, Beedell and Rehman (1999) favoured Ajzen's (1991) 'Theory of planned behaviour'. This theory describes behavioural intention as the result of a combination of the individual's beliefs about the likely outcomes, the expectations of others and the individual's perceptions of their ability to control their behaviour.

Austin et al. (2001) extended the work of Willock, suggesting that, apart from profit-maximisation, personality and intelligence also substantially influence farmers' behaviour. Austin et al. (2001) suggest that it is possible that two farmers who are in the same position from an economic utility theory viewpoint will make differing decisions because of their cognitive ability and personality. A farmer's personality has a substantial influence on their decision-making and behaviour and should be considered when seeking to understand their behaviour (Austin et al. 1996; Shrapnel & Davie 2001), or to achieve successful policy interventions (Crase & Maybery 2004).

The work that has been done studying the influences on farmers' behaviour has often arrived at different results because the researchers have used different lenses for viewing

the problem. By providing a diverse range of results, each study, has added to our understanding of the influences on farmers' behaviour.

Relationships between farmers' behaviour and their values, attitudes and goals

As a result of previous research there is now a general consensus that values, attitudes and goals influence farmers' management behaviour. However, this was not always the case as the early attempts to model the relationship between attitudes and behaviour "provided not just poor or low relationships between attitude and behaviour, but none at all" (Beedell & Rehman 2000, p. 119). More recently there has been a greater emphasis on the importance of social and psychological factors as well (Willock et al. 1999a). This added complexity reflects the fact that farmer behaviour is rarely a result of a single category of influences. Schoon and Grotenhuis (2000, p. 18) hint at some of this complexity when they suggest that "[c]ertain more or less broadly accepted values thus influence farmers in a more or less direct way". The relationship between objectives and behaviours is also complex because behaviours are subject to moderation from resource constraints (Gasson & Errington 1993).

Previous research supports the idea that landholder values lead to landholder behaviour (Maybery, Crase & Gullifer 2005) through the role that values play in shaping the farm manager's goals (Olsson 1988). The farm manager needs to act in a complicated environment, so that no behaviour is able to be judged as being necessarily right or wrong; but the behaviour is judged by whether it is in accordance with the manager's values (Olsson 1988).

Although they are relatively fixed values can change. However, goals and objectives, the actual expression of those values, can change much more readily. This can be in response to changes in the external environment or to the farmer's changing internal environment (Gasson & Errington 1993).

Not only is there influence from the external and internal environment, but the occupation of farming itself has an influence on the values that a farmer possesses. This is because "the unique nature of farming gives a certain flavour to the values and objectives of those pursuing the occupation which are then responsible for setting it apart from other types of family business" (Gasson & Errington 1993, p. 91). For other values, regardless of their pre-farming background, farming itself has contributed to shaping their values (and attitudes, goals and objectives). At least some farmers who weren't born into the career

could be expected to hold differing values. It might appear that the values farmers hold may lead them to the selection of farming for their career but this would mostly only apply to those entering farming from another background (Gasson & Errington 1993). The explanation for some of the values held by farmers is that most farmers are born into the career and have internalised the values gained from parents, teachers and peers regarding the career at an early age (Gasson 1973; Gasson & Errington 1993). Producers who choose different production systems, for example alternative rather than conventional agriculture, are likely to have different value systems (Abaidoo & Dickinson 2002). Their values may lead to them adopting the alternative production system, or because they have adopted the alternative production system, they may have changed their values to suit their actions, or a bit of both. This bi-directional interplay between values and management behaviour is demonstrated by farmers awareness of their own values becoming more intense for those who are affected by, or are making, unique decisions, compared to those making repetitive mundane decisions (Ohlmer, Olson & Brehmer 1998).

One explanation for the range of values held by farmers is that they internalise those values that are appropriate to the job and then either discard or ignore those not satisfied by the job (Gasson & Errington 1993). For example, farmers stress the enjoyment they receive from the farming way of life, downplaying the negatives such as the low and variable income in an effort to convince others and themselves, of the value of their work (Gasson & Errington 1993). This approach also fits with farmers' adherence to the protestant work ethic (Weber, M [1904] 1958) whereby they recognise a moral value coming from the hard work associated with their career (Gasson & Errington 1993).

The influence of farmers' values runs deeper than just affecting their individual behaviours. Salamon's (1985) classification of farmers into the 'ideal types' of *Yeoman* and *Entrepreneur*, is according to their goals and is used to describe whole communities not just individuals within those communities.

Objectives and goals give direction to a business. However the relationship between them is complex because behaviours are also subject to moderation from resource constraints (Gasson & Errington 1993). This complexity is also because of the nature of their business; farmers need to combine both business and way of life goals in complex and personal ways (Fairweather & Keating 1994). These goals, which are neither entirely

business nor way-of-life, lead to the possibility of multiple objectives. They may have an objective of maximising profit which may be in conflict with another objective such as being a good land manager (Gasson & Errington 1993).

Economic goals such as increasing farm growth and/or productivity are only some of the goals that farmers have; there are also others such as self-reliance and connection to land and the community (Thompson, P 1986; Vandermersch 2006, p. 14).

The complex and sometimes conflicting goals do not need to appear rational because "[f]armers make choices about farming practices in complex contexts and in the presence of various imperatives. Some of these multi-layered contexts and underlying imperatives may have contradictory effects" (Abaidoo & Dickinson 2002, p. 129).

Researchers generally agree that values, attitudes and goals influence farmers' behaviours. They also suggest that this happens in a complicated environment with influences also felt from external and internal sources. Adding to this complexity is the nature and culture of farming, the actual type of farming being undertaken, and the requirement to balance business and way of life goals. One way to better understand the complexity of influences on farmers is to categorise them into groups of individuals with like values, attitudes and goals and then compare the differing behaviours among the groups.

Categorising farmers

Categorising farmers has usually been done with the aim of being able to better understand them by having separated them into groups of like individuals. Differing approaches have been used, some preferring a dichotomous classification, while others develop complex typologies with numerous types. Gasson and Errington (1993) suggest that one way of making farmers' multiple objectives easier to comprehend is to classify them into more homogenous groups based on their value orientations or their similar objectives, (which is usually according to the researcher's area of interest), and then focus on understanding each group.

Typologies of farmers have been developed, classifying them according to whether they "share similar views, have similar socio-economic characteristics, and make decisions in a similar manner" (Emtage, Herbohn & Harrison 2006, p. 80). By selectively choosing the dimensions used for determining the membership of the groups within the typology,

the area of interest to the researcher can be made much more prominent. It is therefore ultimately a decision that reflects the researcher's and, in some cases, the research sponsor's view of the world (Emtage N 2007). Some conclusions drawn from typologies are therefore likely to be the result of these choices rather than reflecting accurately farmers' management styles (Gasson & Errington 1993). The use of typologies can not only fail to highlight differences between individuals, but they can also lead to researchers ignoring commonalities between individuals, restricting their exploration of interaction between the dimensions that define the types, and mistakenly assuming that there is complete uniformity of values and behaviour within a given typological classification (Fish, Seymour & Watkins 2003).

Salamon (1995) developed the 'ideal types' of *Yeoman* and *Entrepreneur*. Using these types as a way to describe and predict farmers' behaviour, she suggests that the *Yeoman* is a group consisting of traditional family-oriented farmers while *Entrepreneurs* are profit-oriented, business-like farmers. Austin (1996, p. 472) did not find 'ideal types' very convincing, suggesting that "farmers' motives have much more complexity than is explored by the dichotomous classification of such an instrument". Austin et al. (1996) did not find distinct clusters but suggested instead that the labels of *Yeoman* and *Entrepreneur* were still useful for defining directions in the data. They also stated that the choice of method used for analysing self-report survey data "may virtually guarantee" that 'ideal types' are found (Austin et al. 1996, p. 472). As an example they criticise rank ordering of data for imposing a one-dimensional structure on multidimensional data that then obscures the underlying factors and biases results towards typologies.

The work of Taylor et al. (1998), although drawing on the ideas of Salamon, does not find the same grouping. They found that the *Yeoman* and *Entrepreneur* typology was relevant for a quarter of farmers in their study, but proposed that a better way of differentiating farmers was to classify them as either an *Expander* or as a *Conservator*. Their *Expanders* are risk takers with entrepreneurial drive and ambition. Their *Conservators* are hard working, unwilling to borrow money to expand, and prefer to rely on their own resources. They were more likely to have plans in place for retirement. The groups could not be distinguished on the basis of whether they were interested in "reproducing a farmer, or optimising profit" (Taylor, J, Norris & Howard 1998, p. 561).

While these classifications were being suggested others had come to different conclusions about the possibility of classifying farmers and the value of doing so. Even though Willock et al. (1999a; 1999b) see that aggregation of farmers into typologies would be helpful, they found no evidence that this was possible, and suggested that farmers may need to be treated as individuals within any policy models (Willock et al. 1999a; Willock et al. 1999b). Thompson (2002), on the other hand, suggests that grouping farmers into categories is unnecessary, and suggests instead that the simple recognition that there is heterogeneity amongst farmers is the most important thing. While Thompson (2002) criticises the practice of categorizing farmers for hiding the complexity of individuals' multiple objectives research with large samples needs an empirically determined classification system for understanding the data.

Fairweather and Keating (1994) suggest that classifying farmers according to their management styles, such as the *Dedicated Producer*, *Flexible Strategist* and *Environmentalist*, is a more effective way of studying farmers' approaches to management than just examining their individual management goals.

Schoon and Grotenhuis (2000) describe two types of farmer; one an idealistically motivated farmer who is a person that is guided by moral principles, and the other a pragmatically motivated profit maximising farmer who is mainly concerned about the continuation of their business (Schoon & Grotenhuis 2000). The decisions of the latter group are dominated by economic considerations. For example, when considering changing to organic agriculture they would only do so if the financial returns become attractive, even if it were a long-standing belief that they should change.

Maybery, Crase and Gullifer (2005) did not classify farmers but classified their values for their landholdings into three distinct groups as a way of determining where their conservation attitudes might flow from. They identified that economic and conservation values are independent, so that policy approaches which rely on changing the attitudes of the public may need to be different for each value.

Dimension of family

For most of history, and in most places, farming and family have been closely linked. However with increasingly sophisticated technology and mechanisation, the need for more intense management, and a greater emphasis on the needs of the individual, the family farm is coming under increasing financial and social pressure. However, despite

these pressures family farms still dominate the agricultural landscape and are responsible for 76% of the annual farm cash income (Australian Bureau of Agricultural and Resource Economics 2002). The influence of family, and the desire to pass the farm on to family members, is a strong influence on farmers' decisions (Barclay et al. 2007).

Any study of this nature, which investigates the non-profit-maximising influences on farmers' behaviour, will be required to focus on, or at least acknowledge, the role of family as an influence in farmers' management behaviour. It is clear that farmers' decisions are not made in isolation but are influenced by their spouses and other members of the family. All farmers value family to some extent, but express this in different ways (Fairweather & Keating 1994). Farmers take family considerations and aims into account along with other factors such as economic and environmental concerns. This important aspect of farm decision-making is relatively unexplored (Gasson & Errington 1993). Gasson and Errington (1993) suggest that there is a growing trend for farm succession to go to those family members who would be more suitable as farmers, or would be better at running the farm as a business rather than those less skilled in these respects as has been the traditional practice (Gasson & Errington 1993).

For some, the prime objective of the farm business is never only profit-maximisation but rather, the continuation of the business in the hands of family members (Gasson & Errington 1993). A possible explanation for this is that many farm businesses are inherited by the current generation and as a consequence these farmers are interested in passing the business on to the next generation in the same way (Gasson & Errington 1993). However, this desire might also come from a feeling of responsibility towards family— i.e. not to let the farm leave family ownership after previous generations have worked hard to keep it going. Farmers may also see the farm as a family asset, with family being an intergenerational idea. This dual nature of a family farm results in the farmer needing to balance both enterprise and family goals at the same time (Vandermersch 2006). This balancing between profit maximization and passing the business on to the next generation only applies to those with potential, willing successors, and for farm businesses that are financially viable or can be developed to be financially viable within available means.

The result is that the family farm concept is complex, it is a business that is "steered by not one but many objectives, which are held with varying degrees of intensity by different

family members" (Gasson & Errington 1993, p. 110) . This study examines families as an important influence on farmers' behaviour.

There is support for the idea that family influences on farmers' behaviour are much stronger than economic influences. Gasson (1993, p. 112) states that "[r]ational decisions are made within a framework that embraces intrinsic values in farm work, the values of autonomy and family continuity as well as maximising profitability". The prime objective for many farm businesses is not profit-maximisation but rather the continuation of the business in the family (Gasson & Errington 1993) and, in a broader sense, utility maximisation. Fairweather and Keating (1994) suggest that even when the prime goal is maintaining the environment or one's lifestyle an orientation towards business and profit is what makes the achievement of the goal possible.

Values, attitudes, and goals summarised

The literature from the disciplines of ecology (Dent, Edwards-Jones & McGregor 1995), economics (Fairweather & Keating 1994; Gasson & Errington 1993; Gomez-Limon & Riesgo 2004; Ilbery 1982; Vandermersch 2006), psychology (Maybery, Crase & Gullifer 2005), social and health psychology (Beedell & Rehman 2000; Willock et al. 1999a; Willock et al. 1999b), rural sociology (Taylor, J, Norris & Howard 1998), sociology (Vanclay, Mesiti & Howden 1998) and water management (Bjornlund 2002; Kuehne & Bjornlund 2006a, b) suggests that farmers' management responses to any new policy instrument will not be solely influenced by profit maximising. Instead farmers take into account "interwoven economic, environmental, social and cultural goals and values" (Walter 1997, p. 66). They try to maximise their benefits, many of which are non-economic in nature (Kuehne & Bjornlund 2006a). Not surprisingly then, new policies that assume that farmers are motivated solely by profit-maximisation can have unexpected and sometimes undesirable outcomes and impacts.

Even farmers who appear similar in terms of demographic characteristics will make different decisions due to a range of influences. Gomez-Limon and Riesgo (2004) studied irrigators in a homogeneous area of Spain (in terms of soil, climate, age, family size and educational level) and found that their crop planning decisions varied significantly. Their decisions were apparently not influenced by their demographic characteristics. Ilbery (1982) found that farmers, even though they might have very similar types of enterprises will have differing values. Kuehne and Bjornlund (2006b, a) found that irrigators in the

Namoi Valley region of Australia were planning to make different management decisions in response to their impending reductions in water entitlement depending on how they perceived themselves as a farmer, whether as an investor or as a custodian of the land. *Investors* were profit-oriented, needing to achieve the best returns from their water, while *Custodians* were also motivated by a range of non-profit-maximising factors. This meant that maximising the financial returns they received from their water, (by selling it), was not always their primary goal.

Values, attitudes and goals as value domains

Values, attitudes and goals have been defined and discussed individually, but to make this study manageable they are being grouped together into a higher order concept and treated as 'value domains'. This type of grouping is a common practice, with Garforth and Rehman (2005, p. 15) suggesting that a "feature of motives and behaviour studies in agriculture is that the conceptual background is a 'conflation' of attitudes, characteristics, needs and norms of the subjects".

Separately identifying values, attitudes and goals and examining their influence on behaviour is difficult. But taken together, farmers' scores on attitude, objective and behaviour statements can be an indication of their underlying preferences (Vandermersch 2006). Using factor analysis Vandermersch uses the combination of attitudes, goals and objectives as the building blocks to measure what she terms 'preference constructs'.

Vandermersch (2006, p. 20) suggests the preference construct acknowledges the "...complexity of the relationship between attitudes, goals and objectives...". This study takes the view that relationships between values, attitudes and goals is complex and difficult to study when each variable is studied individually, but when combined into a value domain they become useful for predicting behaviour.

Closing comments

This chapter has highlighted what is already known about the influences on farmers' management behaviour other than profit-maximisation, and shows that there are under-researched areas in this topic.

This study differs to those reviewed in this chapter in that it selects and examines the dimensions of land, water, profit, family, lifestyle and community (identified from earlier stages of the research) and their interrelationships, and their influence on farmers'

behaviour in a fashion that has not been done previously. The study does this by first identifying the extent to which farmers are holding values with respect to land, water, profit, family, lifestyle and community then exploring how these values are influenced by the characteristics of the farmers and the properties that they operate, and then exploring in turn whether these individual values influence their management behaviour. It then continues to investigate whether farmers can be grouped based on the interrelationship between these values. The assumption behind this study is that farmers are utility maximisers rather than profit maximisers in that they are trying to maximize their total utility from farming, given all of the values that they are holding, not just one particular value such as profit-maximisation.

The next chapter explains which methods were chosen to first, measure these dimensions, and then secondly to establish their relationship with farmers' behaviour. It also explains why those particular methods were chosen as being most appropriate, and discusses how the validity of these methods is assured.

CHAPTER FIVE

5 Research Design and Methodology

Introduction

The literature review of the previous chapter argued that an exclusive emphasis on profit maximization is not a satisfactory explanation for farmers' behaviour. It showed that others have explored the roles of values, attitudes, goals and objectives as influences on farmers' behaviour. It also showed that the particular combination of values and attitudes concerning land, water, profit, family, lifestyle and community, and the relationships between these values and attitudes, appear to be under-researched. The aims of the present study were to explore the influence of these values and attitudes (and the relationship between them) on farmers' behaviour. To better explore the differences in behaviour, a typology classifying farmers according to how they value these dimensions was also constructed.

The research aims were to, 1) investigate and compare the influence of non-profit-maximising values and profit-maximising values on farmers' management behaviour, and 2) construct a typology that illustrates how farmers' management behaviour differs according to the values that they hold.

The data-gathering methods which were chosen to achieve the research aims were:

- exploratory visits to the region
- a mail-out survey
- personal interviews
- a telephone survey.

The exploratory visits to the region were designed to provide background information, allowing the research to commence with some understanding of the region and to engage potential participants. The mail-out survey was designed to gather demographic, personal and property data and provided a foundation for understanding what type of people and businesses were to be found among the ground water licensees. The survey was also exploratory, giving the respondents the opportunity to bring forward concerns regarding the introduction of the Water Sharing Plans and water reform more generally within Australia. This information was useful for developing trust and credibility; and was used

to build rapport in the subsequent personal interviews with licence holders. Eight open-ended questions were used as a starting point for identifying the non-profit-maximising influences on farmers' management behaviour. The questions sought respondent's views about:

- their actions taken or planned in response to the water sharing plans
- their sources of decision-making information
- their aids to decision-making
- what they would have done differently regarding the implementation of the WSP
- the factors that they considered with their most recent machinery purchase
- the factors they considered when making larger decisions such as farm purchases
- how they would return the country's water use to sustainable levels
- how they would summarise the effects of the water-sharing-plans.

Personal interviews followed the mail-out surveys and were used to reduce any confusion by making survey responses more understandable, and to develop a more intimate understanding of irrigators and their concerns regarding the development of the WSPs.

Information and insights about the practical reality of operating an irrigation farm (only able to be gained from in depth personal interviews) assisted in developing the value and attitude statements for the telephone survey. With this input, participants were expected to perceive the value and attitude statements as being accurate, credible and meaningful.

To further examine the influence of non-profit-maximising factors on farmers' management behaviour the telephone surveys gathered their responses to a series of value and attitude statements. These responses, when analysed, allowed the influences on farmers' management behaviour to be described in the form of value constructs and also provided a way to group farmers according to their values.

Study aims

Because the study was exploratory and iterative in nature the research aims were expected to evolve over the course of the mail-out survey and the personal interviews. After beginning with aims that were broad and unfocused the study aims were expected to become increasingly focused. The initial study aims were:

- ***Aim 1***

Identify and examine those factors in addition to profit-maximisation that influence farmers' management behaviour.

- ***Aim 2***

Provide knowledge of the range of influences on farmers' behaviour useful to those wishing to influence the behaviour of, or achieve more harmonious interactions with, farmers.

- ***Aim 3***

Refine the current understanding of the factors that farmers consider when making decisions.

- ***Aim 4***

Construct a model that incorporates the range of influences on farmers' behaviour.

Prior to the last data-gathering event—the telephone survey—the aims had been more clearly defined and evolved so that they had become:

- ***Aim 1***

Investigate and compare the influence of non-profit-maximising values and profit-maximising values on farmers' management behaviour.

- ***Aim 2***

Construct a typology that illustrates how farmers' management behaviour differs according to the values that they hold.

Study design

The philosophical position for this research is positivism, in that knowledge is based on the senses, or on observation. The positivist approach has an emphasis on behaviour that

can be directly observed. The ultimate aim is to predict, explain and control natural phenomena (Guba 1990). The aims of this approach are to find out what things are really like and how they really work. Personal values and biases are to be controlled and managed so that the researcher "understand[s] fully that their culture, experience, history, and so on impact the research work they undertake and thus the results of their work" (Weber, R 2004, p.vi). Adopting the positivistic approach assumes that "human experience of the world reflects an objective, independent reality and that this reality provides the foundation for human knowledge" (Weber, R 2004, p.vi). The traditional methods of the positivist social researcher include (but are not limited to) survey and interview with the analysis being conducted using descriptive and inferential statistics (Weber, R 2004). Not just limited to quantitative data positivist research also often includes qualitative data (Lin 1998).

The present study used a multi-method and multi-stage approach to answer the research questions. Quantitative methods were used to gather numeric data that compares a smaller number of variables across a larger number of cases. The research also gathered qualitative data, which has more variables but spread over a smaller number of cases (Ragin 1994).

Methodology

The sequence of the research was: (1) initial visits to the region to gather background information, (2) mail-out survey to gather demographic data and licence holders' intended responses to the WSPs, (3) personal interviews to further explore issues raised by the mail-out surveys, and (4) telephone surveys to elicit participants' values and match them with behavioural information.

This exploratory research was needed because not much was known about irrigation in the Namoi Valley, the people involved, the problems they faced, how they responded to the problems, or about the range of non-profit-maximising factors that influenced their management behaviour. Armstrong (1971) suggests that exploratory research is undertaken when there is little prior knowledge and suggests that the polar extreme is 'theory-based' research where much use is made of existing knowledge.

Ragin (1994) suggests that sometimes ideas are deliberately left underdeveloped so that the researcher can be open to new insights, but this was not the strategy in this case – the

idea that farmers' behaviour is influenced by the values they hold toward land, profit, water, family, lifestyle and community was yet to be fully formed. But as it is almost impossible to conduct research without at least having some ideas about the topic almost all research has some component that is deductive (Ragin 1994). Ragin suggests that (1994, p. 15) "...deduction starts with general ideas and applies them to evidence; induction starts with evidence and assesses its implication for general ideas". In this study the researcher's prior understanding and experience of non-profit-maximising behaviour were supported by the evidence that farmers were not always making or intending to make profit maximising decisions.

The mail-out survey was informed by existing theory. It was expected to gather data that would be useful for refining the focus for the further stages of the research. The intent of the mail-out survey was to find out how irrigators intended to respond to the WSP, what pressures they were under and what concerns they had as a result of the introduction of the WSP. It entailed gathering as much information as possible, including personal, property and demographic information within the constraints of the survey instrument. As the focus of the research became clearer some of this information was no longer useful and was not used in further analysis for the purpose of this thesis although it has been published in journal articles (Kuehne, Bjornlund & Cheers 2007), a book chapter (Kuehne & Bjornlund 2006a) and conference papers (Kuehne & Bjornlund 2007).

During the personal interviews the research problem became more clearly defined. A potential hypothesis for further research emerged following the completion of the personal interviews. The telephone survey was based on the developing theory that emerged during the previous stages of the research.

The sample

The population consisted of all those people that held a licence to use groundwater in the Namoi Valley during 2004. The licence holder database was provided by the then NSW Government department DIPNR as a Microsoft Excel file. The file contained licence number, name, mailing address, ground water entitlement amount and ground water usage details for the twelve years between 1991-92 and 2002-03. The total number of entries on this database was 771 but this was reduced to a sampling frame of 659 when obvious duplicates were removed. This was further reduced to a sample of 453 when surveys were returned as address unknown or respondents indicated that certain licenses

could be grouped together or that they did not wish to participate in the research. Prior to the ability to permanently trade groundwater the way to accumulate more water was to purchase another property. This action, and the normal process of farm build-up, has led to a number of farmers having multiple licenses.

Initial visits to the region

The first action undertaken for this study was a brief visit to the region from 22 February to 24 February 2005 to establish contacts with key informants. This was followed by a visit on the 8 April 2005 to conduct an exploratory interview with an irrigator recommended as a key informant to gather background information on the development of the WSPs and the region in general. The manager of Science and Information of the former DIPNR, who was intimately involved in the development and implementation of the WSPs, was also interviewed for historical context. The information gained from these interviews assisted in the formulation of relevant questions for the mail-out survey questionnaire.

Exploratory mail-out survey

The mail-out survey (see Appendix B) was a five-page, thirty-two question survey designed to gather demographic data and identify the planned management response of irrigators prior to the changes associated with the implementation of the WSPs. The survey consisted of twenty-two demographic questions. These were included to better understand who the respondents were. The survey also included ten open-ended qualitative questions related to the development of the WSPs and water reform in general.

The construction and formatting of the questionnaire was done with the aim of making it easy to understand and to fill out. A logical flow was used, with less arduous questions at the beginning and more detailed questions towards the end. The survey was designed to gather introductory and exploratory information. It was also designed to uncover the general concerns about water reform and specific concerns regarding the implementation of the WSPs. This information was then to be related to the demographic data and previously supplied water usage data to better understand how the concerns of survey respondents varied according to their demographic characteristics. Questions were asked about the influences on respondents' decision-making in response to the WSP. Because web-based discussion groups were chosen as a research method questions were also

asked regarding respondents use of the Internet. Respondents were also asked to indicate whether they were prepared to participate in the subsequent stages of the research.

In hindsight the survey can now be criticised for being deficient in some respects, (for example a more detailed exploration of succession issues would have been useful), but it is only the use of the survey and the subsequent research that allows these criticisms to be made. The survey gathered the information that was required at the time.

The survey was piloted with a small number of irrigators with similar characteristics from a similar New South Wales cotton-growing irrigation district. Following this feedback, changes were made to the layout of the survey allowing greater space for responses to the open-ended qualitative questions

The survey was posted to the sampling frame of 659 groundwater licence holders. Over a two-month period the total number of responses reached 261 resulting in an overall response rate of 39%. After duplicate records were amalgamated into single records, and the responses of those indicating that they did not intend to participate in the survey were removed, the response rate fell to 151 or 23% of the total mail-out.

The responses to the qualitative, open-ended questions of the survey were grouped into themes, using a simple cut-and-sort technique with Microsoft Word. While the main aim of the survey was to explore the management response of the respondents, the information that respondents preferred to communicate were perceptions and feelings related to the development of the WSP. The main themes uncovered were:

- criticisms of the NSW Government regarding the WSP consultation process
- criticism of the NSW Government department DIPNR
- uncertainty resulting from not knowing the final details of the WSP, and how it would affect them.

In an effort to further understand the behaviour of licence holders, they were classified into three groups according to their history of extraction from the aquifer (Kuehne & Bjornlund 2008a):

- Inactive (also labelled as 'INACTIVE') — those who had not used any of their water entitlement at any time.

• High HOE (labelled as 'AFFECTED') — those with a high history of extraction, who were facing cuts to their water usage. Their average groundwater use was greater than their entitlement after the implementation of WSP reductions.

• Low HOE (labelled as 'STABLE')—those that, although they were active irrigators at the time, would not be required to make cuts to their water usage. Their average groundwater use was less than or equal to their entitlement after implementation of WSP reductions.

The responses to the quantitative questions of the survey were analysed by using simple descriptive statistics, frequency tables and tests of significance.

Personal interviews

A visit to the region was undertaken over a four-week period to discuss with licence holders the issues identified from the mail-out survey regarding the implementation of the WSP. The mail-out survey had shown that these licence holders were frustrated by the consultation process, confused by the result of the consultation process and uncertain as to their future water entitlements, and consequently, in some cases their future involvement with irrigated agriculture. These were the core concerns for most of the participants in the personal interviews. These concerns formed the reason for approaching the licence holder and are likely to have been why they agreed to participate in the interviews. Every person who was approached for an interview agreed to participate.

To make any progress with communication these issues needed to be acknowledged and discussed first. Because of their importance to the interview participants these issues became the pre-requisite topics that any other communication was built on.

The aims of the personal interviews were to:

• verify and further discuss responses given to the initial questionnaire

• build an understanding of the issues concerning the WSPs, the expected impacts of the WSPs on licence holders, and how these impacts were perceived by licence holders

• indicate the likely anticipated collective responses of licence holders to the WSPs prior to their implementation

- provide background information regarding the operation of an irrigation property, including how it might differ to other common forms of agriculture in Australia
- gather information to avoid redundancy and irrelevancy when designing questions for the telephone survey.

The topics discussed included the:

- consultation process for the WSPs
- development of the problem of over-allocation of entitlements
- recognition and acceptance of the problem of over-allocation
- options for individuals to respond to the WSP
- influences on individuals when choosing which responses to make
- reasons why those responses were made.

The interviews had the characteristics of conversations with a purpose (Berg 1998), but like all interviews they could be criticised because they were inter-personal transactions, subject to 'interviewer effect'. This was, however, deemed of minor importance given their exploratory nature (Hyman 1975).

The theory that the values licence holders hold toward family, land, water, community, lifestyle, as well as profit, is a better explanation for their behaviour than a solitary emphasis on profit maximising was based on the outcomes of the interviews. Consequently, the interviews were not concerned with gathering data to test a theory, but with gathering data to construct a theory. This is what Berg (1998) describes as a research-before-theory model, starting with an idea that leads to a research design, then data collection, theory analysis, and finally findings. None of the interviews were done with the expressed intent of exploring how irrigators value family, land, water, community, lifestyle or profit, as these dimensions had not yet been formally identified as potential influences on irrigators' behaviour. These interviews were what Berg (1998, p. 69) describes as "unstandardised interviews"; there were no standard questions, but

questions were developed during the course of the interview and in response to the interaction with the interviewee.

Because of a concern that the participation of interviewees would be difficult to achieve, and that their engagement would be difficult to maintain, an effort was made to maximize rapport between interviewer and interviewee. Rapport and willingness to take part in the interview is influenced by the characteristics of the interviewer such as "race, gender, ethnicity, style of dress, age, hairstyle, manner of speech and general demeanour" (Berg 1998, p. 76). Conscious effort was made to maximize rapport by selecting appropriate clothing and being groomed in a manner appropriate for this particular rural area.

Appointments for the interviews were made by phone at least twenty-four hours beforehand. Apart from negotiating a time for the interview directions were also obtained to the property. Some properties required travel of about 160 kilometres from the office used as the base for the research, and some were twenty to thirty kilometres from any township.

After the initial handshake and greeting, the conversation typically began with a discussion of those things which were of interest to the farmer at that moment. This included such topics as the weather conditions at that time, the amount of rain that had fallen, or the activities that were happening on that farm at that time. This was done to foster rapport and establish the researcher's credentials as having previously been a farmer. Prior to commencing the interview its purpose was explained as being the gathering of information regarding irrigators' anticipated management responses to the reductions in water entitlements associated with the introduction of the WSP.

Ashworth and Lucas suggest that:

> ...the research interviews have to be introduced to the interviewee as being 'about' something. So there is a necessary presupposition concerning the starting point of research. The researcher and researched must begin with some kind of (superficially) shared topic, verbalised in terms that they both recognise as meaningful (Ashworth & Lucas 2000, p. 299).

Prior to the interview the interviewee was provided with a participant information sheet that described the purpose of the interviews in detail, how they fitted with the larger research project, the benefits to be gained from participation and the confidentiality

procedures that were to be followed. They were also asked to read and sign a consent form if they agreed to participate in the interview.

The interview process was only loosely controlled by the interviewer. As the interviews were exploratory the rationale was that the direction in which the interviewee took the interview would inevitably cover the information and the issues that were of the most importance for them at that time.

Interviews took place in various settings including farm offices, kitchens, living rooms and one in the shadow of a tractor parked in a paddock. The interviewee determined the level of distraction that they were prepared to accept during the interview. Over the course of the interview several busy interviewees answered occasional phone calls. The taping of the interview ceased at these times and resumed with little apparent effect on the discussion. In most cases the interviewer's sense (reinforced by listening to the transcripts of the interviews) was that the interviews would have been perceived by the interviewee as having been enjoyable conversations.

During the visit to the region nine interviews were held with business and industry representatives and seventeen interviews were conducted with ground water licence holders. Three of these interviews were with key informants who were suggested by an irrigation officer based in the study region. They were chosen because of their involvement in the WSP consultation process and their intimate understanding of the issues associated with the WSP. The other interview subjects were selected from those who responded to the mail-out survey because they appeared to have something interesting to contribute or to ensure balance between opinions (Kuehne & Bjornlund 2006b). Undertaken over a four-week period, the interviews were exploratory and unstructured, and aimed to understand the issues from the irrigators' individual viewpoints. Ezzy (2002, p. 80) summarises this approach as being about "listening to their voices, understanding their perspectives and sharing in their problems". The problems associated with the implementation of the WSP—the perceptions of unfairness and the uncertainty of the final impacts on the individuals—were of greatest concern to interviewees at that time and became the natural springboard to wider discussions (Kuehne & Bjornlund 2006b).

After the interviews were completed the first step in the data analysis was taken when the decision was made as to what was transcribed and what wasn't (Miles & Huberman

1994). In this research, interviews that consistently provided important information related to the study aims were fully transcribed, while interviews which were of lesser interest such as those primarily focusing on the technical aspects of irrigation, or the background to the development of the problem, were selectively transcribed. As the interviews were exploratory and took place before the refinement of the theory, much of their content, while providing interesting material, is neither relevant to the developed theory nor does it help in answering the research question (McLellan, MacQueen & Neidig 2003).

This restricted the quantity of data that was included in this analysis to an amount where the power, efficiency and flexibility of a computer-assisted qualitative data analysis program was not of much advantage. Seale (2000, p. 199) appears to endorse a similar approach when he states that using computers for qualitative data analysis is "no substitute for thinking hard about the meaning of the data".

Interviewees provided some information addressing the study aims through chance remarks and offhand observations. This, together with the written field notes, the thoughts and interpretations that were generated after the interviews also contributed to the development of the idea that there were distinct types of irrigators, with differing influences on their management behaviour and consequently differing likelihoods of participating in water markets.

Prior to conducting the interviews with irrigators interviews were also conducted with community members, business people, government departmental staff and academics. These meetings in the form of unstandardised (Berg 1998), face-to-face interviews were arranged and conducted with each of these people or organizations to gain background information on developments within the region and to identify the issues that they saw as being important. These interviews were not conducted to develop the theory dealt with in this research, but to develop an understanding of the region, the industry and the people. This degree of preparation was considered necessary to ensure credibility and encourage acceptance from licence holders when conducting the personal interviews.

These particular people were chosen for their pivotal roles in the WSP development and implementation process, or their insights into the irrigation industry or the region. They included representatives from the following organisations:

- Namoi Water
- NSW Department of Infrastructure, Planning and Natural Resources
- New South Wales Department of Agriculture
- New England North West Area Consultative Committee
- Namoi Catchment Management Authority
- Cotton Consultants Association
- Rural Financial Counselling Services NSW.

Interviews were also conducted with the following individuals:

- Property valuer
- Real estate agent
- Bank manager
- Irrigation consultant
- Academics with research experience in the region.

Telephone surveys

Telephone surveys were conducted with groundwater licence holders. This survey method was chosen because it has a higher response rate than mail questionnaires, and provides a data set with fewer missing values. While face-to-face surveys would have been ideal they would have been prohibitively expensive and time consuming. The sample for the telephone survey was based on those groundwater licence holders who consented to being called by providing their telephone numbers in their returned mail out questionnaires. Gorsuch (1997, p. 541) suggests that "the sample should consist of people similar to those with whom the scale will ultimately be used". The sample was checked for representativeness and found to include irrigators from locations dispersed throughout the region, as well as a representative sample from all of the different major grower types. This meant that the results of the analysis are applicable, at least, to people similar to the groundwater licence holders of the Namoi Valley.

The aim of the telephone surveys (see Appendix C) was to identify the value constructs that farmers held, and to explore the relationships between these and farmers' investment and management decisions. The survey instrument contained twenty-five questions to gather demographic information, twelve questions to gather production data and twenty-four questions soliciting information on past water management actions and irrigators' anticipated future water management actions. The survey also included fifty value and attitude statements against which the respondents were asked to rate their level of agreement using a five-point Likert scale (see Table 6). The five-point scale was chosen because it was expected to be the most acceptable for telephone interviewing, providing data of greater validity (Gorsuch 1997).

The surveys were structured and used questions and statements that were developed from the outcomes from the preceding stages of the research. The value and attitude statements were designed by developing paired statements that best represented the polar views of the two groups identified in the first part of this study: the profit-oriented farmer and the non profit-oriented family farmer. The paired statements were chosen as a first step in developing statements which would be capable of eliciting both strong and weak examples of values, attitudes, goals and behaviour for each of the dimensions of family, land, water, community, lifestyle and profit. The paired statements were used as a development tool, rather than as part of a paired comparison method, so that the relevant statement or statements gave all participants the opportunity to provide a response that fitted with the scale boundaries. A focus group consisting of six agricultural extension professionals was used to further develop these value statements. Their experience of direct contact with farmers was useful in further refining these statements, removing ambiguities and strengthening statements.

The statements related to community aimed to uncover the extent to which business decisions were influenced or not influenced by feelings of commitment or responsibility towards the community.

The lifestyle statements were added to acknowledge that lifestyle issues are becoming increasingly important to many irrigation and farming communities as tensions develop between commercial farmers and lifestyle farmers.

Duplicate, or in other ways redundant, statements were removed. Extra statements were added when further clarification or definition of an area was needed. Fifty final

statements were used; twelve for *land*, ten each for *family* and *profit*, eight for *water* and five each for *community* and *lifestyle*.

The instrument was piloted on a group of irrigators on the Lower Murray Reclaimed Irrigation Area of South Australia between September and October of 2006 (Kuehne, Bjornlund & Cheers 2007), resulting in some revisions being made to the value and attitude statements. The main problems found were with the wording and the tone of the statements. When re-examined, many of the statements were not definitive enough, in that they neither provoked strong agreement nor disagreement. Some statements were worded in such a way that they could be interpreted in an idiosyncratic manner (Gorsuch 1997). Other statements did not help to define potential groups as they were likely to be either acceptable or unacceptable to most people. Gorsuch (1997, p. 541) suggests that "[a]n analysis is enhanced if the sample has a wide variety of people. There should be many who would score low on the proposed scale(s) and many who would score high".

Problems also existed with the first ten statements dealing with family as an influence. These statements would have been difficult to respond to for a range of people who may not have been members of traditional farm families such as:

- single farmers,
- childless couples
- farmers with children who are disinterested in becoming farmers.

These statements were reworded in such a way that these groups could perceive the statement as relating to them. Each of these problems with the survey statements were corrected before the final telephone survey was administered.

Table 6: Value statements used in the telephone survey

Q31 Family should be an integral part of the farming enterprise
Q32 Farming is a business that should not involve family
Q33 My family is fully committed to farming as an occupation and way of life
Q34 Farming is all about conducting a business

Q35 I would like some or all of my family to continue farming
Q36 It is not important to me whether members of my family continue operating the farm
Q37 Farmers should support family members to do the kind of work they are good at whether this is farming or not
Q38 Farmers should consider how their farming decisions will affect their family
Q39 Farmers should encourage family members to be involved in the family farm
Q40 Farmers should encourage family members to get a good education or develop a skill before deciding on their careers
Q41 Profit is important to me, not for its own sake but for its role in achieving farming or family goals
Q42 Financial gain is the only reason for my involvement in farming
Q43 It is best to avoid reliance on financing from banks
Q44 Bank finance is the only way to ensure business growth
Q45 I am only farming to develop a business for myself or my family
Q46 I am only farming because it gives me a good financial return
Q47 I would rather sell off-farm investments at a loss than sell any part of my farm
Q48 Most of the money I make is invested back into the farm
Q49 I always consider alternative places to invest my money other than my farm
Q50 I always invest any money I make where I can achieve the largest financial gain
Q51 It is OK to buy and sell land regularly if it helps me to achieve my farming goals
Q52 Owning my farm means more to me than just an investment
Q53 If I were to sell land I would never consider selling my 'home block'
Q54 I will readily buy and sell any of my land when opportunities arise

Q55 Being involved in farming is more important than owning a particular piece of land
Q56 Owning land provides security for my family and I
Q57 My land is just something I use to generate an income
Q62 My most important goal is to leave my land in better condition for future generations
Q63 I would like to buy or develop enough land for my family to remain or to become farmers
Q64 If my farm doesn't generate a reasonable financial return (compared to alternative investments) I would consider selling it
Q65 Improving my farm if only important because it will increase future sale value
Q66 I consider land values when I make farming decisions
Q67 I believe that my right to use the water also brings with it a responsibility to use it wisely
Q68 I should be able to use my irrigation water however I choose
Q69 People that buy and sell water regularly are just greedy for money
Q70 I would never consider selling any of my water unless it was absolutely necessary
Q71 I would seriously consider selling my water if I was offered substantially more than market price
Q72 If I had unused water I would rather use it to expand my irrigation than to sell it at an attractive price
Q73 If I had unused water I would probably not sell it because I would expect the price to increase in the future
Q74 If I had unused water I would probably not sell it because it is good drought security

Q75 Being a member of my local community is very important to how I think of myself as a person
Q76 I would be very sorry to move away from my local community
Q77 My values and attitudes are similar to most people in my community
Q78 It is not especially important to me whether I am a member of my community or not
Q79 I am an integral part of my local community
Q80 Freedom associated with being ones' own boss is important
Q81 Working outdoors is important to me
Q82 Peace and quiet from living in the country is important for me
Q83 Farm work gives me a real sense of fulfilment
Q84 I find that farming is a stress-free occupation

From a sampling frame of 659 Namoi Valley groundwater licence holders 175 individuals were contacted between 30 November and 11 December 2006, and 157 individuals were contacted between 21 November and 9 December 2007. Of these, 120 did not fit the criteria for participation or refused to participate. The survey was therefore administered to 212 licence holders by telephone. The average length of time taken to complete the 96 survey questions was 17 minutes.

Telephone survey data

The survey data were combined from the two separate telephone surveys. The interviews were conducted by the Ehrenberg Bass Institute and the data were provided by them as SPSS files. The files were generated in December 2006 as a result of the first telephone survey and in December 2007 as a result of the second telephone survey. The second telephone survey was conducted to ameliorate the problems experienced with the small sample size encountered during the analysis of the first survey. Accepting a smaller sample size was initially thought appropriate as some authors (MacCallum, Widaman & Zhang 1999) indicate that a sample size of 121 can be adequate for factor analysis. Some suggest that the prescriptive rules for factor analysis sample sizes have tended to become less stringent in recent times (Costello & Osborne 2005), with minimum acceptable

sample sizes able to be lower when data are stronger. Strong data will lead to factor analysis results that have high communalities, with several items loading strongly on each factor and without items that cross-load (Costello & Osborne 2005). Pett et al. (2003) adopt a pragmatic approach acknowledging that with certain populations it will simply not be possible to obtain a large enough data set. With the original sample size of 121, and data that were not exceedingly strong, it became apparent that the reliability of the results was questionable. The best option became to increase the sample size. Issues with validity were discounted due to the relatively short time frame between the survey events.

After adjusting the two files to allow fields to match up the files were merged. The data were then checked for outliers and for any aberrant entries. Where existing records were available they were used to verify the accuracy of the data. For example the survey questions, "How much groundwater entitlement is attached to this farm business?" and, "Over the last five years what was your average annual usage of groundwater for irrigation?" were checked against groundwater entitlement and usage data from the original contact lists provided by DIPNR. A methodological problem was identified with interviewers using two different types of coding with the question, "Over the last five years what was your average annual usage of groundwater for irrigation". Some interviewers recorded a zero answer as -1, (which was interpreted in the analysis as a missing entry) and some reported it as 0. This inconsistency was able to be addressed by cross-referencing with the original contact and usage details provided by DIPNR, and making corrections as necessary.

Thirteen of the telephone interviewees did not know the quantity of groundwater entitlements that they possessed. Because it is likely that little, if any, permanent groundwater trading had taken place up until the time of the interviews, this information was added to the telephone survey using the data that were provided in the original DIPNR contact list. Reasons for them not knowing the amount of their entitlement could be associated with the entitlement reductions that had occurred with the implementation of the WSP in November 2006, or possibly they may not have known which figure was expected - the pre- or the post-entitlement reduction figure. In addition it is possible that the interviewers, although trained professionals, may not have had a deep enough understanding of the significance of the reductions to have clarified this issue when questions were raised by participants.

Factor analysis

> Factor analysis has been most often applied to samples of individuals to derive general factors of performance, ability, achievement, personality attitudes and so on. The individuals involved in such studies were not of intrinsic interest except in the variance that they contributed to defining the factors (Rummel 1970, p. 490).

Factor analysis was chosen as the method of analysis to discover the latent dimensions within the data by summarizing and reducing it. A small set of variables were combined so that they could explain what was common to the larger set of variables in a more concise fashion. Gorsuch (1997, p. 533) suggests that "[t]he purpose of factor analysis is to identify the fewest possible constructs needed to reproduce the original data".

One of the concerns with factor analysis is ensuring an appropriate sample size. At one time the rule of thumb was that the number of subjects should be ten times the number of items but this is now discounted as being too conservative, with some suggesting that 150 subjects should be seen as a minimum (Gorsuch 1997). The minimum sample size is ultimately determined by the item-factor correlations, so that when correlations are high a smaller sample size is permissible (Gorsuch 1997). Hair et al. (1998) suggest that under fifty observations is inappropriate for factor analysis and that generally the number should be over 100, and that there should be four to five times more observations than there are variables. However, they acknowledge that often practical realities force researchers to accept a 2:1 ratio, although they do warn that, if this is done, caution in interpreting the results is advised (Hair et al. 1998).

The only variables that need to be included in the factor analysis are those that help to define the factor (Gorsuch 1997), therefore it is acceptable to reduce the number of variables in the analysis stage. If it were possible, it would be ideal not to ask participants to respond to items which fail to assist in defining the factor in the first place. This is unlikely, however, as this information only becomes uncovered by asking for the response and then conducting the factor analysis.

One test used for determining the suitability of data for factor analysis is the Kaiser-Meyer-Olkin (KMO) statistic. This measure of sampling adequacy is derived by comparing correlation and partial correlation coefficients (Kaiser 1974; Stewart 1981).

To be acceptable the KMO value should be above 0.5, although values close to this cut-off point should still be of concern. Kaiser (1974) describes the KMO Values in the:

- .90s as marvellous
- .80s as meritorious
- .70s as middling
- .60s as mediocre
- .50s as miserable
- below .50 as unacceptable.

Bartlett's test of sphericity (Bartlett 1950; Stewart 1981; Gorsuch 1997) is used to test the null hypothesis that the variables in the population correlation matrix are uncorrelated (Foster, Barkus & Yavorsky 2005), allowing the null hypothesis to be rejected. When it has significance, this test indicates a strong relationship among the variables and shows that the data are suitable for factor analysis.

After testing the data for suitability for factor analysis, the different methods of factor extraction can all arrive at roughly the same result (Child 2006). Gorsuch (1997) suggests, however, that this is more so when there are over thirty variables and none (or very few) of the variables have communalities less than 0.4. The correlation-focused Principal Axis Factoring extraction method of factor analysis was chosen to identify latent constructs in the form of interpretable factors. The oblique method of Promax rotation with Kaiser normalization was used because the correlation between factors was large enough that covariance between factors was assumed. Within psychology it has been found that oblique rotations provide a "more accurate and realistic representation of how constructs are likely to be related to one another" (Fabrigar et al. 1999, p. 282). Oblique rotation allows but does not require the rotated factors to be correlated with each other. Russell (2002, p. 1635) suggests that one of the consequences of using oblique rotation is that "the resultant factors overlap to some degree in the variance they explain in the measures that are being analysed. In essence, the resultant factors are predictor variables that are not independent of one another."

When oblique rotation is performed a pattern matrix (which is like partial regression standardized regression coefficients) and a structure matrix (which is a matrix of the simple correlations of items with factors) are generated (Pett, Lackey & Sullivan 2003). The pattern matrix is the most commonly used because it allows for the easiest interpretation of factors and the determination of how well the factor structure has been achieved (Rummel 1970; Pett, Lackey & Sullivan 2003).

Internal consistency reliability is commonly tested using Cronbach's alpha coefficient. The Cronbach's alpha scores have been described as "> 0.9 – Excellent, > 0.8 – Good, > 0.7 – Acceptable, > 0.6 – Questionable, > 0.5 – Poor and < 0.5 as Unacceptable" (George & Mallery 2003, p. 231). When data have a multidimensional structure, Cronbach's Alpha will usually be low. Although it is the most commonly used statistic for accessing scale reliability the problem with Cronbach's alpha is that it is influenced by the number of items on a scale (Cortina 1993; Pallant 2001). When working with small numbers of items the Cronbach's alpha value can be quite small. For the purposes of reliability testing fewer than ten items is better tested using the mean inter-item correlation (Pallant 2001). Briggs and Cheek (1986, p. 115) suggest that "the optimal level of homogeneity occurs when the mean inter-item correlation is in the 2 to 4 range". A higher value shows that the construct is narrowly defined and that each item provides little new information above what is already provided by the existing items (Briggs & Cheek 1986; Piedmont & Hyland 1993). When examining factor analysis results the Cronbach's alpha score against each item is the score that would occur for the factor if that item were to be deleted. In the interests of consistency and interpretability, when conducting the Cronbach's alpha testing, items that cross-loaded on more than one factor were allocated to the factor with which they had the highest communality. Others suggest alternative approaches; Pett et al. (2003) suggest that the item should be placed with the factor to which it is the most related conceptually, while others (Costello & Osborne 2005) suggest that the item may be dropped from the analysis entirely.

Principal Axis Factoring was chosen with Promax rotation and Kaiser normalization. The factor scores were then used to conduct cross tabulations and chi-square tests. The results are presented in the next section.

Significance and correlations

Correlation analysis and significance testing were used to assess relationships between this study's variables. The problem with relying only on those relationships that have statistical significance is that it confuses 'statistical significance' with 'practical significance'. Taken by itself all that statistical significance means is that the same results are likely to occur if the study was repeated, it does not mean that the findings are of any importance (McLean & Ernest 1998). Statistical significance is influenced by sample size, which in some cases is simply an indication of the resources available to the researcher. To provide a measure of importance Pearson correlation coefficients were generated. Because these are exploratory analyses, the size of the statistical significance was judged to be of lesser importance than the strength of the correlation. DeVaus (2002) claims that social research can accept lower correlation values than the physical sciences, and suggests that the strength of correlations could be interpreted as: 0 to 0.09 trivial, 0.10 to 0.29 low to moderate, 0.30 to 0.49 moderate to substantial, 0.50 to 0.69 substantial to very strong and > 0.70 very strong. Lutz (1983) provides similar importance rating for correlations (see Table 7).

Child (2006, p. 21) describes the testing for correlations as being about "finding out if two or more variables have something in common and exploring the magnitude and direction of these relationships".

Table 7: Describing the numeric value of a correlation in words

Value	Description
0	No relationship
.01-.10	Very weak
.11-.25	Weak
.26-.50	Moderate
.51-.75	Strong
.76-.99	Very strong
1.00	Perfect association

Table from Lutz (1983)

Cross tabulations

A cross tabulation is a simple technique where results are displayed as a contingency table with each cell of the table displaying a single cross tabulation value. They are a common method for displaying data when investigating associations between two categorical variables (De Vaus 2002). The cross tabulation is easily interpreted by looking at the individual values in each cell and determining if they are different to the expected value. Chi-square is the statistical test used to test for the strength of association in a cross tabulation. This test indicates whether the relationship is strong enough that an inference can be made from the sample to the population.

The chi-square test does have a requirement that no more than twenty per cent of cells have expected cell counts of less than five (Miller et al. 2002) for it to be usable.

To avoid the problem of violating the minimum recommended cell size when using relatively small sample sizes, it is possible to recode data so that categories are collapsed into each other, resulting in smaller numbers of cells for each table, but with the loss of some data. But there are problems with this approach especially when the data become dichotomous:

> ... [W]e should never work with only two categories, Throwing everything into two bins by dichotomizing the data is just about the most severe form of censorship we could impose on the data... a major amount of information is lost by dichotomising the data (Tufte 1969, p. 646).

Babinec and Mehta have a less stringent approach but are still concerned with the effects on the data of reducing the number of categories:

> The problem is that these (and other) rules are sometimes unduly conservative. Once again, it is difficult to find a rule that always holds true. When faced with sparseness, some researchers collapse categories to conform to the above rules. However, collapsing categories cannot be recommended because it can seriously distort what the data convey about associations (Babinec & Mehta 1999, p. 3).

Various tests can be used to test for the statistical significance of the differences between the observed and the expected values in the cross tabulation contingency tables. The most appropriate test for nominal values in a table greater than 2x2 is the Cramer's V. For this

test a value of 0 indicates the absence of any association and 1 indicates perfect association, (-1 indicates perfect inversion) (De Vaus 2002).

Cluster analysis

Because there is heterogeneity amongst farmers the best approach, the approach where the maximum amount of information is retained, would be to treat them all as individuals (Ward 1963). As this is not practical (Dent, Edwards-Jones & McGregor 1995; Vandermersch 2006) except in cases where the sample size is small enough to use case studies, an alternative is to cluster cases into groups of similarly motivated individuals, and then examine how these groups differ from each other. As the 212 cases of this study were too large to examine individually, cluster analysis was was deemed to be the most appropriate method for grouping them into manageable and understandable groups.

Cluster analysis and the factor analysis, which was described in the previous section use the data in complementary, but different ways. While factor analysis groups variables into factors, cluster analysis groups individuals according to their characteristics. Clustering can be used to either condense a sample or to uncover naturally occurring homogenous groups within the data, and it is this last option that is most widely used (Bailey 1975; Aldenderfer & Blashfield 1984). Cluster analysis has no null hypothesis to disprove (Townend 2002) and consequently no right answer. As there are no hypotheses being tested, it is simply a procedure used for searching for patterns in the data in the form of clusters.

Two of the first, and most important, steps when conducting cluster analysis is deciding which variables to include in the analysis, and then choosing which methodology to use for clustering (Dolnicar 2003). A technique commonly used to reduce noise within a data set is to first reduce a large number of variables using factor analysis and then use the associated factor scores as cluster analysis variables. This technique has its critics (Ketchen & Shook 1996), in that "factor analysis tends to blur the relationship" if it is conducted before cluster analysis (Aldenderfer & Blashfield 1984, p. 21). Dolnicar (2003) in a study of 243 business administration journal articles found that 27% used factor analysis prior to cluster analysis. This may provide a poor representation of the underlying data (Hair et al. 1998) resulting in a sub-optimal range of clusters; and according to Dolnicar (2002, p.6) is an "outmoded and statistically insupportable

practice". Adams (2003) suggests that an alternative, and a more appropriate, approach is to reduce the number of variables by taking the means of the variables contributing to each dimension, and then conducting cluster analysis on those means. Factor analysis reduces the number of variables to a smaller number of variables and only explains part of the variance, meaning that a lot of the information in the data is left unexplained (Dolnicar 2003). It is not clear why using factor analysis prior to cluster analysis would be desirable or even why it is so commonly used. The cluster analysis for this study was done on the responses to the value and attitude statements not on the results of the factor analysis.

The ideal number of variables to include in the cluster analysis has not been prescribed, but having fewer variables is better (Dolnicar 2002). Although tempting, there are problems with including all potentially relevant variables in the analysis, in that it can generate results that contain spurious effects (Donoghue 1995). Punj and Stewart (1983) and Hair et al. (1998) also warn against including variables indiscriminately, suggesting that the included variables need to characterise the objects being clustered, and that they need to relate specifically to the objects being clustered. Because of the "heuristic nature" of cluster analysis it is important that the variables chosen relate to the theory behind the intended classification (Aldenderfer & Blashfield 1984, p. 20).

The previous emphasis of variable selection for cluster analysis was primarily aimed at avoiding multi-collinearity but those concerns now appear to have been replaced with an acceptance of "some conceptual overlap and empirical correlation between the constructs" (Homburg, Jensen & Krohmer 2008, p. 137) and a greater emphasis on choosing variables that are not irrelevant to the analysis (Milligan 1996). The users of cluster analysis have become much more aware of the need to choose variables that assist in defining different groups and discarding those that have no role in discriminating between groups (Bailey 1975; Hair et al. 1998). The aim then, is to choose those variables that are capable of eliciting responses that are not common to all cases.

The overall aim of the cluster analysis used in this research has been to expand our understanding of the influences on farmers' management behaviour by placing them into groups and examining the differences in behaviour between the groups. Bailey (1975) explains, however, that it is not correct to say that objects are put into groups, but more correct to say that boundaries are put around similar objects to define groups. Cluster

analysis is an exploratory, pre-theoretical (Bailey 1994), multivariate statistical technique that seeks to maximise the similarity within groups at the same time as it maximises the difference between groups. Because cases in one cluster group are more similar to each other than they are to cases in other cluster groups clustering will be difficult or even impossible if objects are randomly distributed (Bailey 1975). Individuals within groups should have more in common with each other than they have with members of other groups (Adams 2003). Cluster analysis can also be viewed as a "proposition concerning the data" (Anderberg 1973, p. 16) that can possibly point to novel relationships and concepts.

Cluster analysis is criticised for lacking statistical rigour, (it will always provide a result regardless of the number of variables or the sample size and regardless of whether the result is useful), and being vulnerable to the biases of the researcher (Adams 2003; Dolnicar 2003). Because there is a lack of published guidelines and a consequent reliance on rules of thumb, and because it will always provide an answer, results can be misleading (Dolnicar 2003). Questionable standards have arisen in that it doesn't always appear that the exploratory nature of cluster analysis is recognised, or that the reasons for particular results are understood. Some of the benefits of cluster analysis when used for market segmentation such as improved ability to hit the target are just as useful for policy development, but the quality of groupings chosen remains critical for this to be successful (Dolnicar 2003). Two statistical tests are used to evaluate cluster analysis. R-squared tests are used to evaluate the degree of heterogeneity between clusters—a high value meaning effective clustering—and Root mean squared standard deviation tests for the degree of homogeneity of the cluster with a low value meaning higher homogeneity (Vandermersch 2006).

Successful clustering relies on choosing the:

- correct distance measures
- most appropriate clustering method
- right variables to include
- appropriate number of variables per sample size
- right number of clusters

- right methodology (Adams 2003; Dolnicar 2003).

The aim of cluster analysis is to determine the similarity or dissimilarity between individuals, which requires that a choice is made on how to measure the distance between individuals. The most commonly used measure of distance for cluster analysis is Euclidean distance (Adams 2003).

There are a wide number of choices of clustering methods, with most doing an adequate job. Hierarchical clustering was chosen for this study because it does not involve a prior hypothesis (Adams 2003). It is the extent of homogeneity in the data that will determine whether clusters can actually be formed (Bailey 1975). Wards' Method was chosen as the most appropriate method for clustering because of its emphasis on forming groups in a manner that minimises the loss of information (Ward 1963). Accepted as a versatile technique for cluster analysis (Anderberg 1973) it is often used because it finds relatively similarly sized spherical clusters (Aldenderfer & Blashfield 1984) although it does have a flaw in that it is sensitive to effects from outliers (Everitt, Landau & Leese 2001).

The 'right' variables need to be chosen for inclusion in the analysis. "A variable should be included only if strong justification exists that the variable helps define the underlying clustering" (Milligan 1996, p. 348). Social scientists place a strong emphasis on parsimony and endeavour to minimize the number of variables (Anderberg 1973), which then puts pressure on selecting the most relevant variables. Because the presence of extraneous variables can conceal the cluster structure (Vandermersch 2006), variables should be chosen to be good descriptors and rejected if their occurrence appears random (Bailey 1975).

While problems with methodology occur from a small sample size, this is made worse if it also occurs in conjunction with a small number of variables (Dolnicar 2003). Because the technique is primarily exploratory, the literature does not specify a minimum sample size for cluster analysis (Adams 2003).

With no objective and widely recommended way of choosing the right number of clusters, the issue of when to stop clustering needs to be resolved subjectively and according to the goals of the researcher (Bailey 1975; Dolnicar 2003).

If natural groups do not exist in the data, clustering is then a process of creating the most useful segments from the data. A determinant of usefulness is stability and repeatability

(Dolnicar 2003). Dolnicar (2002, p. 10) suggests that "If there is no strong structure in the data—which is typically the case using survey data—many solutions are legitimate if they are useful for industry purposes" (which would also include policy purposes). It is possible that the preoccupation with the number of clusters expressed by some researchers is not useful, and that the "possibility of several alternative classifications, each reflecting a different aspect of the data, is seldom entertained" (Anderberg 1973, p. 15).

Other potential problems with cluster analysis may arise from scale issues. Cluster analysis is sensitive to the measurement scales used for determining variables and discrepancies can occur when those scales are not uniform. This is not an issue with the data of the present study because the variables used in the cluster analysis all use the same scale. Cluster analysis should preferably be done on interval data. Although the Likert-scaled data of this study is ordinal, it is commonly accepted that Likert-scaled data can be treated as though they are interval scales for the sake of the cluster analysis (Adams 2003).

Cluster analysis can be prone to researcher bias because it relies heavily on the subjective input of the researcher. To counter this issue all of the steps in the analysis must be made explicit. Each step in the process needs to be critically questioned with reasons provided for why specific choices are made. To ensure validity the results should be transparently reported and validated in as many ways as possible (Aldenderfer & Blashfield 1984; Dolnicar 2003).

For this study, cluster solutions were based on a combination of: 1) what intuitively made sense from the researcher's understanding of irrigators, 2) the information collected from earlier stages of the study, 3) the literature review, 4) the results of the factor analysis, and 5) examining a dendrogram of the cluster analysis. Cluster analysis dendrograms are useful for illustrating the distinct groups in the data. The distinctiveness of groups can be established by examining the length of the 'branch' (the length of the X-axis) from the time that the cluster first came into existence until the time that it was incorporated into a larger cluster. Longer branches mean that the groups are more dissimilar.

SPSS offers seven hierarchical clustering methods, with Ward's method often being chosen. Morey et al. (1983) suggest that checking the validity of the solutions should be

done by using variables that are different to those used to generate the cluster solution. With this study the checking of the cluster groups' validity was done using the demographic data and the actions and intentions data.

In the absence of any perfect theoretical way of determining the number of clusters (knowing when to stop clustering) the two ways that are used are rules of thumb and statistical tests (Aldenderfer & Blashfield 1984). It may be that "the only way to use the product of cluster analysis effectively is to examine closely the different cluster solutions. Where a substantive meaning can be ascribed to cluster membership, then that is the best judge of the effectiveness of the process" (Pollock, Antcliff & Ralphs 2002, p. 100).

To be useful for this study, the clusters formed from the cluster analysis need to be related to other variables such as the actions and intentions or demographic data:

> Thus, the user of cluster analysis should provide a demonstration that clusters are related to variables other than those used to generate the solution. Ideally, only a small number of variables should be required to classify individuals. This classification should then have implications beyond the narrow set of classification variables (Punj & Stewart 1983, p. 146).

This was done using cross tabulation and significance tests.

Sequence of the research

The initial data gathering began in February 2005 with the initial visit to the region. The data gathering began in earnest in July 2005 with the launch of the mail-out survey and was completed with the final telephone survey of December 2007. To avoid conflicting with periods of busy on-farm activity, and to ensure a better participation rate, the on-farm visits for the personal interviews took place during September 2005.

Initial visits to the region:

1. Arranged meetings with key informants.

2. Conducted unstructured interviews with key informants.

Mail-out survey:

1. Developed a five-page questionnaire.

2. Delivered questionnaire by post.

3. Receive responses to questionnaire by reply-paid mail.

4. After fourteen days non-respondents were identified.

5. Two reminders and one replacement survey were posted to non-respondents over a six week period.

6. Responses entered directly into MS Excel.

7. Excel file exported to SPSS for statistical analysis.

8. SPSS analyses were conducted to provide descriptive statistics, frequency tables and establish relationships between variables.

Personal interviews:

1. Identified potential participants and issues from information gained from the questionnaire.

2. Developed unstructured interview questions from previous analysis.

3. Conducted interviews.

4. Transcribed interviews.

5. Conducted cut and paste coding of interviews.

Telephone surveys:

1. Identified potential interviewees from licence holder database and consent provided from the mail-out survey.

2. Developed a structured questionnaire.

3. Piloted questionnaire as a mail-out survey with the irrigators of the Lower Murray Reclaimed Irrigation Area.

4. Revised questionnaire.

5. Contracted Ehrenberg-Bass Institute for Marketing Science to administer telephone survey using computer assisted telephone interviewing.

6. Received results as an SPSS file.

7. Conducted descriptive statistics, frequency tables, exploratory factor analysis and cluster analysis and cross-tabulation.

8. Decision made to increase sample size.

9. Contracted Ehrenberg-Bass Institute for Marketing Science to administer second round of telephone survey.

10. Examined second data set for compatibility.

11. Results of first and second telephone survey combined.

12. Conducted descriptive statistics, frequency tables, exploratory factor analysis and cluster analysis and a cross-tabulation on the combined data.

Data recording:

Each of the data collection stages used different techniques to record the data:

- mail-out survey respondents returned the survey which provided a paper record
- personal interviews and meetings were recorded as a WAV file using a digital voice recorder and then subsequently stored on CDs
- telephone surveys were conducted using computer-assisted telephone interviewing software and were delivered as a SPPS file, and then stored on a CD.

Assumptions and limitations

Assumptions of the research

Walker (2003) suggests that five assumptions operate for almost all research studies. They are: 1) theoretical fit, which assumes a theory's veracity; 2) conceptual coherence, which is a function of a theory's sensitivity; 3) operational logic, which assumes a method's veracity; 4) empirical evidence, which is a function of a method's sensitivity; and 5) research merit, which assumes the veracity of the substantive phenomenon and that it is worthy of study.

Theoretical fit is assumed when the choice is made to investigate the dimensions of family, land, water, community, lifestyle and profit as influences on farmers' behaviour.

The assumption is that these dimensions can, either individually or in some combination, explain some or all of the behaviour of farmers in addition to that which is attributable to profit maximization.

Conceptual coherence is assumed with the choice of dimensions. The choice of family, land, water, community, lifestyle and profit are grounded in previous research and intuitively plausible. There may be relationships between the dimensions that can be reasonably assumed in the first instance.

Operational logic assumes that the chosen method will measure the right concepts. The assumption is that the value and attitude statements of the survey will effectively measure how participants regard the dimensions under consideration.

Empirical evidence assumes that the methods selected are appropriate and capable of measuring that which is required to test the theory. In this study the selection of methods, sample sizes, data gathering and data analysis are assumed to be appropriate for this purpose.

Research merit is assumed because the results of this study are likely to have a significant influence on the way policy makers and others, interact with farmers when undertaking similar reforms.

Limitations of the research

One of the limitations of this research is that it creates a typology of a particular group of people that is temporally relevant—i.e. it describes how they behaved at the time that the survey was conducted. How people respond to surveys is dependent on the influences they experience at that time from the external environment as well as those from their internal environment. For example, the question in the 'actions and intentions' section of the telephone survey regarding participants' willingness to sell water may have been influenced by the continuing debate in the media on whether the Australian Government should be able to buy water from irrigators to return it to the environment. Alternatively, an irrigator facing financial pressure may have been much more inclined to sell water to reduce debts. Each may have had a similar long-term view of water but would have responded according to the pressures of the moment. This is not to suggest that the research should be seen as unreliable, but rather to suggest that there is value in testing

generalisability by repeating this study in different contexts and at different times and with different samples.

A limitation that could not be controlled was the timing of implementation of the WSPs which had precipitated the 'management response' that is the subject of this PhD. They were initially planned to be implemented on 1 July 2005, but then deferred to 1 July 2006, and then deferred again until finally being implemented on 1 November 2006. In the response to the mail-out survey, and in their personal interviews, licence holders repeatedly drew attention to the negative effects of living with this continual uncertainty (Kuehne & Bjornlund 2006b). It also frustrated this time-limited three-year project, as initially it was anticipated to survey irrigators prior to cuts and then again two years after the cuts had actually taken place. This became impossible due to these postponements and resulted in a change of emphasis of the study.

With the prolonged and at times fractious debate, irrigators were expected to be reluctant to participate in this research. This expectation was confirmed by the return of only 24% of the mailed surveys even with a concerted effort to gain the maximum possible response rate including an interview on the ABC radio program Bush Telegraph and two articles regarding the research in the local Namoi Valley newspaper. It also included a letter of support from Namoi Water, the additional mailing of two reminder postcards and a replacement survey. The response rate is less than half of the 49% response rate achieved from the pilot survey that was sent to 143 irrigators in South Australia's Lower Murray (Kuehne, Bjornlund & Cheers 2007). The pilot survey mail-out also used a similar modified Dillman (2000) survey technique but did not benefit from publicity in the local media that was received for the Namoi Valley mail-out.

Cotton Australia gave clues to the feelings of some of the cotton growers at the time the survey took place, when they suggested that:

> [W]here industries, no matter in what endeavor, are acting within the full right of the relevant laws, working to research and develop technologies that lead to more and further water use efficiencies and are seeking to support and enhance economic, environmental and social outcomes within their own and the broader community, government allows these industries to continue without the continued harassment of vexatious public comment (Rural and Regional Affairs and Transport References Committee 2006).

In any kind of interview and survey-based research there is a risk of researcher bias. In this instance such bias could have occurred because the researcher's values were derived from a twenty-five year farming career. This background could also have introduced bias when conducting the personal interviews. The point of the interviews were, however, not to have interviews that were without researcher bias, but to produce research that was trustworthy through ensuring that the issues of credibility, transferability, dependability, and confirmability were addressed (Lincoln & Guba 1985). Researcher bias could have also influenced the mail-out survey or the telephone survey if the selection of participants did not represent the sampling frame, or the wording of the questions was biased. In these instances being aware of the potential for researcher bias also helped to guard against it.

A limitation of the methodological design which only became apparent towards the end of the study relates to the ability to examine the relationship between farmers and their successors. Had interviews been conducted with both, such as done by Taylor et al. (1998), this important relationship would have become easier to understand. This relationship should be the subject of future research.

This study was also limited by a changing and uncertain external environment. As noted earlier of most concern to licence holders was the continually deferred implementation date for the WSPs.

Strengths

The main strength of this research is that it involved a distinct group of people who were dealing with a clearly defined management problem of deciding how to respond to the introduction of the WSPs, which required serious consideration within the timeframe allocated for the data gathering of this PhD. This study formed part of an ARC linkage grant, which because of the involvement of industry partners, was well resourced.

The researcher has had a twenty-five year career as a 'wheat/sheep' farmer in South Australia. The topic of the thesis has come from his existing interests and observations of farmers during this time. More than just enabling easier access to, and communication with, a disaffected group of irrigators, these twenty-five years of experience were advantageous for understanding how to approach irrigators, communicate with them and interact with them.

Theory development is reliant on the researcher's "skill, fatigue, maturity, cycling of motivation, life cycle interest, insights into and ideation from the data. Generating data is done by a human being who is at times intimately involved with and at other times quite distant from the data ..." (Glaser 1978, p. 2). The ability to be involved in, and yet disconnected from, the research comes from the researcher's combination of a farming career and more recent academic career involving the completion of an MBA with University of South Australia, followed by the opportunity for PhD research. Without a genuine interest in the behaviour of farmers from the researcher this study would have been less successful.

"[P]urposeful enquiry requires some prior interest in the topic under scrutiny. Data create interest only when they relate to a problem" (Steele 2004, p. 1022). But for this to be good science it was important for the researcher to maintain a degree of detachment from the problem with objectivity as a goal (Steele 2004). An advantage of the researcher's familiarity with agriculture is highlighted by Steele (2004) who suggests that the more foreign the cultural customs and conventions of those being studied, the harder it is to understand them.

Ethical considerations

The ethics protocol was approved by the University of South Australia's Human Research Ethics Committee (protocol number P118/05).

For the mail-out survey consent was assumed when the survey was voluntarily returned.

Prior to the personal interviews informed consent was sought by having a University of South Australia approved consent form signed by the participants. Confidentiality and anonymity were guaranteed in the case of the:

- Mail-out survey, by the appropriate handling and storage of returned forms and the absence of personal identifiers in the material.
- Personal interviews and telephone surveys, by appropriate storage of interview files and transcripts and the absence of personal identifiers in this material.

The initial questionnaire was transferred to an Excel file and then stored on a CD. The interview information was recorded by digital voice recorder and transferred to a portable

hard drive. The results from the telephone survey were entered directly into an Excel file which was then stored on CD.

The research data are being stored for a minimum of seven years by the School of Commerce at the University of South Australia as files on CDs. Consent forms from participants are stored as paper records, as are research proposal approvals and the ethics clearance. The approval for the use of the DIPNR licence holder database is stored as a paper record.

Access to the files is only available to the researcher, Kuehne, the supervisors, Bjornlund and Cheers, and the Director and Deputy Director of the Centre for Regulation and Market Analysis, Round and Shanahan.

Closing comments

The data gathering exercise—involving exploratory visits to the region, a mail-out survey, personal interviews, and a telephone survey—which has been described in this chapter has been chosen as the best combination of methods to achieve the aims of this research. The techniques chosen for the analysis of the data, factor analysis for examining the values influencing irrigators, and cluster analysis for grouping irrigators according to how they are influenced by those same values has been described. The aims of the thesis, the resources available, and the nature of the people being researched have all influenced the selection of methods. The next chapter presents and analyses the results that were obtained from the factor analysis.

CHAPTER SIX

6 The Value Constructs

Introduction

The preceding chapter described the methodology chosen for this research. It justified the choice of each method used for data collection: the mail-out survey, personal interviews and telephone survey. It also described the analytical methods used and what tests were performed to ensure validity of the analysis. This chapter presents and discusses the results that were obtained from the first part of the analysis. The results were used to help identify and explore the influence of farmers' values, attitudes and goals with regard to land, water, family, profit, community and lifestyle on their management behaviour. To examine the influences of these values in greater detail, three value constructs were identified and described.

The mail-out survey was exploratory in nature, gathering both quantitative and qualitative responses. The purpose of the mail-out survey was to take the researcher from a provisional to a more robust and reliable understanding of the problems and issues faced by the farmers of the region. The (at that time, soon to be implemented) ground water WSP provided the justification for asking these farmers to respond to the mail-out survey. In their responses, farmers strongly criticised policy makers for taking a 'one-size-fits-all' approach to policy design. The personal interviews with the farmers of the Namoi Valley, like the mail-out surveys, were also exploratory. These interviews further expanded on the results gained from the exploratory interviews and the mail-out survey, as well as the developing literature review. In addition the interviews attempted to uncover areas where the survey was deficient and to identify other areas of interest or relevance for the study. The personal interviews were unstructured and informal, often taking place across the farmer's kitchen table. The initial aim of the interviews was to develop an understanding of the events leading up to the development of the WSPs, the licence holders' understandings of these events, how they were planning to respond to them and what factors influenced their responses.

It became apparent after the seventeen interviews were completed that each of the licence holders had different issues and concerns, they were affected by the WSPs in different ways, and they intended to respond to the WSPs in different ways. This was in part as a result of their past investment decisions and the resources at their disposal; but it also appeared to be guided by their personalities, their values, attitudes and goals. The variety of their circumstances and their intended actions helped to reinforce what one irrigator

termed the "mind-boggling complexity" of the issues associated with water management in the Namoi Valley (Interview 1, 2005).

During the interviews some people emphasised that they would never consider selling their water. Others, however, talked of water more as a tradeable resource that they could use to generate a profit. The question that arose was: "why would some sell their water when offered an attractive price, but others would never consider this"?

Because the interviews were exploratory and unstructured, interviewees mostly did not talk about their values, attitudes, goals or objectives, other than in an oblique fashion. They mostly wanted to talk about the impacts of the WSPs on their businesses and their communities. They freely offered alternative ways to implement the WSPs, which were usually more to their advantage. The interviews were continued until the point that Glaser (1978) calls 'theoretical saturation' was reached—the point at which no further useful information was provided. This usually resulted in interviews that lasted from sixty to ninety minutes. It did not result in a comprehensive investigation into farmers' goals and objectives, but it did provide a useful insight into the heterogeneity of farmers.

The theory of a *Custodian–Investor* continuum to describe farmer behaviour emerged during the initial analysis of the mail-out surveys and during the course of the personal interviews. It appeared that some of the farmers, because of their polarised opinions, could be placed into these two groups with the majority being dispersed between the poles.

The phone surveys were conducted in two stages separated by twelve months. Although not part of the original research plan this increase in sample size from 121 to 212 which delivered improvements to the validity of the analyses. The telephone survey instrument was developed to elicit the values which farmers held and to identify how these values influenced their management behaviour. Other than demographic questions, and questions related to land and water management actions and intentions, the survey also included fifty, five-point Likert-scaled value and attitude statements.

Survey-based research such as this is influenced by the current political, economic and climatic environment. The way that respondents answer questions is likely to be influenced by the context of the research, the economic and policy signals that they are

receiving, and the information they are getting through the media, farmer organisations and the local community. The next section describes the context of the research in more detail.

Study context

Garforth and Rehman (2005) suggest that it is the context of a study that really determines what is actually being measured. With this study there were some prominent external influences that may have affected participants' responses.

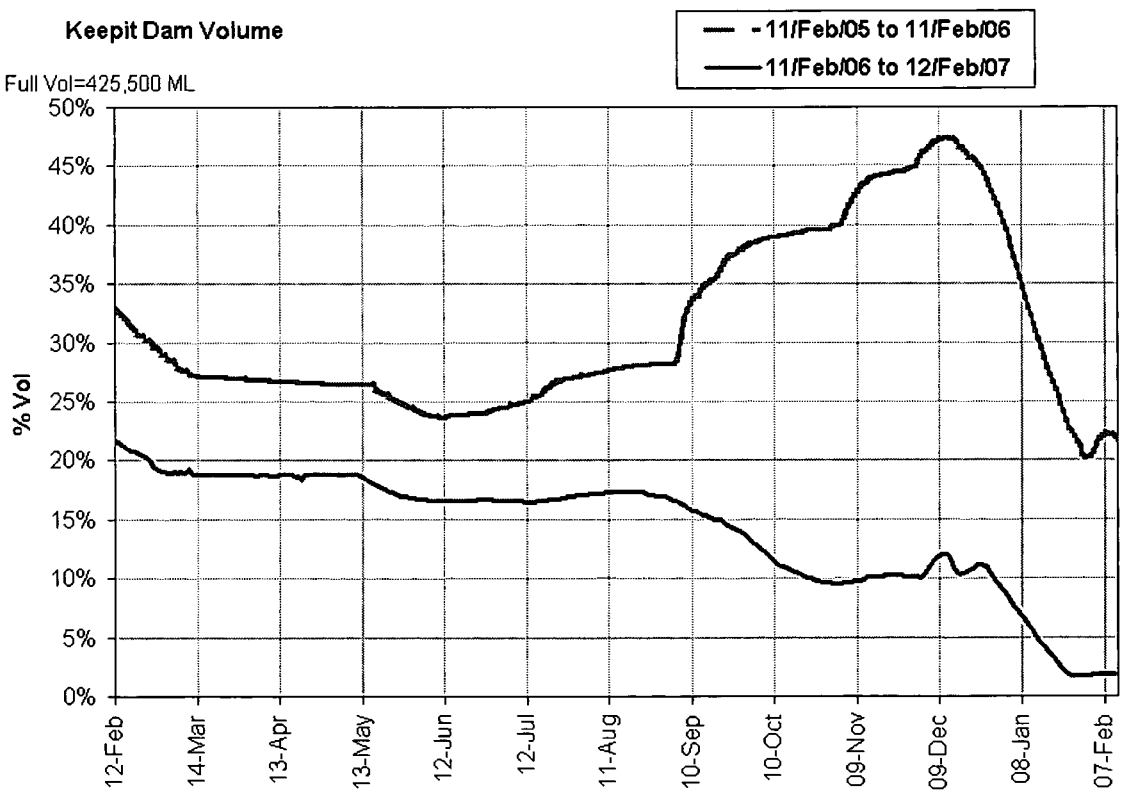
An issue that is top of mind, perhaps because of recent media focus, is likely to become over-represented. A potential example of this is a predominance of replies to question nineteen of the mail-out survey (which asked about perceived threats to the business) suggesting that Occupational Health and Safety (OHS) concerns were one of the most important threats to their business. OHS issues, although obviously strongly felt, were unlikely to have as large a threat to the business as some of the issues identified by other respondents such as low commodity prices or rising input costs.

These farmers appear to have placed such a disproportionate emphasis on OHS as a threat to their businesses partly because the survey took place three months (during July–August 2005) after an April 2005 farmers rally in Sydney protesting against the changes to the NSW OHS legislation. The issue had also been widely discussed in the rural press, and opposition to the proposed laws had been actively championed by the NSW Farmers Association at the time.

The first telephone surveys were conducted between 30 November and 11 December 2006. The second surveys were conducted between 21 November and 9 December 2007. The possible influences on farmers' responses at this time were the continuing drought combined with ongoing low cotton prices. (Unlike other agricultural commodities which often rise in value during times of drought, in Australia the price of cotton is dependent on the world market). The drought, leading to a fall in farm GDP of 10%, was responsible for the poor performance (0.3% growth) of the Australian economy for the September quarter of 2006 (Gittins 2006). The second phone survey was conducted in similar conditions as the previous year's survey—the drought had not lifted, and there had been little change to the price of cotton.

The chart of Keepit Dam storage volumes also illustrates the effects of water scarcity associated with the drought (see Chart 3). While the participants in this research are groundwater irrigators, some of them also use water from Keepit Dam. However, even if they do not use water from the dam, the low storage levels from February 2006 to February 2007 are an indication of the dry conditions in the Namoi Valley catchment at the time of this study. This is relevant because, even for ground water irrigators, dry conditions such as those experienced in drought years need to be countered by the application of relatively larger quantities of water to achieve the full potential from the growing crops. This results in either more expense from pumping extra water (if they have it available) and consequently a less profitable irrigated crop, or smaller areas of crop being grown.

Chart 3: Reducing water availability at the time of the surveys



NSW Government 2002-2005

Planning for the Namoi Valley WSP first started in March of 2001 (Kuehne & Bjornlund 2006b) and, after a contentious and conflict-ridden development period, was implemented in November of 2006 (NSW Government 2008).

The chief executive officer of the NSW Irrigators Council, when discussing the development of the NSW WSPs stated that:

> [I]t's been fraught with difficulties from day one—and bear in mind it's been going in the Namoi for probably five or six years...with two governments involved and a whole raft of industry participants it hasn't been easy. The things that the industry has wanted in we haven't got. Governments have made decisions without reference to industry, so it's not been a good application of public policy from day one (Miell 2006, p. 3).

The reasons why irrigators, and especially cotton growers, could be disheartened and disillusioned are that the "lack of water, low cotton prices and good grain and sorghum prices will see the lowest cotton area in the Namoi since 1975" (Eveleigh 2006, p.63). The NSW Irrigators Council chief executive officer also stated that:

> Water policy reform has been undertaken in the past 3-4 years against a backdrop of drought of record conditions in most of the State's major irrigation regions. This has tended to mask the long-term benefits of water sharing plans and other reform initiatives and instead been largely overshadowed by the industry's struggle to manage seriously low water allocations and other impacts of the drought (Rural and Regional Affairs and Transport References Committee 2006, p.2).

To further define the context within which the phone survey should be interpreted, four in-depth, in-person interviews were undertaken on 8 December 2006, midway through the conducting of the first telephone interviews. Three of the interviewees had already participated in the telephone survey while one was yet to arrange a convenient time. The participants were asked to identify issues that might have influenced the surveys with regard to water and irrigation issues. If the respondents did not identify any influences they were also probed about wider issues such as the drought and the low cotton price.

The interviews were indicative of how irrigators were feeling. Limited to only four people they are not exhaustive of all opinions but are likely to illustrate commonly held opinions. Each of the interviewees had varying concerns about equity issues. One appeared to be entirely focused on his own business and the impacts from the WSPs on the business; another showed a great concern for the effects of the WSPs on the community and those less powerful.

In summary, the concerns of the interviewees and the issues that they thought might have influenced the telephone surveys were:

- drought and the spectre of climate change
- the potential demise of cotton as a publicly acceptable crop for cultivation
- water trading issues that were yet to be resolved
- lack of depth in the ground water markets
- continuing tension between small irrigators and corporate cotton growers
- delayed structural adjustment payments associated with the WSP reductions
- uncertainty over the taxation status of any structural adjustment payments
- continuing belief that Federal and State Governments mishandled the WSP process
- belief that the method of entitlement reduction (HOE) was unfair
- belief that the WSP consultation process was a charade.

Most of these issues were continuing concerns that had existed from the beginning of the research (Kuehne & Bjornlund 2006b).

Categorising farmers' behaviour

The extreme opposite approach to assuming that farmers are homogenous is to see each farmer as unique and therefore requiring individual consideration. While this may be the most accurate representation of the influences on farmers' behaviour, but the resultant complexity makes it unlikely to ever be a useful approach for policy-makers or researchers. These two extreme views are represented by the generalised models used by some economists contrasted with the detailed analysis of the individual's specific behaviour carried out by anthropologists (Dent, Edwards-Jones & McGregor 1995). Fitting between these two approaches are the range of typologies attempting to describe farmers' behaviour by recognising a degree of commonality in their behaviour, but at the same time acknowledging that their behaviour is also dependent on the characteristics of the individual (Dent, Edwards-Jones & McGregor 1995).

Typologies are a useful tool for the study of farmers. They help organise the diversity of factors influencing their management behaviour into groups that can be more easily studied and understood, therefore providing important insights for policy makers when

designing new policies and instruments. To reiterate, the aim of this study is to 1) investigate and compare the influence of non-profit-maximising values and profit-maximising values on farmers' management behaviour, and 2) to create a typology that illustrates how farmers' management behaviour differs according to the values that they hold.

The aim of the typology developed from this research was not to build a model to explain all influences on farmers' management behaviour but rather to make a contribution to knowledge by focusing on under-researched combinations of influences.

The relevance and usefulness of typologies like this depends on the choice of classification variables. Typologies with well-chosen variables have the ability to "improve the understanding and description of the diversity of landholders' values, attitudes, behaviour and socio-economic circumstances in rural communities" (Emtage, Herbohn & Harrison 2006, p. 90).

A number of typologies focusing on farmers' values, attitudes and goals have been developed. These include that of Fairweather and Keating (1994), who classified the goals of farmers in relation to their farming businesses. The three types that they identified were the *Dedicated Producer*, the *Flexible Strategist* and the *Environmentalist.* Salamon (1995), using an anthropological and sociological approach, developed the 'ideal types' of *Entrepreneur* and *Yeoman,* or, respectively, a profit-oriented farmer and a farmer motivated by family tradition. In contrast, Shucksmith and Hermann (2001) used cluster analysis to identify six types of farmers sharing similar backgrounds, attitudes and farms. They identified: *Hobby Farmers*—smaller farmers with low levels of farm income, *Pluriactive Successors*—also smaller farms but with greater income from an inherited farm, *Struggling Monoactives*—medium sized farms with low debt levels and conservative practices, *Contented Monoactives*—larger farms with higher debts and focused on production, *Potential Diversifiers*—similar to previous groups but recent entrants to agriculture, and *Agribusinessmen*—with very large inherited farms with high debt levels (Shucksmith & Herrmann 2001).

Australian researchers have developed typologies that are often very similar to each other and usually include the following types: *Conservatives*, *Hobby-Farmers*, *Progressives*, those who are *Resource-Limited*, and those who are financially *Comfortable* (Emtage, Herbohn & Harrison 2006). Using a psychological and sociological approach, Maybery,

Crase and Gullifer (2005) classified farmers' values into three categories: *Economic*, *Lifestyle* and *Conservation*. They suggested that before introducing new instruments policy makers should understand these categories, the influence they have on the management behaviour of farmers, and how these categories can therefore affect the final impact of those new instruments. Examining irrigators' progression through the structural adjustment process Bjornlund (2002) developed three clusters according to the perceived threats to their viability: *Strugglers*, *Defenders*, and *Comfortable*.

The literature suggests that in determining how farmers are likely to respond to new policy instruments it is important not only to understand the nature of farming, but also the values, attitudes and goals of farmers. The existing literature explores the influence of farmers' values and attitudes on their behaviour but it doesn't explore the influences and the interrelationships of their values and attitudes concerning family, land, water, lifestyle, community and profit in a coordinated and consistent fashion.

Classificatory schemes are useful for simplifying the complexity of farmers' varying socio-economic circumstances, values and capacities provided that they explain a useful proportion of the variance amongst them (Emtage, Herbohn & Harrison 2006). This simplification, in the case of objectives for example, involves scoring them according to their importance, and then investigating differences in scores between differing types of farmers (Gasson & Errington 1993). Another approach is to look for "common characteristics among individuals who share similar objectives" (Gasson & Errington 1993, p. 102). The cluster groups need to be different to each other but the members of cluster groups need to be similar to each other.

Anthropologists, marketing professionals and political analysts have had a continuing interest in clustering the community into discrete groups (Emtage, Herbohn & Harrison 2006). Sociologists have also had a long tradition of attempting to use typologies to group farmers, either by examining goals, values and attitudes or by taking a farming styles approach that relies on taking the "farm structural and technical variables (such as accountancy data) to obtain a basic classification" (Vandermersch 2006, p. 6). There are good reasons for this emphasis on the development of typologies as they avoid the problems associated with a one-size-fits-all approach. However, their use should be undertaken with the recognition that differences exist between people, and that the grouping is only being done because of the impossibility of addressing these differences

individually. Depending on which variables are chosen, typologies can encourage a greater understanding of the interrelationships between values, attitudes and behaviours; which can then be the key to the success or failure of policies and programs aimed at changing landowners' behaviours (Emtage, Herbohn & Harrison 2006).

Typologies have become more popular and more easily constructed due to the ready availability of easy-to-use software that allows complicated cluster analysis calculations. This trend towards making increased use of typologies has also been driven by its acceptance in the field of marketing, where it has allowed marketers to segment the population in ways that allow them to be approached with more accurately targeted marketing offers than previously (Emtage, Herbohn & Harrison 2006).

Australian researchers have chosen differing methods for the development of typologies depending on their favoured theoretical approaches, the researchers' discipline backgrounds, the influences of funding bodies and the research budget (Emtage, Herbohn & Harrison 2006). In general the approach has been to classify people according to whether they share similar views, socio-economic characteristics, business characteristics, and/or decision-making behaviour (Emtage, Herbohn & Harrison 2006).

Whatmore (1994) summarises the different typologies as:

- taxonomic or positivist—based on measurement of data
- relational—defined by the relations between the environment, individuals and institutions
- experiential—defined by interpreting people's reasoning about the meaningfulness of various practices.

Typologies can't be expected to represent every permutation of influences on behaviour (Emtage, Herbohn & Harrison 2006), and may not even be useful over time, as they are only a snapshot. As the criteria from which they are constructed change over time, they need to be updated (Emtage, Herbohn & Harrison 2006), which means that it is often not possible to use existing typologies to make generalisations:

> [T]he applicability of a certain typology seems restricted to a specific research purpose or study objective, and in answering different research questions different typologies would be necessary. The use of groups is restricted to the purpose for which they are designed (Vandermersch 2006, p. 67).

Some suggest that classifying people into groups oversimplifies reality (Fairweather & Keating 1994; Austin et al. 1996; Vandermersch 2006). However, this oversimplification should not be seen as a flaw but as a necessary step of research as it tries to generalise across 'cases' using 'variables', and not real individuals.

Typologies have been used with farmers mainly to "improve the understanding and description of the diversity of landholders' values, attitudes, behaviour and socio-economic circumstances in rural communities" (Emtage, Herbohn & Harrison 2006, p. 90). The relevance and usefulness of a typology is reliant on the amount of variance that it can explain, the selection criteria chosen, and the information that is available to support or explain the types that are found (Emtage, Herbohn & Harrison 2006).

Data analysis summary

This section briefly summarises the data analysis of the mail-out survey, the personal interviews and the telephone survey.

The data analysis of the mail-out survey was undertaken by deciding on the categories of codes for the data, (Miles and Huberman 1994) so that they could then be placed into meaningful groups. This was done by:

- counting the occurrences of categories and examining data for underlying themes (through the examination of patterns) doing a simple cut, paste and sort analysis of the mail-out survey qualitative responses
- drawing conclusions, and exploring the implications of these conclusions
- analysing descriptive statistics, frequencies and significance tests of the mail questionnaires.

The data analysis of the personal interviews was undertaken by:

- categorising personal interview transcripts using scoring procedures and codes, developed from a consideration of the literature and an initial analysis of the first stages of the research.

The telephone survey data analysis was undertaken as follows:

- Factor analysis was used to explore the underlying values embedded in the respondents' answers but was not used to group the respondents. The variables included in each factor helped to describe a value construct expressed by the factor.

- Cross tabulation and chi-square tests further helped in describing the value constructs.

- Cluster analysis was used to cluster respondents into groups.

- Cross tabulation and chi-square tests helped to identify how each cluster group differed in their property and personal characteristics and their management behaviour.

Exploratory mail-out survey analysis

The mail-out survey response rate of 23%, from a distinctly disaffected and in some cases markedly uncooperative group, was considered acceptable. It is most likely explained by the use of a well designed and relatively brief survey, a topic that respondents were strongly interested in at the time, and an introduction to the research through two articles in the local press. Apart from a slightly greater representation from more active water users, the 151 respondents to the survey were similar to the non-respondents. The higher response rate from active irrigators was expected as they have more at stake as a result of the WSP entitlement reductions. Logic suggests that farmers' management responses would be influenced by the degree to which they are likely to be affected by the cuts. To investigate this, the entitlement and usage data provided by the Government was used to classify licence holders into three groups (see Table 8); *Affected*, *Stable* and *Inactive*. These groups were named according to how the WSP was expected to impact on their water use (Kuehne & Bjornlund 2008a).

Table 8: Ground water licence holder groups

Group	Criteria for group membership
Affected	Average groundwater use > Entitlement after implementation of WSP reductions
Stable	Average groundwater use <= Entitlement after implementation of WSP reductions
Inactive	Average groundwater use = 0

The *Affected* irrigators have larger water entitlements and use a higher percentage of their entitlement over a larger irrigated area than the other groups (see Table 9). This group needs to reduce their water use in the future: either because the zone in which they operate is requiring large cuts to achieve sustainability and/or because they have been using a high percentage of their entitlement and now need to reduce their usage to fit with the reductions required in the zone. The *Affected* irrigators have a similar farmed area to the *Stable* irrigators, but have 36% more entitlement and 37% more irrigated area. *Affected* irrigators are more reliant on irrigation while *Stable* irrigators depend more on dry land farming. Each year *Affected* irrigators use nearly four times the amount of water that is used by the *Stable* irrigators, which is a contributing factor to them being placed in the *Affected* group.

The *Stable* irrigators are those that will be able to continue using similar quantities of water as they have in the past, either because they haven't previously used a large proportion of their entitlement, or because their zone is not suffering significant reductions. The *Inactive* license holders are licensed to use ground water but have never done so. These licence holders have smaller entitlements (34% of the size of the *Affected* and 53% of the *Stable* irrigators) which may, in some cases, not be large enough to justify investment in irrigation infrastructure such as water storages, channels and pumps.

Table 9: Land and water use of licence holder groups

Group	Entitlement (ML)	Annual Usage (ML)	Farmed area (ha)	Irrigated area (ha)
Affected	907	551	760	234
Stable	591	146	762	170
Inactive	311	n.a.	443	n.a.
All	713	316	724	199
Note: water usage only refers to groundwater, figures in table are mean figures for group.				

An open-ended question was used in the mail-out survey to seek information on planned management responses to the WSP. The qualitative responses were then grouped into meaningful categories (see Table 10).

Table 10: Planned actions of ground water licence holder

Action	Affected (n=44)	Stable (n=53)	Inactive (n=19)
Buy extra water	41%	13%	21%
Sell or lease out water	-	9%	10%
Sell or lease out land	-	-	10%
Reduce irrigated area or water use	23%	-	-
Change crop types to use less water	18%	-	-
Change irrigation technology	30%	19%	-
Water use efficiency improvements	36%	-	-
Infrastructure improvements	-	24%	-
Diversify away from irrigation	-	9%	-
No action	9%	26%	32%
Don't know	2%	24%	47%
Note – As more than one response is possible total percent can be more than 100			

Many (41%) of the *Affected* irrigators said they would buy more water to avoid owning stranded assets and were therefore not considering selling or leasing their water. To do this they would need to purchase their water either from *Stable* irrigators or from *Inactive* licence holders, but only 10% of *Inactive* licence holders and 9% of *Stable* irrigators were considering selling or leasing their water. Some *Inactive* licence holders indicated that they intended to use their currently unused water in the future. However, if they had not developed their irrigation licence by the time of the survey, it seemed unlikely that they ever would. It was more likely that they were viewing water as an asset; but not as an asset to be traded separately to the farm. It is also possible that they knew that the price of water was likely to rise and they were therefore not in a hurry to sell.

Affected irrigators were planning to become more efficient water users. They were looking at a range of possibilities, including changing what crops they grew, changing their technologies and changing the way they irrigated. Many of them had already made substantial investments to achieve the easiest and most obvious water savings; further efficiency gains were therefore likely to deliver less return on investment, at least at the

going market rate for water. The *Stable* irrigators, because they had not approached the usage limits of their licence, had not previously needed to invest in water-saving technologies or practices; they were therefore likely to have some of the cheaper and more cost-effective options available to them, which the *Affected* irrigators may have already carried out.

As *Affected* irrigators start to offer to pay higher prices for water entitlements *Stable* irrigators might become more likely to carry out water use efficiency improvements to free up water for sale or to use for expansion. The results suggest that irrigators may view a hierarchy of water use efficiency improvements based on the returns from their investment, the total amount of investment required and how close the new technologies and practices fit with their existing way of doing things. However, the pursuit of water use efficiencies can in some cases be motivated by the savings in labour more so than the savings in water.

While some of the actions of the three groups (see Table 10) are not profit-maximising (considering the likely impact that the WSP will have) they could be seen as rational in terms of the farmers' attitudes, objectives and goals and when considering the non-profit-maximising benefits that farmers expect to derive from their profession and lifestyle.

Personal interview analysis

The personal interviews were recorded using a digital recorder and then selectively transcribed—some entirely and others only partially—according to the relevance of the interview content to the research. The transcripts of the interviews were examined and then, using a simple cut-and-sort technique with Microsoft Word, grouped into themes related to values and attitudes.

Each of the initial sources of data (the mail-out survey and the personal interviews) contributed to the development of an initial theory that there were two types of farmers who combine values and attitudes in different ways: 1) *Custodians*, whose management decisions were driven by a desire to conserve the family farming lifestyle and by a greater concern for the long-term sustainability of the land and water resources; and 2) *Investors*, whose management decisions were driven by a determined pursuit of financial gain. Because these classifications were conceptualised as 'ideal types' they were not necessarily expected to exist in reality, but were expected to form the polar opposites of a

continuum on which all cases could be plotted (Weber, M 1978). It was expected that the placement of farmers on the continuum could be predicted by their attitudes to family, land, water, profit and community.

The opposing attributes for each of the classification variables chosen for this typology are the extremes of each type (see Table 11). The variables were developed by a synthesis of the qualitative responses to the open-ended questions of the mail-out survey, the literature and personal experience. During the personal interviews the differences between *Custodians* and *Investors* became quite clear as farmers discussed their attitudes towards land and water mentioning the variable attributes during the course of the interviews.

The link between land and water is recognised by a *Custodian* who says, "some people may want to sell [water]. They may see it as their superannuation. It's going to greatly devalue our properties".

Table 11: Initial typology

Classification variables	***Investor*** attributes	***Custodian*** attributes
Goals / Motivation	Focus on return on investment	Replicate the farm, with children all owning farms
Family objectives	Not focused or dependent on family	Family-centric
Business objectives	Money needs to 'work'	Committed to farming as an occupation and way of life
Business history	Recent entrants and may be new to agriculture and the community	Family-based, possibly multi-generational business
Attitudes to debt	Recognition that large debts can be necessary to ensure business growth	Prefer to avoid exposure to large business debts
Attitudes to water	Resource to be bought and sold	A right and a responsibility, not likely to be sold
Attitude to land	Resource that is tradable, farms will be bought and sold	Desire to leave the land in better condition for future generations

Caring for the land is important to the *Custodian*; one said, "we can keep going ... and really improve the soil over the next ten years... Another ten years and this place is going to be in really good shape. An *Investor* described a contrasting approach to the land stating, "we're using the land as one of our tools to make a dollar; no one will deny that". *Custodians* expect to continue farming, and ideally on the same property. There is pride in the length of time that the family has been farming, and the length of time that the property has belonged to the family; one said, "I was born here, and my father had this

place so the family has been around since the late 1800s". Another *Custodian* made his attachment to the land quite clear, stating, "our attachment to this country is far greater than they [the government authorities] could ever imagine... so [we're] not about to give it up easily ... the perception is that we're a bunch of... wealthy, large... cotton farmers ... but most of us are just ordinary people, just trying to... educate our kids and keep our heads above water". An *Investor* displayed a more pragmatic approach to land, "You've just got to get more and more and more land. You know irrigation is very important to us, it's king, it's king of the castle as far as we're concerned". An *Investor* who stated "we've always been on the lookout for opportunities elsewhere" seemingly could easily leave the farm behind.

For the *Custodian* water is more than a resource to be bought and sold. Talking about the possibility of selling water one said, "it wouldn't enter our head. We said to the bureaucrats and the politicians ... We don't want the money. We want the water... We're here for the long haul. I'm second generation... our son is third. And he's put his name on a bit of land". Some *Custodians* see the water as backup, or protection, to be used as a buffer in drier years. "As we lose our allocation... if the drought hits and we've still got substantial debt or interest rates change, it's going to have a severe impact on us". Some *Custodians* also see their water as a responsibility: "the government has allocated you... so many megalitres, it's your duty to make as much production as possible from each of those megalitres, I think it's your public duty, and I don't think people would argue too much about that". Another *Custodian* shows a sense of stewardship, "If you're being selfish you just think, I'll use it to the end of time, it doesn't worry us, but it does... the aquifer is in trouble". But the *Investor* sees water differently; one stated, "I said to my wife ... that's our super... In another 15 or 20 years when I want to retire to the Gold Coast ... that water licence alone is going to be worth a hell of a lot."

This next section summarises how *Custodians* and *Investors* approach each of the value dimensions. *Custodians* regarded farming as not only being an occupation but also a way of life in which family members should strongly be encouraged to be involved. *Investors* considered farming to be no more than just a business. They saw no need for the involvement of family members in the business. *Investors* believed that family members should obtain a good education and be encouraged to do the work they are good at, whether it involves farming or not.

Investors expected their investment in land to generate an income and were more prepared to freely buy and sell land as opportunities arose. *Custodians* regarded land less as a financial investment and more as something that generated a range of non-commercial benefits. They were likely to demonstrate an attachment to land. For example when selling land, even when it is being done to achieve family goals such as facilitating family members to become farmers, they would never sell their 'home block'.

Custodians had a strong affinity with water, based on a sense of ownership and responsibility. It also involved the conservation of water for future use and the perception of water as an integral part of the family farm. *Investors* believed that benefits were only derived from water when it was being used, and that water was little more than an investment capable of generating financial returns either by its use for irrigation or for trading.

Custodians considered that community was integral to farmers' lives and an important contributor to their identity. Those that belonged to this group believed they had values and attitudes that were similar to other community members and tended to think in terms of what they could do for the community. In contrast *Investors* viewed the community more as a resource to be used.

Custodians viewed profit as being useful primarily for achieving farming or family goals. They also viewed off-farm investments as being of lesser importance than on-farm investments, meaning that profits that they generated were usually re-invested into the farm. *Investors* approached farming as a business that had profit as its main goal. In addition when profits were generated they were then invested to achieve the best financial return.

With further analysis of the personal interviews and further development of the literature review, it became doubtful that farmers would be scattered along the *Custodian-Investor* continuum. Instead it became more likely that farmers hold various combinations of values which could be described as value constructs and that it is possible that their behaviour is influenced by more than one of these value constructs as they aimed to maximize the utility they derive from irrigation.

Following on from the analysis of the personal interviews, the value dimensions of family, land, water, community, lifestyle and profit became more clearly identifiable.

These dimensions were used to develop the value and attitude statements which were the key components of the telephone surveys. The first step in the analysis of the telephone surveys was the factor analysis.

Telephone survey—Factor analysis

Results and discussion of factor analysis

The telephone survey instrument was developed because there was no other existing instrument capable of providing the data that was required for answering the research question. There are two common types of instrument, the criterion-reference framework that measure what a person knows or can do, and the norm-referenced framework that is designed to identify the differences between people in such a way that differing amounts of a characteristic are able to be illustrated as a continuum of values (Pett, Lackey & Sullivan 2003). The value statement of the survey instrument developed for this study was an example of the latter, being designed to gather ratings of participants' degree of agreement, or otherwise, with each of fifty statements. The value and attitude statements were not direct measures that could easily be measured, such as the person's height, but they were indirect measures of an abstract construct and consequently were harder to elicit (Pett, Lackey & Sullivan 2003). By seeking response ratings to the value and attitude statements the survey aimed to elicit the values and attitudes held by the individuals so that they could then be subjected to further analysis.

Exploratory factor analysis—using the method described in the previous chapter— was conducted on the value and attitude statements, which identified three factors. Costello and Osborne (2005) suggest that exploratory factor analysis is not suitable for testing hypotheses or theories but that it was designed, and is still used most appropriately, for exploring data. In this case factor analysis was used to explore the data by looking for the underlying patterns and structure. The process of exploring the data required eight successive attempts at a factor solution before a satisfactory result was achieved.

To check items for factor analysis suitability a correlation matrix was generated with all fifty value and attitude statements. Items that were weakly correlated with other items (with a correlation of below 0.3) were discarded (Pett, Lackey & Sullivan 2003), leaving thirty items suitable for the initial factor analysis.

The factor analysis was conducted using Principal Axis Factoring and Promax rotation. The Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) was considered satisfactory at 0.753. Bartlett's Test of Sphericity was significant, meaning that the data were suitable for factor analysis. Nine factors with Eigen values of greater than one were extracted and accounted for 58.5% of the variance.

By examining the factor structure matrix (Pett, Lackey & Sullivan 2003) the number of items were able to be further reduced, and the analysis was run again. Because low to moderate communalities (of 0.4 to 0.7) are considered to be the norm in the social sciences (Costello & Osborne 2005), items with communalities of 0.4 or less were removed from the analysis. These adjustments resulted in a KMO of 0.753, and seven factors explaining 57.2% of the variance.

After a new factor analysis was conducted with the reduced number of items it was necessary to remove a further two items that had developed communalities of less than 0.4. Six factors were extracted with Eigen values of over 1.0 and accounted for 55.6% of the variance. The KMO had increased to 0.758.

The Factor Pattern matrix was examined and a further three items were removed as they had developed communalities of less than 0.4. The factor analysis was re-run resulting in a slightly decreased KMO of 0.748; but six factors still remained and explained an increased amount of the variance at 59.0%.

Once again the factor pattern matrix was examined and one more item, which had developed a communality of less than 0.4, was removed. The KMO remained similar at 0.747. However five factors now explained 55.7% of the variance.

The factor analysis was performed again with everything unchanged apart from limiting the result to four factors. Cronbach's Alpha scores were generated for all four factors. Two factors were found to share an item, which, when deleted, led to improved Cronbach's Alpha scores for both of the factors. After the item was deleted and the factor analysis was re-run using the remaining seventeen items the KMO dropped slightly to 0.736. What had now become a four factor solution was able to explain 50.8% of the variance.

Another item with a low communality of 0.388, "I am only farming because it gives me a good financial return", was discarded from factor four. The sixteen remaining items were

once again factor analysed. The KMO changed to 0.734. The total variance explained increased slightly to 52.2%. Only four of the factors had Eigen values of over 1.0; meaning that four factors were automatically extracted without the need to specify the number of factors to be extracted. Cronbach's Alphas were generated for all factors and all items.

Examining the Pattern matrix showed that the item "Peace and quiet from living in the country is important to me" no longer contributed to any factor in a substantial way, therefore it was removed and the factor analysis was re-run.

One factor now only had two items, "Working outdoors is important to me", and "Farm work gives me a real sense of fulfilment". A test of reliability was run on the items to examine how strongly correlated they were. As the result of 0.627 was below the suggested minimum of 0.7 for two item factors (Tabachnick & Fidell 1989) these two items were deleted and the factor analysis was re-run. The KMO measure of sampling adequacy for this final factor analysis was 0.730 and Bartlett's test of sphericity was 434.9. There are no definitive guidelines for determining when a satisfactory level of variance has been explained, although the more stringent guidelines of the natural sciences are not appropriate for use in the social sciences. Less than 50-60% appears acceptable, especially when using the Principal Axis Factoring method (Hair et al. 1998; Pett, Lackey & Sullivan 2003). The three factors of the final factor analysis solution (see Table 12) were able to explain 52% of the variance (see Table 13).

The scree plot function of SPSS which graphs Eigenvalues against the factor number was used to check whether the correct number of factors had been extracted (see Chart 4). The three factors that were retained were those that occurred above the elbow of the scree plot; (that point where the slope of the line changes from shallow to steep) (Pett, Lackey & Sullivan 2003).

Table 12: Factor analysis results with communalities and Cronbach Alpha's

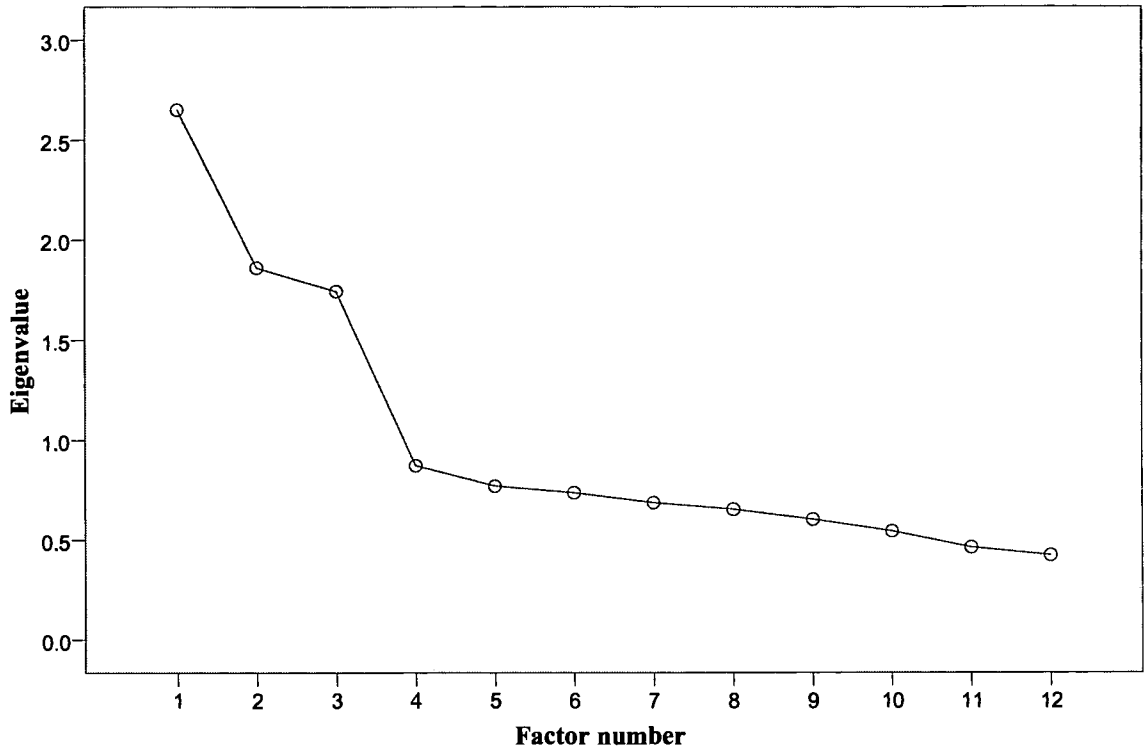
	Variables	Factor Communalities and Cronbach's Alphas					
		Com.[a]	alpha[b]	Com.	alpha	Com.	alpha
Factor A	Family should be an integral part of the farming enterprise.	0.533	0.745				
	My family is fully committed to farming as an occupation and way of life.	0.654	0.704				
	I would like to buy or develop enough land for my family to remain or to become farmers.	0.796	0.703				
	I would like some or all of my family to continue farming.	0.675	0.658				
Factor B	Farmers should support family members to do the kind of work they are good at whether this is farming or not.			0.577	0.602		
	Farmers should encourage family members to get a good education or develop a skill before deciding on their career.			0.579	0.602		
	My most important goal is to leave my land in better condition for future generations.			0.584	0.588		
	I believe that my right to use the water also brings with it a responsibility to use it wisely.			0.552	0.589		
Factor C	I am only farming to develop a business for myself or my family.					0.523	0.469
	I always invest any money I make where I can achieve the largest financial gain.					0.524	0.484
	My land is just something I use to generate an income.					0.455	0.509
	Improving my farm is only important because it will increase future sale value					0.497	0.492
Cronbach's Alpha Score			0.760		0.560		0.466

[a] Communalities, [b] Cronbach's Alpha scores if corresponding variable removed.

Table 13: Total variance explained for the factor analysis

Factor	Initial Eigenvalues			Extraction Sum of Square Loadings			Rotation
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	2.65	22.09	22.09	2.09	17.48	17.48	1.97
2	1.86	15.50	37.59	1.23	10.27	27.75	1.48
3	1.74	14.53	52.13	1.02	8.55	36.31	1.04
4	.87	7.26	59.39				
5	.76	6.41	65.80				
6	.73	6.12	71.92				
7	.68	5.71	77.64				
8	.65	5.43	83.08				
9	.60	5.01	88.09				
10	.54	4.52	92.62				
11	.46	3.85	96.47				
12	.42	3.52	100				

Chart 4: Scree plot of the factor analysis



A reliability test was performed (see Table 14) on the resulting three-factor solution using the SPSS alpha option. Hersen et al. (2003, p. 47) suggest that "[t]he importance of reliability is also relative to the intended use and the potential decisions to be made based on the behavioural data". They suggest that if the data are just being used for research purposes—or at least for psychological research— very high reliability may not be important, however with low reliability only coarse judgements and comparisons are possible (Hersen, Haynes & Heiby 2003). Although *Factor C* has low reliability when using Cronbachs alpha, this same factor was more reliable when using the mean inter-item correlation measure. Using this combination of tests, reliability was judged to be acceptable for this study.

Table 14: Factor solution reliability test

	Cronbach's Alpha	Mean inter-item correlation
Factor A	0.760	0.442
Factor B	0.560	0.242
Factor C	0.466	0.216

Describing the factors

Naming the factors is done to make them easier to work with and understand, but also to aid in communication with others; to achieve this, the names need to make sense and be useful. The names, *Succession, Caretaking* and *Commerce*, were chosen to describe the nature of the factors and to allow others to better understand the value constructs described by the factors (Rummel 1970). The problem with choosing a name for these factors is also described by Rummel (1970, p. 474) when he suggests that they can contain "surplus meaning so that meanings that are irrelevant to the nature of the factor are able to be confused with the intended description of the factor". Even with these potential problems Rummel (1970, p. 475) suggests that factor names "make identification easier and confusion less likely" and that "factor names facilitate analysis if they are clear and simple tags for the concepts involved".

The defining of the three factors began with a subjective assessment of those items contributing to each factor. The labels of *Succession, Caretaking* and *Commerce* were chosen as they give the clearest indication of the value constructs being described.

The *Succession* value construct includes the individual items:

- Family should be an integral part of the farming enterprise.
- My family is fully committed to farming as an occupation and way of life.
- I would like some or all of my family to continue farming.
- I would like to buy or develop enough land for my family to remain or to become farmers.

The variables that contribute to the *Succession* value construct are all related to the family. Those cases that have high factor scores for this factor express family values and attitudes, and describe how they feel about their family, how they think their family feels about farming, and their goals for future development of their farm with acknowledgement of the family's role in it. This value construct is therefore labelled as *Succession.*

The *Caretaking* value construct includes the individual items:

- My most important goal is to leave my land in better condition for future generations.

- I believe that my right to use the water also brings with it a responsibility to use it wisely.

- Farmers should support family members to do the kind of work they are good at whether this is farming or not.

- Farmers should encourage family members to get a good education or develop a skill before deciding on their career.

The variables that make up the *Caretaking* value construct represent the goal of practising good land husbandry, a goal of responsible water use, and a concern that family members obtain skills and education before choosing careers. These are some of the values and attitudes expressed by lifestyle farmers and farmers concerned about conservation. Prima facie these values might best be described by the term *Caretaking*.

The *Commerce* value construct includes the individual items:

- Improving my farm is only important because it will increase the future sale value of the farm.

- I am only farming to develop a business for myself or my family.

- I am only farming because it gives me a good financial return.

- I always invest any money I make where I can achieve the largest financial gain.

- My land is just something I use to generate an income.

The variables making up the *Commerce* value construct are profit-oriented and business-like. The combination of variables suggest that the reason that farmers who strongly associate with this value construct are involved in farming is primarily to conduct a business. They are not sentimental about their farming activities; if they spend money on the farm it needs to return a satisfactory profit otherwise they will invest elsewhere. They do not automatically expect their children to become farmers. This value construct is simply described as *Commerce.*

Each of the items contributing to the individual factors has been useful for describing the three factors (value constructs). The choice of items used for the factor analysis of this study is endorsed by the comments of Hofstede, who states:

> From the point of view of interpretation, the strength of a factor (its percentage of variance explained) tells nothing about its importance unless we are sure that the variables [items] put in were important and representative of the phenomenon we wanted to study (Hofstede 2001, p. 32).

This study's factor solution is plausible because the items contributing to the factors are meaningful and easily interpreted, but it is also important that the factors describe unique constructs. This is checked by testing for correlation between factor scores (see Table 15).

Table 15: Factor score correlations

	Succession	Commerce
Commerce	-0.080	
Caretaking	-0.041	0.136*
*Significant at 0.05.		

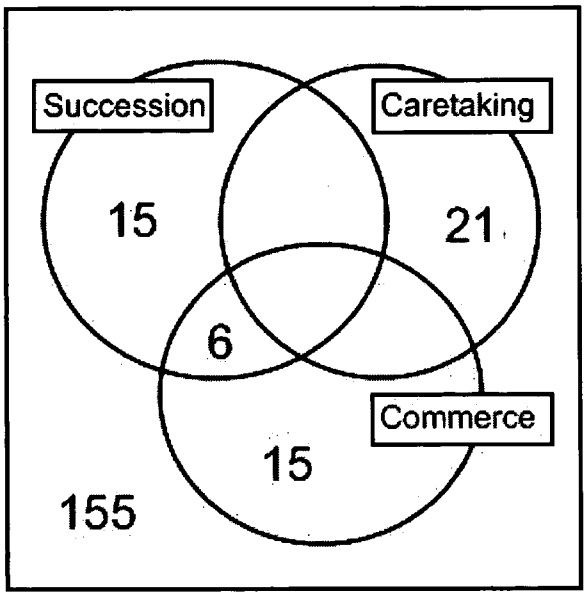
Correlations between *Caretaking* and *Commerce* value constructs (see Table 15) are low to moderate (De Vaus 2002) and have statistical significance. Correlations between *Caretaking* and *Succession* value constructs, and *Succession* and *Commerce* value constructs are very low and are not statistically significant. This shows that the value constructs are almost unrelated and sufficiently independent of each other that they can be seen as describing unique value constructs. This section has described how the value constructs were developed. The next section describes how their characteristics were identified and elucidated.

Working with factor scores

When SPSS calculates factor scores "all of the individuals' scores on the items in the instrument pool are standardized, weighted by a generated factor score coefficient for the factor under consideration, and then summed across all items" (Pett, Lackey & Sullivan 2003, p. 215). The factor scores were made interpretable by dichotomising values either side of a chosen percentile. To examine how the cases associating most strongly with

each value construct (those with the highest factor scores) were distributed; the factor scores were dichotomised using the 90th percentile as a cut-off point (see Figure 5).

Figure 5: Number and distribution of cases above the 90th percentile for each value construct



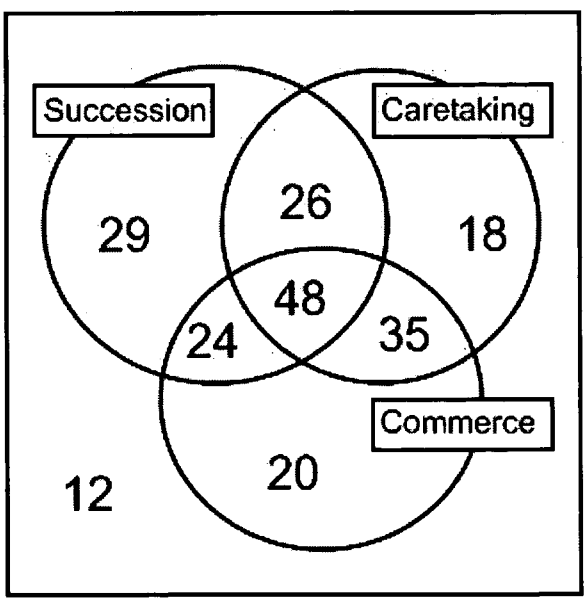
The cases above the 90th percentile group are those 10% of cases that are most strongly associated with that value construct. These cases are quite clear in their value construct preference, although even at this level just over 10% of the cases are influenced by more than one value construct. Some of the strongly associated cases share an influence from the *Succession* and *Commerce* value constructs but not from the *Caretaking* value construct as suggested by the analysis reported in table 15. As the cases with weaker association to the value constructs are introduced to the model (by progressively lowering the percentile cut-off point) the overlap of value constructs becomes much more pronounced, and the value constructs become less clearly defined.

Using the 90th percentile as a cut-off point is useful for illustrating how there are overlaps between value constructs, but a fuller understanding of these three value constructs is gained by examining the values and attitudes of the participants who are most strongly associated with each construct. This is also done by splitting the factor scores into two groups, but of more similar sizes, and then making comparisons between the two. The choice of where to split the factor scores has a strong influence on the subsequent data analysis (see Figure 5). The previous example, using a 90th percentile cut-off point, results in the highest 10% of each factor score being compared with the lowest 90% of

each factor score. This example allowed the value constructs to be very clearly defined. However, using a less extreme cut-off point results in much less clearly defined groups but allows the emergence of the interactions and overlaps between the value constructs that are a much better representation of reality.

There is no convention for the choice of where the cut-off point should be when working with factor scores. Minke (1997) suggests creating two groups, one with negative factor scores and the other with positive factor scores, while De Vaus (2002) suggests dividing factor scores into thirds. For this study the 40th percentile cut-off point was chosen to empirically define those cases that were more strongly, and those case that were more weakly, associated with each of the value constructs (see Figure 6). This cut-off point also offered advantages when dealing with a small sample size. By keeping the groups to similar sizes fewer problems were encountered when using chi-square tests with cross tabulations, as this reduces the possibility that the assumption of minimum expected cell counts is violated. For smaller sample sizes, using similar sized dichotomous groups for the broad picture of interrelationships that they provide seems sensible. However when working with larger sample sizes there may also be advantages in using a higher percentile cut-off point, or the division into thirds that De Vaus (2002) suggests, allowing a more striking disclosure of the characteristics of each value construct.

Figure 6: Number and distribution of cases above the 40th percentile for each value construct



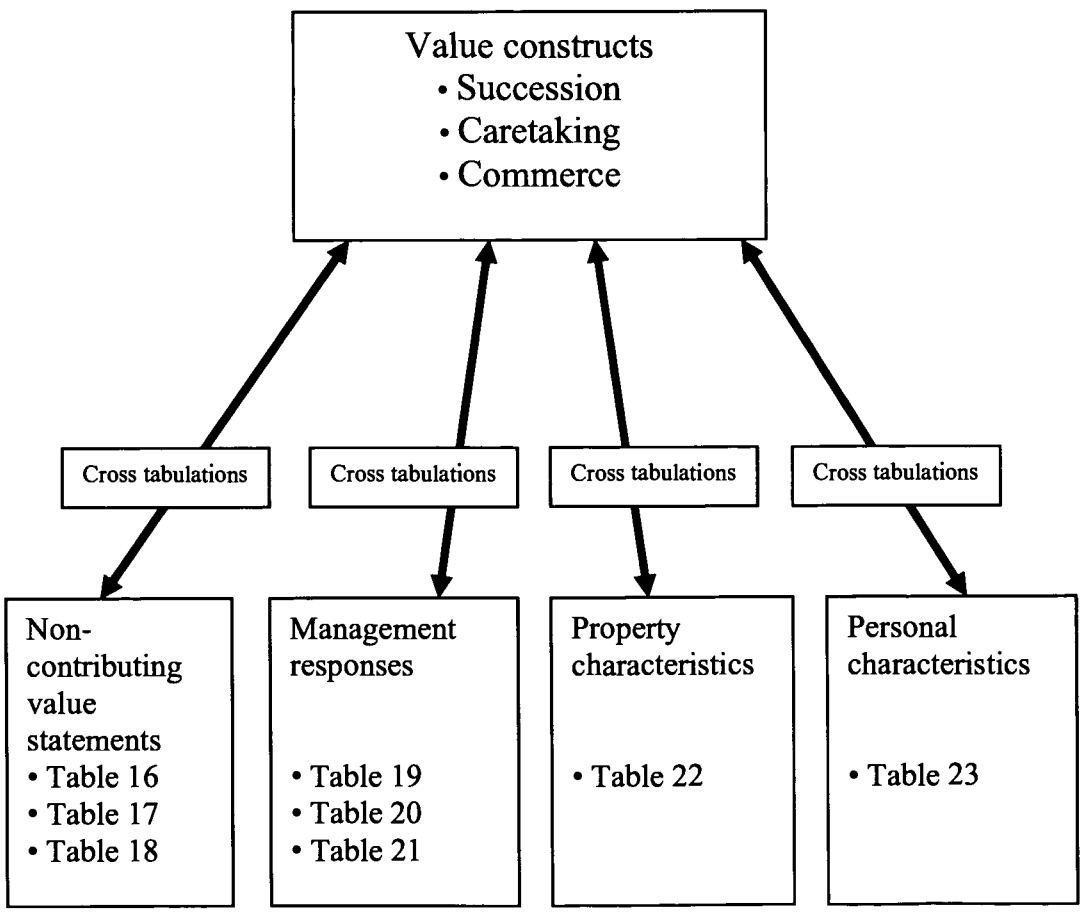
The groups formed above and below the 40th percentile of the factor scores were used as the basis for further analysis using cross tabulations because they gave the most meaningful results. The twelve un-allocated cases of Figure 6 are simply those who have no strong association with any value construct above the 40th percentile.

Figure 6 shows that some cases are influenced by more than one value construct. This finding fits with the observations of Solano et al. (2001) who suggest that even though economic goals are the most important for the majority of farmers, both economic and non-economic goals can co-exist in the farmer's mind. For this study it might be that each farmer has three constellations of values influencing their behaviour. Each farmer has their own configuration of these, with the possibility that their behaviour at a given point in time is explained by how they lean more toward some than they do towards others.

Factor score cross tabulation

To make the values contributing to the factors (the value constructs) more intelligible, cross tabulations were performed between them (see Figure 7) and the non-contributing value and attitude statements, the management actions and intentions data, and the property and personal characteristics data.

Figure 7: Cross tabulations with value constructs



The convention for cross tabulations is to use the independent variable (in this case the cluster group) as the column variable and the dependent variable as the row variable. The choice between row and column percentages is determined by what needs to be found out from the table. In this study column percentages (so that columns add to 100%) have been selected. The table is examined by looking for increases or decreases in the dependent variable between categories of independent variable (Sirkin 2006).

Cross tabulations were conducted to identify how the 60% strongly associating with the value construct differed to the 40% with a weaker association. This was done with all of the value and attitude statements not contributing to the formation of the factors under examination (see Tables 16, 17 and 18). The column headed 'response to value statement' provides participants' mean responses to the value and attitude statements. Cross tabulations were performed on farmers' past and planned farm and water management decisions (see Table 19, 20 and 21) and their demographic and property/production characteristics (see Table 22 and 23). Chi-square tests were carried out to test for the statistical significance of the cross tabulations.

Table 16: Value and attitude statements not contributing to the *Succession* value construct

	Value and attitude statements –***Succession***[a]	Chi-square[b]	Sig.[c]	Response to value statement
Family	Farming is all about conducting a business	4.74	0.093	Agree
	It is not important to me whether members of my family continue operating the farm	20.24	0.000	Disagree
	Farmers should encourage family members to be involved in the family farm	11.30	0.004	Agree
Profit	I would rather sell off-farm investments at a loss than sell any part of my farm	18.03	0.000	Agree
	Always consider alternative paces to invest my money other than my farm	10.09	0.006	Disagree
	Owning my farm means more to me than just an investment	13.15	0.001	Agree
Land	Being involved in farming is more important than owning a particular piece of land	9.08	0.011	Agree
	If I were to sell land I would never consider selling my 'home block'	11.43	0.003	Agree
	Owning land provides security for my family and I	11.90	0.003	Agree
	If my farm doesn't generate a reasonable financial return (compared to alternative investments) I would consider selling it	4.87	0.087	Disagree
	I consider land values when I make farming decisions	4.62	0.099	Agree
Water	If I had unused water I would rather use it to expand my irrigation than to sell it at an attractive price	17.72	0.000	Agree
	If I had unused water I would not sell it because it is good drought security	8.34	0.015	Agree
	I would seriously consider selling my water if I was offered substantially more than market price	6.30	0.043	Disagree
Community	Being a member of my local community is very important to how I think of myself as a person	11.25	0.004	Agree
	I would be very sorry to move away from my local community	4.84	0.089	Agree
	My values and attitudes are similar to most people in my community	7.78	0.020	Agree
	I am an integral part of my local community	4.93	0.085	Agree

[a] 60% highest of saved factor scores for each component. [b]Critical value for chi-square with 2 degrees of freedom and significance of 0.1 is 4.60,[c]Significance.

Table 17: Value and attitude statements not contributing to the *Caretaking* value construct

	Value and attitude statements –***Caretaking***[a]	Chi-square[b]	Sig.[c]	Response to value statement
Profit	Financial gain is the only reason for my involvement in farming	8.50	0.014	Disagree
Land	It is OK to buy and sell land regularly if it helps me to achieve my farming goals	6.20	0.045	Disagree
	I will buy and sell any of my land when opportunities arise	4.75	0.093	Disagree
	Owning land provides security for my family and I	5.19	0.075	Agree
Water	People that buy and sell water regularly are just greedy for money	8.96	0.011	Disagree
	I would seriously consider selling my water if I was offered substantially more than market price	4.90	0.086	Disagree

[a] 60% highest of saved factor scores for each component. [b]Critical value for chi-square with 2 degrees of freedom and significance of 0.1 is 4.60, [c]Significance.

Table 18: Value and attitude statements not contributing to the *Commerce* value construct

	Value and attitude statements –***Commerce***[a]	Chi-square[b]	Sig.[c]	Response to value statement
Family	Farming is all about conducting a business	27.89	0.000	Agree
Profit	Financial gain is the only reason for my involvement in farming	13.19	0.001	Agree
	It is best to avoid reliance on financing from banks	8.82	0.012	Agree
	Bank finance is the only way to ensure business growth	16.08	0.000	Agree
	I always consider alternative places to invest my money other than my farm	4.77	0.092	Agree
Land	Owning my farm means more to me than just an investment	10.02	0.007	Disagree
	Being involved in farming is more important than owning a particular piece of land	5.82	0.054	Agree
Water	I should be able to use my irrigation water however I choose	7.70	0.021	Agree
	If I had unused water I would rather use it to expand my irrigation than to sell it at an attractive price	5.53	0.063	Agree
	If I had unused water I would probably not sell it because I would expect the price to increase in the future	18.40	0.000	Agree
	If I had unused water I would probably not sell it because it is good drought security	7.35	0.025	Agree
Community	My values and attitudes are similar to most people in my community	7.35	0.025	Agree
	It is not especially important to me whether I am a member of my community or not	9.90	0.007	Agree

[a] 60% highest of saved factor scores for each component. [b]Critical value for chi-square with 2 degrees of freedom and significance of 0.1 is 4.60, [c]Significance.

To provide a measure of importance, correlations (see Table: 19, 20, 21and 22) using Pearson correlation coefficients were also generated.

For this type of data, De Vaus (2002) claims that a correlation of 0.30 could be regarded as being relatively strong. The correlations of this study appear low, in part because when correlating dichotomous variables with continuous variables it is not possible to have a perfect correlation. The maximum possible correlation is close to 0.8, but reduces to around 0.20 as the split of the dichotomous variable becomes increasingly unequal. De Vaus (2002, p. 262) suggests that "[i]f, as social scientists, we accept the notion of multiple causation and understand something of the complexity of human social behaviour, we should mainly anticipate fairly weak correlations".

Describing the value constructs

The following three subsections profile the *Succession*, *Caretaking* and *Commerce* value constructs developed in the present study. The detail for the value construct descriptions have been developed from the responses to the value statement (see Table 16-18), the cross tabulations and correlations of the demographic data (see Table 19-22) and the cross tabulations and correlations of the personal characteristics (see Table 23). For each value construct the profiles are built by comparing the 60% of irrigators that are most strongly associated with the respective value construct against the 40% that are least strongly associated with the same value construct. For tables 19-21 this comparison is found in the column "relative likelihood compared to the 40% least associated". Farmers are likely to be influenced by each of the three value constructs to varying extents. Some will be influenced just by one, others by two, and some by all three value constructs. Using tables 16-23 the next section describes farmers who ranks highly on each of the value construct under discussion.

Table 19 provides data on the management actions of the last five years and the management intentions for the *Succession* value construct. The table compares the 60% of cases most strongly associated with that value construct against the 40% of cases that are least strongly associated with the value construct.

Table 19: Management actions and intentions for the *Succession* value construct

Actions[a]	Correlation	Significance[b]	Chi-square[c]	Probability[d]	Relative likelihood compared to 40% least associated[f]
Bought or leased more land*	0.274	0.000	10.03	0.001	More likely to have
Bought or leased more water	0.002	0.982	0.09	0.454	Slightly more likely to have
Invested in more efficient irrigation and drainage systems*	0.147	0.034	4.97	0.018	More likely to have
Invested in more water storage	0.093	0.181	0.96	0.204	Slightly more likely to have
Increased your irrigated area	0.094	0.177	0.22	0.392	Slightly more likely to have
Reduced your irrigated area	-0.078	0.258	0.18	0.391	Slightly less likely to have
Sold or leased some of your land	-0.012	0.859	0.54	0.303	Slightly less likely to have
Sold or leased some of your water*	-0.117	0.089	2.04	0.118	Less likely to have
Intentions[e]					
Buy or lease more land*	0.208	0.002	8.90	0.002	Much more likely to
Buy or lease more water*	0.120	0.084	2.89	0.062	Much more likely to
Invest in more efficient irrigation and drainage systems*	0.224	0.001	6.85	0.006	Much more likely to
Invest in more water storage*	0.219	0.001	5.33	0.015	Much more likely to
Increase your irrigated area*	0.095	0.168	1.72	0.136	More likely to
Reduce your irrigated area	-0.018	0.791	0.18	0.414	Slightly less likely to
Sell or lease some of your land*	-0.187	0.007	4.88	0.023	Much less likely to
Sell or lease some of your water*	-0.036	0.603	2.66	0.076	Much less likely to

*Data with acceptable chi-squares and significance and used in the discussion, [a]Actions of the 60% most strongly associated with the *Succession* value construct for last five years, [b]Spearman's rho, [c]The critical value for chi-square at p= 0.1 and d.f. = 1 is 2.70, n=212, [d]Fisher's Exact Test, [e]Chi-square of the 60% most strongly associated with the *Succession* value construct for next five years, [f]This judgement is made by interpreting the different responses to the actions and intentions statements of the 60% most strongly associated compared to the 40% least strongly associated with the value construct.

Table 20 provides data on the management actions of the last five years and the management intentions for the *Caretaking* value construct. The table compares the 60% of cases most strongly associated with that value construct against the 40% of cases that are least strongly associated with the value construct.

Table 20: Management actions and intentions for the *Caretaking* value construct

Actions[a]	Correlation	Significance[b]	Chi-square[c]	Probability[d]	Relative likelihood compared to 40% least associated[f]
Bought or leased more land	0.014	0.841	0.10	0.427	Slightly less likely
Bought or leased more water	-0.062	0.368	0.18	0.400	Slightly less likely
Invested in more efficient irrigation and drainage systems*	0.111	0.107	1.90	0.107	More likely to
Invested in more water storage*	0.099	0.154	2.49	0.076	More likely to
Increased your irrigated area	-0.024	0.724	0.00	0.545	Similar
Reduced your irrigated area	-0.010	0.887	0.04	0.483	Slightly more likely
Sold or leased some of your land	0.033	0.633	0.03	0.520	Slightly more likely
Sold or leased some of your water	0.066	0.341	0.93	0.236	More likely
Intentions[e]					
Buy or lease more land*	-0.146	0.035	5.82	0.013	Much less likely
Buy or lease more water	0.056	0.421	0.41	0.321	Slightly more likely
Invest in more efficient irrigation and drainage systems*	-0.117	0.090	4.10	0.031	Much less likely
Invest in more water storage*	-0.121	0.081	3.02	0.059	Less likely
Increase your irrigated area	-0.022	0.750	0.18	0.414	Similar
Reduce your irrigated area*	-0.143	0.039	1.67	0.141	Less likely
Sell or lease some of your land	0.030	0.666	0.02	0.515	Similar
Sell or lease some of your water	-0.036	0.605	0.72	0.255	Less likely

*Data with acceptable chi-squares and significance and used in the discussion, [a]Actions of the 60% most strongly associated with the *Caretaking* value construct for last five years, [b]Spearman's rho, [c]The critical value for chi-square at p= 0.1 and d.f. = 1 is 2.70, n=212, [d]Fisher's Exact Test, [e]Chi-square of the 60% most strongly associated with the *Caretaking* value construct for next five years, [f]This judgement is made by interpreting the different responses to the actions and intentions statements of the 60% most strongly associated compared to the 40% least strongly associated with the value construct.

Table 21 provides data on the management actions of the last five years and the management intentions for the *Commerce* value construct. The table compares the 60% of cases most strongly associated with that value construct against the 40% of cases that are least strongly associated with the value construct.

Table 21: Management actions and intentions for the *Commerce* value construct

Actions[a]	Correlation	Significance[b]	Chi-square[c]	Probability[d]	Relative likelihood compared to 40% least associated[f]
Bought or leased more land	-0.115	0.097	1.44	0.145	Less likely
Bought or leased more water	-0.019	0.781	0.63	0.268	Less likely
Invested in more efficient irrigation and drainage systems	-0.075	0.278	1.35	0.153	Less likely
Invested in more water storage	0.035	0.617	0.04	0.470	Similar
Increased your irrigated area*	-0.079	0.254	3.39	0.050	Much less likely
Reduced your irrigated area	0.054	0.440	0.72	0.246	Slightly more likely
Sold or leased some of your land	-0.054	0.438	0.54	0.303	Slightly less likely
Sold or leased some of your water*	-0.125	0.071	3.64	0.049	Much less likely
Intentions[e]					
Buy or lease more land	-0.019	0.782	1.96	0.109	Much less likely
Buy or lease more water	0.038	0.581	0.00	0.545	Similar
Invest in more efficient irrigation and drainage systems	-0.045	0.514	1.20	0.173	Less likely
Invest in more water storage	0.063	0.360	0.00	0.544	Similar
Increase your irrigated area	0.000	0.999	0.18	0.414	Similar
Reduce your irrigated area	-0.075	0.281	0.73	0.259	Less likely
Sell or lease some of your land	-0.046	0.512	0.38	0.333	Less likely
Sell or lease some of your water*	-0.117	0.091	4.09	0.035	Much less likely

*Data with acceptable chi-squares and significance and used in the discussion, [a]Actions of the 60% most strongly associated with the *Commerce* value construct for last five years, [b]Spearman's rho, [c]The critical value for chi-square at p= 0.1 and d.f. = 1 is 2.70, n=212, [d]Fisher's Exact Test, [e]Chi-square of the 60% most strongly associated with the *Commerce* value construct for next five years, [f]This judgement is made by interpreting the different responses to the actions and intentions statements of the 60% most strongly associated compared to the 40% least strongly associated with the value construct.

Table 22 compares property data between the 60% of cases most strongly associated with each of the value constructs.

Table 23 compares the personal characteristics such as age, education and succession intentions for the 60% of cases most strongly associated with each of the value constructs.

Table 22: Property characteristics of the cases above the 40th percentile for each value construct

	All	*Succession*[a]	Correlation[b]	Significance	*Caretaking*	Correlation	Significance	*Commerce*	Correlation	Significance
Farm size	1107	1529	0.07	0.26	558	-0.12	*0.06	893	-0.12	*0.06
Groundwater entitlements	708	766	0.07	0.30	679	-0.05	0.38	707	-0.03	0.66
Groundwater usage	354	401	0.10	*0.13	334	-0.08	0.22	350	-0.02	0.71
Surface water entitlements	317	291	0.01	0.88	279	-0.03	0.60	356	0.06	0.36
Surface water usage	135	122	-0.02	0.74	135	-0.05	0.46	150	0.08	0.21
Cotton area (irrigated)	92	83	-0.02	0.74	80	-0.08	0.32	83	-0.04	0.61
Cereal area (irrigated)	81	85	0.07	0.40	91	0.05	0.54	61	-0.01	*0.06
Pasture area (irrigated)	20	24	0.05	0.50	16	-0.16	*0.06	20	-0.00	0.99
Flood irrigation area	227	227	0.01	0.88	252	0.06	0.480	207	-0.02	0.75

[a] Mean values for highest 60% of each factor score, [b]Correlations performed using entire factor score, *Significant at 0.1.

Table 23: Personal characteristics of the cases above the 40th percentile for each value construct

	Succession [a]	Correlation[b]	Significance	*Caretaking*	Correlation	Significance	*Commerce*	Correlation	Significance
Age	Similar to average	-0.06	0.33	Similar to average	0.16	*0.01	Similar to average	0.16	*0.01
Family Succession	Much more likely	#	*0.02	Same as average	#	0.98	More likely	#	0.22
When left school	Some left early	#	*0.07	Fewer left early	#	0.63	Some left early	#	*0.00
Family members working on farm	Similar to average	-0.14	*0.03	Fewer	0.17	*0.00	Similar to average	0.02	0.74

[a] Compared to the highest 60% of other factor scores. [b]Correlations performed using entire factor score. # Categorical data unsuitable for correlations, *Significant at 0.1.

***Succession*—characteristics of those strongly associating with this value construct.**

Farmers who strongly associate with this value construct place a high value on their family and the role of family in farming (see Table 18). They are firmly focused on their family and believe that family should be an integral part of the farming enterprise with family members being closely involved in operating the farm. For them farming is more than just operating a business to make a profit, it is, more importantly, operating a business to hand on (down) to those in the next generations. They believe, and probably expect, that their family is fully committed to farming as an occupation and way of life. Because they would like their family to continue as farmers they are aware that they need to buy or develop enough land to make this achievable. They have actively built the size of their landholdings. They are therefore much more likely than those who do not associate strongly with this value construct to expect to have a family successor take over the operation of their farm on their retirement.

Because farming is of such importance to them they gain a distinct sense of fulfilment from undertaking farm work. Reflecting the importance they place on growing the farm business, they would rather reduce off-farm investments (even if this meant selling these at a loss) than consider reducing the equity that they have in their farm. They do not search for the best financial returns when making investment decisions; they are unlikely to consider the returns offered by any other alternative investments; instead their first priority is to invest profits back into the farm.

As they have a relationship with the land that is beyond the purely commercial they are less likely to consider selling their farm if it became unprofitable. But if a situation arose where they were required to sell land it is most unlikely that they would willingly sell their 'home block' as it has added meaning for them. For these people owning their land also provides them with a sense of security and belonging within the community. Water is as useful as land for increasing production, and because they are aiming to grow their farm businesses for the sake of their family members they would be reluctant to sell any unused water. They would rather keep water for the role it can play in ensuring security against drought, or use it to expand their business.

Being a community member is important for them because they consider that they share the same values and attitudes as others in the community. They would be sorry to move away from their community and feel that they are quite integral, if not necessary, to it.

The property characteristics of the farmers who associate more strongly with this value construct show that they are more likely to operate considerable commercial businesses than those who associate strongly with other value constructs (see Table 23); they are operating larger farms and are slightly larger users of groundwater.

With family succession such a firmly entrenched goal they need to ensure that there is a viable farming business to hand on to family members. They are therefore more likely to have bought or leased more land in the past or intend to do so in the future. Conversely, they are also less likely to sell or lease any of their land or water. As improving water use efficiency can be a viable alternative to purchasing more land, they are more likely to have already invested in water use efficiency projects. More so than those who do not strongly associate with this value construct they have also invested in improving their supply security in the last five years or intend to do so in the next five years. They do this by constructing large dams to store water at times when it is more available, to be used at times when it is more profitably used for production or when supply is scarce. This improved storage capacity supports three of their main land and water management objectives: 1) increased supply security; 2) more efficient water management; and 3) increased irrigation area.

Caretaking—characteristics of those strongly associating with this value construct.

Those who strongly associate with this value construct view their participation in the farming lifestyle as being of prime importance (see Table 17). They appear willing to forgo income that they could have gained from selling or leasing unused water. Being offered a good price for their water is little incentive for them to sell. While they do not think that people who participate in water markets are being greedy, they also do not want to sell their water, even if it is at a good price. Unlike those associating strongly with *Succession* they do not gain a sense of security from owning land. They may have tension between what they would like to do and that which they feel is expected of them as members of an irrigation community.

The production and personal characteristics of these farmers also reveal that they might be more oriented towards lifestyle benefits. Despite their orientation toward the *Caretaking* value construct, and that they are more likely to have smaller farms (see Table 23), they are still commercial farmers and should not be confused with lifestyle or hobby farmers (those people who operate small farms without an expectation of generating an income) or those for whom farming is not their main source of income. The reason that they have smaller farms is likely to be because they have had no need to expand, or perhaps because they have been unable to expand because of financial or other constraints.

Those farmers who strongly associate with this value construct are not primarily motivated by financial gain, but are also influenced by conservation values. This includes an important land husbandry goal of leaving their land in better condition for future generations. Also illustrating conservation values they believe that their use of water carries with it both a right and a responsibility. Financial gain from farming is not their most important incentive; they are motivated by things other than profit. For them owning a farm is more than just an investment, it also provides security for them and their family. Because they think of their farm in a way beyond providing just an income they are not prepared to readily buy and sell land.

The property characteristics of those who associate strongly with the *Caretaking* value construct show that they have slightly lower amounts of groundwater and use less of it compared to those that do not strongly associate with this value construct (see Table 23). They appear to be farmers who are less likely to have successors, and consequently are similar to those who Bjornlund (2002, 2004a) describes as the *Strugglers*—those farmers who are pursuing the farming lifestyle while having given up developing the farm any further.

Those associating most strongly with this value construct are more likely to have invested in water use efficiency actions in the past and are also more likely to have created new water storages in the past. Because they have already undertaken these actions they are much less likely to buy or lease more land, and are much less likely to carry out water use efficiency actions or invest in water storages than others in the future. At the time of the survey they did not appear to desire business growth, as they had grown their businesses

in the past. People associating strongly with this value construct also have fewer family members working on their farm.

Commerce—characteristics of those strongly associating with this value construct.

The values of those associating most strongly with this value construct are those of profit-maximisation (see Table 18). Their involvement in farming is, first and foremost, to satisfy a desire to operate a profitable business. Their investment in the farm needs to generate a profit, but if it doesn't, they are more prepared than others to pursue alternative investments. However, this needs to be understood with the proviso that farming businesses are not always readily tradeable, and not able to be traded without a cost to the business. They do not pressure their children to become farmers. They have a less sentimental approach to farming, only making improvements to the farm if it generates a profit.

Those strongly associating with this value construct see that it is best to avoid reliance on bank finance, although this is tempered with the recognition that bank finance is essential if they want to grow their business. Unlike those strongly associating with the *Succession* value construct, these people do not automatically invest in their farm; they always consider other places where they might invest their money. They see their ownership of a farm primarily as an investment in a business. But when they agree that their involvement in farming is more important than owning a particular piece of land it appears that they are also saying something about why they are involved in farming. They have invested in farming (or continue to maintain their investment in farming) because they enjoy doing it, but more so than those who do not associate strongly with this value construct their investment needs to generate an acceptable financial return.

They demonstrate a desire for autonomy when they suggest that they should be able to use their water however they choose. They perceive water as a resource that can be used to grow their business or be retained as a speculative investment. An example of this is when they suggest that they would not sell their water because it is good drought security. When water is plentiful they are likely to lease it out to others temporarily but when water becomes scarce they are likely to use it in their business to maintain their existing levels of production.

They suggest that their values are similar to those of most people in their community, but at the same time do not see that it is important that they participate in their community. It is likely that, because farming communities tend to be more conservative they are likely to be characterized by a greater homogeneity than many other kinds of communities, most farmers would feel that their values are similar to those of other community members. Therefore, it is not surprising that they might see themselves as being similar to others in the community even if they do not feel the need to participate in it, or find participation too demanding (especially during drought years).

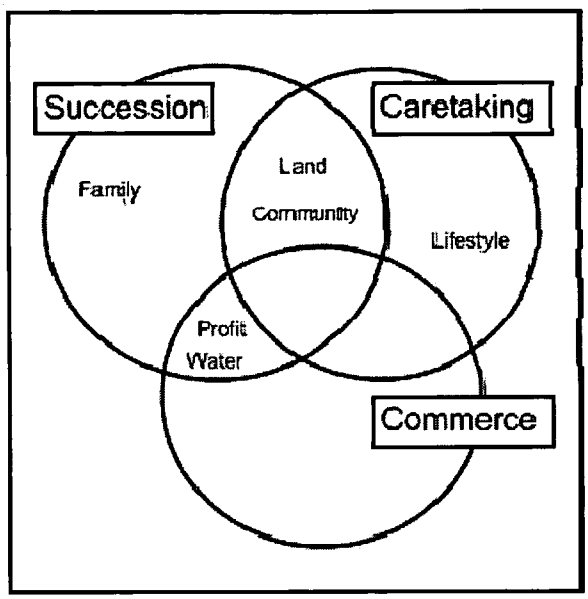
In the last five years those associating strongly with this value construct are less likely to have sold or leased any of their water or intend to do so over the next five years (see Table 21). At first this seems counter to expectations. Intuitively it would seem that those strongly associating with this value construct would recognise that water has a value and therefore sell it when returns become attractive. But this action does not happen without affecting the farming operation. The sale of water is not entered into lightly, but is more likely to occur after a tipping point is reached. The sale of water would only become likely after the profit gained from the sale outweighs the sunk costs associated with developing the farm for irrigated agriculture, which of course, assumes that water is an input in isolation. Any reluctance to sell could also be a result of their profit maximising behaviour. They simply perceive that the value of the water will rise and that it therefore is a better investment decision to retain their water rather than selling it now, even at a 'good' price. When the survey asked about intentions regarding the future sale of water, it did not investigate the effects of the sale of that water on the business. While those associating most strongly with this value construct may believe that water is a tradable commodity, it is a commodity that they expect to buy rather than sell, or hold on to rather than sell, with the expectation of further increases in the market price of water entitlements. Furthermore, it is a resource that they use to conduct their business, and they are not intending to allow their business to contract. They have slightly less land and groundwater than others, but to counter this they do have slightly more surface water.

Differences between value constructs

This study has shown that there are differences in farmers' values and attitudes towards the dimensions of family, land, water, community, lifestyle and profit, and that these differences may lead to important variations in their behaviour. However, the influences

causing the variations in behaviour are not straightforward. Figure 6 shows how farmers can associate with one or more of the value constructs *Succession, Caretaking*, or *Commerce* and Figure 8 shows how the value dimensions overlap between the three different value constructs.

Figure 8: Dominant values for each value construct



Farmers who most strongly associate with the *Succession* value construct consist of family-focused farmers whose primary aims appear to be the continuation of the farm business for the benefit of their family. They achieve this by using water to make a profit. Those associating most strongly with the *Caretaking* value construct appear to be those who, in the absence of family successors, replace those goals with those of caring for the land and water resource, gaining satisfaction from farming because of the lifestyle rewards that it offers. Those associating most strongly with the *Commerce* value construct seek to build and operate a business and use water as a resource to achieve this.

Farmers who associate most strongly with the *Succession* value construct place a high value on their family, and on their family's continuing involvement with farming. They value land for the role that it plays in facilitating their family's goals. They do not see the value of water as being determined by what it can be sold for, instead they see water as having value because it enables them to continue their business, grow irrigated produce, make a profit, and pass on a successful farm business to their family members. In the same way those who associate most strongly with the *Commerce* value construct also

want to generate a profit. They want this however not to satisfy family goals, but business goals instead. Those associating most strongly with the *Caretaking* value construct are not strongly motivated by profit; instead they focus on managing the land for future generations, but not necessarily successors from within their family.

Although it may be going beyond the evidence gained from this study, observations from data collection and analysis and from my own experience suggest the hypothesis that there is a hierarchy of values influencing farmers' behaviour, with the next values in line being adopted when other value constructs become redundant or unachievable. For example in the event that values like those encompassed in the *Succession* value construct are unable to be satisfied, for example, when farmers are without children or have children who are disinterested in farming, the farmer might adopt values associated with other value constructs. This could be that of *Caretaking* for example if the property and personal characteristics do not allow pursuit of *Commerce* values. In a similar way it could be that if *Commerce* values are unable to be achieved through financial constraints the value construct also reverts to *Caretaking.*

These value constructs of *Caretaking, Commerce* and *Succession* are not mutually exclusive. Using the 40th percentile cut-off point on the factor scores shows that 48 (23%) of the cases above the 40th percentile associate with all three value constructs and 85 (40%) associate with two value constructs (see Figure 6). This demonstrates that the value constructs are very much overlapping and interacting. Farmers appear to be capable of associating with two or even three value constructs simultaneously without experiencing serious cognitive dissonance, incongruency, or disloyalty to themselves and other value constructs.

Although beyond the scope of the data collected for this research, it seems plausible that people could associate with different value constructs at different times of their lives and during different phases of the development of their farm business. Similar observations had previously been made by Fairweather and Keating (1994) and this finding remains an area that is worthy of future research. Farmers could also associate with different value constructs as they progress from youth through to marriage, raising a family, middle age and then contemplation of retirement, and as other family members make their decisions about their lives. Those farmers who are childless, or whose children have chosen or pursued careers other than farming, may modify their values to suit their current situation.

As the partners of farmers change their goals over time they might also have an influence on the farmer's values.

There are policy implications arising from the examination of these value constructs, especially with regard to the Federal Government's 'buyback' of water entitlements (Wong 2008). Those strongly associating with the *Caretaking* value construct disagree with the statement "I would seriously consider selling my water if I was offered substantially more than market price". The sale of water does not appear to fit their paradigm, but even so, it appears that these people are the least likely to have their goals disrupted by the sale of water. It is also a possibility that they are sufficiently affluent that they do not need to sell water: they can afford to be *Caretakers*. For all potential sellers of water it can mean a contraction in their production or a change in the type of production that they carry out. If all of their water is sold it can mean selling the entire farm, moving from the community, and seeking other employment. One way to make this easier, which could potentially be attractive to those associating strongly with the *Caretaking* value construct, would be to encourage them to sell water, but then to provide them with payments for the provision of ecosystem services on their existing farm until they are no longer able to live on it. Those associating with this value construct are the most likely to be able to achieve their goals in the absence of water, but they would still require government intervention to make this possible. An example of this approach is the Federal Government announcement of a 'Small Block Irrigators Exit Grant package' on November 2nd 2008 targeted at purchasing water from small irrigators, but allowing them to remain on their properties (Department of the Environment Water Heritage and the Arts 2008). It is beyond the scope of this thesis to suggest what other instruments might be offered to allow a better matching to irrigators values and attitudes, but it is likely that it will come from a range of instruments rather than one single approach.

Closing comments

Factor analysis reduced the number of variables, allowing them to be represented by a smaller number of groups of variables, referred to in this study as value constructs. Cross tabulations showed that there are between-farmer differences with regard to how they are influenced by these value constructs, and that these differences can assist in predicting and explaining their behaviour in response to changing policies. This study highlighted how participants can associate with one or more of the value constructs at the same time.

Because of the tendency for value constructs to overlap they were not useful in constructing typologies which require "exhaustiveness and mutual exclusiveness" (Bailey 1975, p. 62). The next chapter describes how cluster analysis was used to group participants according to the values and attitudes that they held. Cluster analysis combines cases, enabling them to be represented by a smaller number of groups. Cross tabulations and chi-square testing were also used to define how the cluster group members differed in their behaviour.

CHAPTER SEVEN

7 The Cluster Cohorts

Introduction

The previous chapter presented the results from the mail-out survey and the factor analysis of the telephone survey. The factor analysis was used to group farmers' values and attitudes into value constructs which were then used to understand how values and attitudes influenced their behaviour. To further examine the influence of the values and attitudes that farmers hold on their management behaviour, these farmers were clustered into groups according to those same values and attitudes. The cluster groups formed the basis of a typology capable of explaining and illustrating some of the influence of non-profit-maximising values on farmers' behaviour. This chapter reports on the results from the cluster analysis which was used to group farmers according to their values and attitudes.

Telephone survey—Cluster analysis

Values held by farmers in common

Before the cluster analysis was conducted, an analysis was conducted to identify the variables which could not be used to separate the respondents into distinct groups. These were the value and attitude statements with responses which were uniform across the sample. Because these value and attitude statements prompted responses which were common to all farmers, they were not able to be used in any way to differentiate between them. For the purposes of this research a method was devised to identify these non-contributing value and attitude statements. This involved a simple calculation which provided information allowing a decision to be made regarding acceptance or rejection of the value statement as being suitable for differentiating respondents. The numbers of participants strongly agreeing and agreeing were added together; the result of this calculation was then added to half of the neutral responses. The same calculation was also performed for those strongly disagreeing and disagreeing. The smallest of these figures was then expressed as a percentage of the largest of these figures. If this percentage was 20% or less the variable was deemed to be too uniform to effectively categorise the respondents into distinct groups and was therefore not used for the purpose of the cluster analysis.

An example of this calculation is provided for statement Q.74—"If I had unused water I would probably not sell it because it is good drought security". The numbers of responses for each of the five Likert-scaled responses for this statement are:

- strongly disagree 0
- disagree 25
- neutral 20
- agree 144
- strongly agree 23.

Adding the disagree responses and half of the neutral responses resulted in a figure of 35, while adding the agree responses and half of the neutral responses gave a figure of 177. The smaller figure expressed as a percentage of the larger figure is 20%. As the chosen cut-off point was 20% or less, this value statement, although very informative in that it shows that generally farmers would not do this, was not useful for the cluster analysis.

It is difficult devising value and attitude statements in such a way that the level of agreement expressed with each statement can be used as accurate measures of the intended concept. For statements to perform this function they need to be understood in the same way that the person devising the statement understands it. It is therefore no surprise that some statements should, due to choice of wording or word order, not have achieved this task. Sometimes the differences between statements were subtle and hard to understand. For example statement *Q.31 Family should be an integral part of the farming enterprise,* was used for the cluster analysis but *Q.32 Farming is a business that should not involve family,* was not able to be used. Apart from the directionality of these statements they appear similar to each other; but they have been understood by participants differently.

The twenty-one value and attitude statements that were rejected as a result of the above calculation were not used to define the cluster analysis groups (see Table 24) because for each of these value and attitude statements a large proportion of the participants responded in a similar way. With such uniform levels of agreement or disagreement, these statements are still useful with respect to the study's overall aims and may have predictive power with respect to farmers' behaviour. They also provide a useful

comparison with those value and attitude statements relating to the same dimensions that were retained for the cluster analysis solution.

Table 24: Value and attitude statements not used for the cluster analysis

Dimension		Value statement	Response
Family	Q.32	Farming is a business that should not involve family.	Disagree
	Q.34	Farming is all about conducting a business.	Agree
	Q.37	Farmers should support family members to do the kind of work they are good at whether this is farming or not.	Agree
	Q.38	Farmers should consider how their farming decisions will affect their family.	Agree
	Q.40	Farmers should encourage family members to get a good education or develop a skill before deciding on their careers.	Agree
Profit	Q.41	Profit is important to me, not for its own sake but for its role in achieving farming or family goals.	Agree
	Q.46	I am only farming because it gives me a good financial return.	Disagree
	Q.48	Most of the money I make is invested back into the farm.	Agree
	Q.52	Owning my farm means more to me than just an investment.	Agree
Land	Q.56	Owning land provides security for my family and I.	Agree
	Q.62	My most important goal is to leave my land in better condition for future generations.	Agree
Water	Q.67	I believe that my right to use the water also brings with it a responsibility to use it wisely.	Agree
	Q.70	I would never consider selling any of my water unless it was absolutely necessary.	Agree
	Q.74	If I had unused water I would probably not sell it because it is good drought security.	Agree
Community	Q.76	I would be very sorry to move away from my local community.	Agree
	Q.79	I am an integral part of my local community.	Agree
Lifestyle	Q.80	Freedom associated with being ones' own boss is important.	Agree
	Q.81	Working outdoors is important to me.	Agree
	Q.82	Peace and quiet from living in the country is important for me.	Agree
	Q.83	Farm work gives me a real sense of fulfilment.	Agree
	Q.84	I find that farming is a stress-free occupation.	Disagree

These results show that farmers in general share a common belief that farming should be recognised as a business undertaking. They see their families as being important for their

own sake, but also see them as being an important part of their farm business. They show high levels of support for the actions of family members. Even though it may not lead to the outcomes they desire, they support their family members to undertake things that may lead to careers other than farming. They are consequently supportive of their family members developing skills, or gaining education, before deciding on their careers. When they make farm decisions they believe that those decisions should be done with consideration for the effect that they are likely to have on their family.

These value and attitude statements show that most farmers consider that their pursuit of profit is primarily useful for achieving family and/or farming goals. This response is not surprising—what else would they produce profit for? For most of the participants, owning a farm was treated as being much more than just an investment. Their involvement in farming is motivated by more than just the financial returns; their involvement is also because of the lifestyle and the nature of the activity. For most participants, their profits are invested back into the farm. It is possible, however, that this could have been influenced by the situation at the time of the survey with financial stresses from lower cotton prices, drought conditions and rising input costs.

Land is seen by most as a possession that also provides security for the family. All farmers had a desire to leave the farm in better condition for future generations, but whether they actually achieved this, or took actions to do so, is beyond the scope of this study. While this is a common and oft-stated goal, anecdotal information suggests that this might be a goal that is difficult to attain.

All farmers agree that water is both a right and a responsibility. This survey statement was problematic in that it was two statements in one, and therefore presented difficulties when attempting to interpret how the survey participants might have understood the statement and therefore their reasoning behind their response to it. It may have been better presented as two statements, not one. On the other hand it may be showing that most farmers recognise and embrace the reciprocity of the statement - i.e. that with the right goes the responsibility. Participants generally agreed that they would only sell water as a last resort. Overall, survey participants view the retention of their water as a being useful as a drought reserve. This allows them to rent their water out when conditions are favourable and it is not required for their own production. However, when drought conditions occur, rather than renting it out, they can use it for their own productive

purposes. The responses to this statement may have also been influenced by the drought conditions prevailing at the time of the surveys.

The community is valuable to all of the survey participants and they feel as though they are a part of it. All of the lifestyle statements received consistent responses. Respondents believe that the freedom associated with being one's own boss is important, that working outdoors is important, and that the peace and quiet gained from living in the country is important. All participants agree that farm work gives them a real sense of fulfilment. Not unexpectedly with the influence of drought, low cotton prices and the rising costs of agricultural inputs, they universally disagree with the statement that farming is a stress-free occupation.

This discussion has been about what makes farmers similar to each other. The cluster analysis of the twenty-nine remaining value and attitude statements provided results that were useful for discovering the differences between farmers.

Differentiating farmers using cluster analysis

As previously discussed, factor analysis was used to group the values that influence farmers into value constructs, but cluster analysis was the technique chosen to group farmers according to their values.

Prior to conducting the cluster analysis with the telephone survey data, the *correlate-bivariate* command of SPSS was used to produce a Pearson correlation matrix for all of the predictor variables (the retained value and attitude statements). This was done to search for evidence of multicollinearity. The commonly used cut-off point indicating potentially harmful multicollinearity is a coefficient of 0.80 (Mason & Perreault 1991; Gujarati 2003), while the coefficient of correlation should be above the 0.05 level of significance that Gujarati (2003) describes as relatively low. Mason and Perreault (1991, p. 269) are less concerned about the effects of multicollinearity and suggest that the "widely voiced caveats about the harmful effects of collinear predictors are often exaggerated". They reason that the effect of collinearity has to be judged by taking into account the influence of other factors, including sample size, R^2 and magnitude of the coefficients. To further test for collinearity, the more highly correlated variables should be subject to linear multiple regressions. Variance Inflation Factors generated from the

linear multiple regressions should be below ten—the value indicating the presence of multi-collinearity (Mason & Perreault 1991; Gujarati 2003). All of these tests indicated that multi-collinearity was not present and that the data are suitable for cluster analysis.

After removing the unsuitable value and attitude statements (see Table 24), twenty-nine statements were retained for use in the cluster analysis (see Table 25).

Table 25: Value and attitude statements used for the cluster analysis

	No.	Statement
Family	Q.31	Family should be an integral part of the farming enterprise.
	Q.33	My family is fully committed to farming as an occupation and way of life.
	Q.35	I would like some or all of my family to continue farming.
	Q.36	It is not important to me whether members of my family continue operating the farm.
	Q.39	Farmers should encourage family members to be involved in the family farm.
Profit	Q.42*	Financial gain is the only reason for my involvement in farming.
	Q.43*	It is best to avoid reliance on financing from banks.
	Q.44	Bank finance is the only way to ensure business growth.
	Q.45	I am only farming to develop a business for myself or my family.
	Q.47	I would rather sell off-farm investments at a loss than sell any part of my farm.
	Q.49*	I always consider alternative places to invest my money other than my farm.
	Q.50	I always invest any money I make where I can achieve the largest financial gain.
Land	Q.51	It is OK to buy and sell land regularly if it helps me to achieve my farming goals.
	Q.53	If I were to sell land I would never consider selling my 'home block'.
	Q.54	I will readily buy and sell any of my land when opportunities arise.
	Q.55	Being involved in farming is more important than owning a particular piece of land.
	Q.57*	My land is just something I use to generate an income.
	Q.63	I would like to buy or develop enough land for my family to remain or to become farmers.
	Q.64	If my farm doesn't generate a reasonable financial return (compared to alternative investments) I would consider selling it.
	Q.65	Improving my farm is only important because it will increase the future sale value.
	Q.66	I consider land values when I make farming decisions.
Water	Q.68*	I should be able to use my irrigation water however I choose.
	Q.69	People that buy and sell water regularly are just greedy for money.
	Q.71*	I would seriously consider selling my water if I was offered substantially more than market price.
	Q.72	If I had unused water I would rather use it to expand my irrigation than to sell it at an attractive price.
	Q.73	If I had unused water I would probably not sell it because I would expect the price to increase in the future.
Community	Q.75	Being a member of my local community is very important to how I think of myself as a person.
	Q.77	My values and attitudes are similar to most people in my community.
	Q.78	It is not especially important to me whether I am a member of my community or not.

* These statements either did not achieve significance for the cross tabulation, or experienced minimum cell size violations, and were therefore not suitable for use in the cross tabulations

Ward's method of clustering was chosen, as it gives the most usefully interpreted results (Pollock, Antcliff & Ralphs 2002). Cluster solutions were chosen by considering: 1) what intuitively made sense from the researcher's developing understanding of irrigators (Pollock, Antcliff & Ralphs 2002), 2) the results of the earlier factor analysis, and 3) examination of the branches of the cluster analysis dendrogram. A three-cluster solution was chosen because it fitted with these requirements. It was also desirable because, by keeping the number of clusters low, it reduced the risk of violating minimum cell value assumptions when conducting the chi-square significance testing for the cross tabulations.

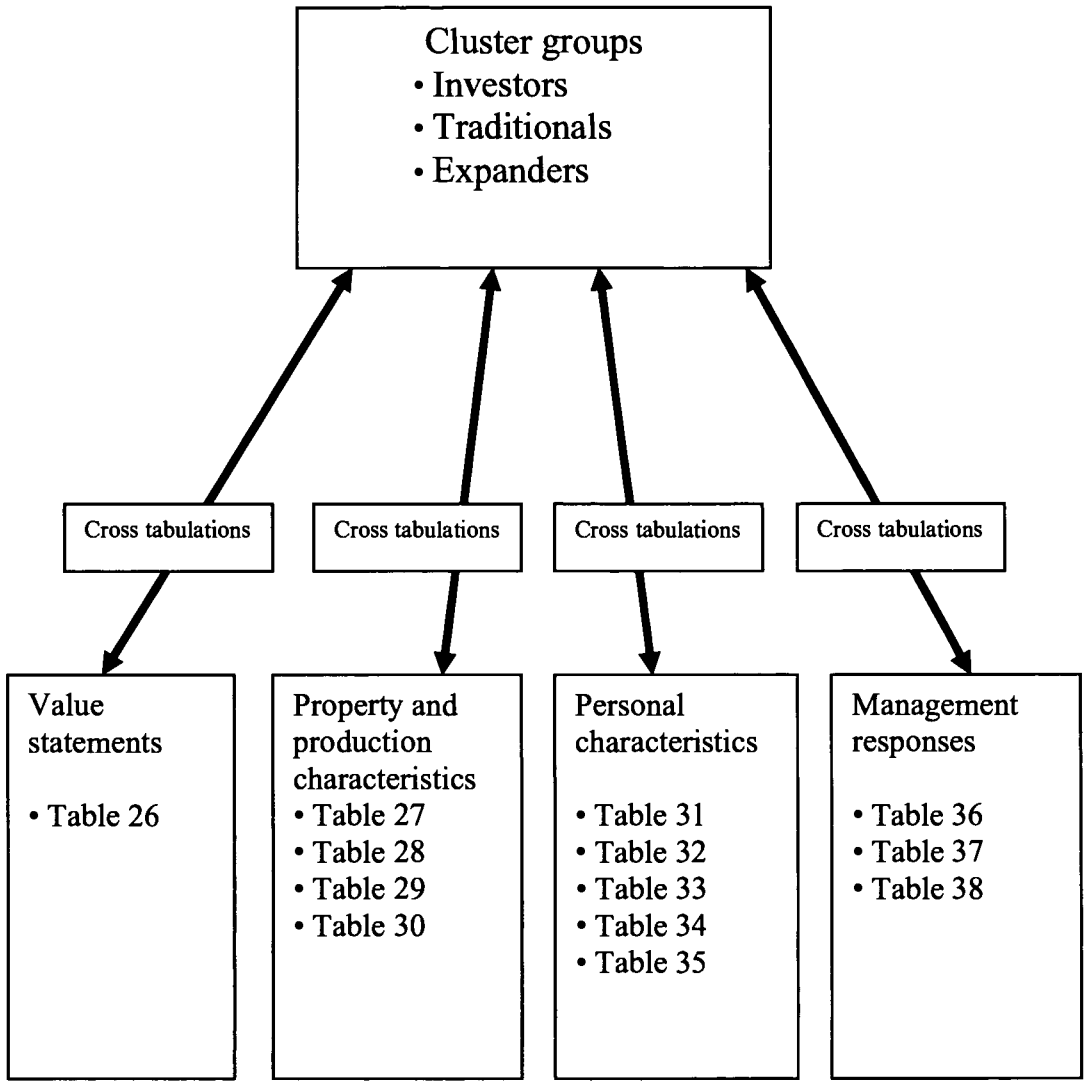
While the dimensions of family, land, water, community and profit contributed to differentiating cluster groups of farmers, the dimension of lifestyle (which was responded to in a consistent fashion by all participants) did not, and therefore was not able to be used for defining the three clusters. All farmers seem to perceive this dimension in a similar way.

The three clusters were named *Traditionals, Expanders* and *Investors*. These names highlight one of the most important characteristics for each of the clusters but are not expected to fully describe the cluster. *Traditionals* exhibit conservative farming practices, *Expanders* seek to grow their farm business, while *Investors* are profit-oriented.

Examining the cluster groups using cross tabulations

A cross tabulation was performed using all of the value and attitude statements that achieved statistical significance and the three cluster groups (see Figure 9). These cross tabulations were performed for 1) the value and attitude statements used for the clustering, 2) the demographic and property characteristics, and 3) the management actions and intentions data. This was done to explore the differences between each of the cluster groups.

Figure 9: Cross tabulations with cluster groups



Two common measures for judging the relevance of a cross tabulation item are the Cramer's V strength of association test and the chi-square test which shows whether the relationship has statistical significance. There are no strict standards for interpreting the strength of association test (Cohen 1988). This is made even more problematic because the value of Cramer's V (the measure of the strength of association) lessens as the degrees of freedom and the proportions of the contingency table that it is applied to increase (Cohen 1988). Notwithstanding these limitations Cohen suggests that the conventional definitions of Cramer's V— that a small effect is 0.10 to 0.30 and a moderate effect is 0.30 to 0.50, while a large effect is over 0.50—should be used as a general frame of reference but should not be taken too literally (Cohen 1988). Critical

values of chi-square (Timm 2002) also vary according to the significance level and the degrees of freedom. For d.f.= 4 and p = 0.10 (which is appropriate for these cross tabulations) the critical value for chi-square is below 7.78. All of the cross tabulation items exceeded the appropriate minimum level for chi-square critical values (showing that there is a statistically significant relationship) and achieved Cramer's V values indicating either a low or a moderate strength of association.

The results from the cluster group and value statement cross tabulations (see Table 26) are now discussed in more detail.

Table 26: Proportion of each cluster group agreeing with the value statement

	Value statement	*Investors*	*Traditional*	*Expander*	All	Chi-square[a]	Cramer's V
FAMILY	Q.31 Family should be an integral part of the farming enterprise.	44.2	75.4	86.0	65.6	33.36	0.28
	Q.33 My family is fully committed to farming as an occupation and way of life.	22.1	68.1	78.9	52.4	60.78	0.37
	Q.35 I would like some or all of my family to continue farming.	19.8	75.4	71.9	51.9	70.38	0.40
	Q.36 It is not important to me whether members of my family continue operating the farm.	76.7	24.6	40.4	50.0	50.08	0.34
	Q.39 Farmers should encourage family members to be involved in the family farm.	33.7	66.7	73.7	55.2	27.96	0.25
PROFIT	Q.44 Bank finance is the only way to ensure business growth.	46.5	33.3	70.2	48.6	18.12	0.20
	Q.45 I am only farming to develop a business for myself or my family.	41.9	29.0	70.2	45.3	24.90	0.24
	Q.47 I would rather sell off-farm investments at a loss than sell any part of my farm.	12.8	55.1	63.2	40.1	62.88	0.38
	Q.50 I always invest any money I make where I can achieve the largest financial gain.	65.1	42.0	70.2	59.0	20.70	0.22
LAND	Q.51It is OK to buy and sell land regularly if it helps me to achieve my farming goals.	67.4	46.4	66.7	60.4	11.49	0.16
	Q.53 If I were to sell land I would never consider selling my 'home block'.	16.3	36.2	38.6	28.8	17.33	0.20
	Q.54 I will readily buy and sell any of my land when opportunities arise.	47.7	18.8	31.6	34.0	18.45	0.20
	Q.55 Being involved in farming is more important than owning a particular piece of land.	36.0	37.7	66.7	44.8	18.12	0.20
	Q.63 I would like to buy or develop enough land for my family to remain or to become farmers.	23.3	65.2	77.2	51.4	60.39	0.37
	Q.64 If my farm doesn't generate a reasonable financial return (compared to alternative investments) I would consider selling it.	73.3	27.5	40.4	49.5	35.15	0.28
	Q.65 Improving my farm is only important because it will increase future sale value.	47.7	29.0	50.9	42.5	11.21	0.16
	Q.66 I consider land values when I make farming decisions.	69.8	55.1	84.2	68.9	15.32	0.19
WATER	Q.69 People that buy and sell water regularly are just greedy for money.	31.4	46.4	63.2	44.8	16.26	0.19
	Q.72 If I had unused water I would rather use it to expand my irrigation than to sell it at an attractive price.	48.8	55.1	77.2	58.5	12.43	0.17
	Q.73 If I had unused water I would probably not sell it because I would expect the price to increase in the future.	48.8	33.3	75.4	50.9	28.04	0.25
COMMUNITY	Q.75 Being a member of the local community is very important to how I think of myself as a person.	67.4	81.2	87.7	77.4	10.27	0.15
	Q.77 My values and attitudes are similar to most people in my community.	67.4	71.0	89.5	74.5	10.55	0.15
	Q.78 It is not especially important to me whether I am a member of my community or not.	12.8	11.6	15.8	13.2	11.00	0.16

Six of the value and attitude statements used for the cluster analysis did not achieve significance and are not included in this cross tabulation, [a]The critical value for chi-square at p= 0.1 and d.f. = 4 is 7.78.

Results for family statements

While most farmers disagree with the statement Q.32 "Farming is a business that should not involve family" (this statement was not used in the cross tabulation because of its uniform rejection), there are a wider range of responses to the statement Q.31 "Family should be an integral part of the farming enterprise". Substantially fewer *Investors* agree with the statement than do *Traditionals* or *Expanders*. In this instance it appears as though the negatively worded statement is uniformly rejected while the positively worded statement is selectively accepted. It could be expected that very few people agree that not involving the family in farming should be a clear decision, and that most would at least accept that they should be involved if they want to be.

Many more *Expanders*, and more *Traditionals*, agree with the statement Q.33 "My family is fully committed to farming as an occupation and way of life". *Investors*, however, are much more likely to disagree with the statement.

Investors also disagree with the statement Q.35 "I would like some or all of my family to continue farming". However *Traditionals* and *Expanders* both have similar levels of agreement with the statement.

Investors are most likely to agree with the statement Q.36 "It is not important to me whether members of my family continue operating the farm" while *Traditionals* are the most likely to disagree and *Expanders* are somewhat likely to disagree.

Investors are likely to disagree with the statement "Farmers should encourage family members to be involved in the family farm". *Traditionals* are the most likely to agree followed by *Expanders*.

Discussion of the family dimension

Family is a dimension that is very useful for helping to differentiate the *Investor* group from the *Expanders* and *Traditionals*, but is less useful for helping to differentiate between the *Expanders* and *Traditionals,* although there are some differences (see Table 33). *Traditionals* value the role of family in farming but are two and a half times more likely to have no succession plans in place than *Expanders*. This could influence how they respond to the statements regarding family. *Expanders* are older than both

Traditionals and *Investors* (see Table 31)—they have the largest percentage of members in the sixty-five years and older age bracket, hence they have a higher certainty of family succession and are likely to have more money to finance expansion. They are also a group that may change their value construct as they progress through their business and personal life-cycles.

It is possible that the difference between those older members of the *Traditional* and *Expander* clusters (those with family old enough to consider succession issues) could be the level of pressure they have put their family members under to continue farming. It could be that *Traditionals* want their family members to continue farming; but even though they see this as important they are reluctant to apply the same pressure on their families to make this choice as the *Expanders*. The *Expanders* are more committed to succession; they are keener to expand and invest. This could be because they have farms more suitable for expansion or that they have the finances to do so, or simply because they have more certainty of succession. Whether this intention translates into action at the time when succession is required is also unknown. These statements are likely to have differing responses according to whether the respondent has family members who have already indicated that they wish to remain as, or become, a farmer. Someone who has family succession assured may be much more likely to agree with Q.36 that family succession is not important.

Results for profit statements

When considering the statements contributing to the dimension of profit, *Expanders* are more likely to agree with the statement Q.44 "Bank finance is the only way to ensure business growth"; in contrast *Traditionals* tend to disagree with it and *Investors* tend to be ambivalent about it.

Expanders are more likely to agree with Q.45 "I am only farming to develop a business for myself or my family". In contrast *Traditionals* are more likely to disagree with the statement. *Investors* are slightly more likely to disagree with the statement.

Investors are very likely to disagree with the statement Q.47 "I would rather sell off-farm investments at a loss than sell any part of my farm" in contrast *Expanders* are much more likely to agree with it, while *Traditionals* are only slightly likely to agree with it.

Expanders are very likely to agree with the statement Q.50 "I always invest any money I make where I can achieve the largest financial gain". *Investors* are a little less likely to agree and *Traditionals* were slightly likely to disagree with the statement.

Discussion of the profit dimension

The way that participants respond to these statements may depend on their existing assets, and whether they have already achieved the growth in their farm business for which they had been aiming. It is possible that *Traditionals* may see themselves as being established farmers and therefore tend not to be motivated by the need for business growth that others might find important. For three of the value and attitude statements the polar opposites were not *Investors* and *Traditionals*, but *Expanders* and *Traditionals*. The value and attitude statements associated with profit are therefore a way that the *Expanders* and the *Traditionals* groups can be differentiated. This might well be related to a combination of their position in the business lifecycle and the difference in family continuity expectation. The *Expanders* are still working towards developing their farms to accommodate the next generation—to do that they need profit. The *Traditionals* have either developed their farm to the required level to accommodate succession, or have no successors and therefore no ambition to expand, but still hold on to their family values.

There was no clear relationship between length of time farming and cluster group; but neither was there a clear relationship with age and cluster group. It is possible length of time farming is not as important as how long the business has been operating, or what stage of development the farm business is at. These measures need to be included when conducting any further research on this topic. The statement about selling off-farm assets at a loss violates the *Investor's* more determined pursuit of profit goals and is therefore readily rejected by them, but not so readily by the other groups.

Results for land statements

When considering the dimension of land both the *Investor* and the *Expander* cluster groups are more likely than the *Traditional* group to agree with the statement Q.51 "It is OK to buy and sell land regularly if it helps me to achieve my farming goals". *Traditionals,* demonstrating their attachment to their land, are slightly more likely to disagree with the statement.

Investors are very likely to disagree with the statement Q.53 "If I were to sell land I would never consider selling my 'home block"'. Both *Traditionals* and *Expanders* also tend to disagree with the statement but to a lesser extent.

The *Traditionals* are very likely to disagree with the statement Q.54 "I will readily buy and sell any of my land when opportunities arise". The *Expanders* also disagree with the statement but *Investors* are neutral in their response to it.

Expanders are very likely to agree with the statement Q.55 "Being involved in farming is more important than owning a particular piece of land". In contrast both *Traditionals* and *Investors* disagree with the statement but each for different reasons. *Investors* because the land they have is good for business; *Traditionals* because they are attached to it.

Investors disagree with the statement Q.63 "I would like to buy or develop enough land for my family to remain, or to become, farmers". *Expanders* are most likely to agree with the statement while *Traditionals* agree but a little less strongly.

Investors agree most strongly with the statement Q.64 "If my farm doesn't generate a reasonable financial return (compared to alternative investments) I would consider selling it" but in contrast *Traditionals* are very likely to disagree with the statement. *Expanders* are slightly more likely than *Investors* to disagree with it.

Traditionals disagree with the statement Q.65 "Improving my farm is only important because it will increase future sale value". *Expanders* and *Investors* are both ambivalent about the statement.

Expanders are the most likely to agree with the statement Q.66 "I consider land values when I make farming decisions". In contrast *Investors* are less likely to agree and *Traditionals* are neutral.

Discussion of the land dimension

Traditionals do not consider that land should be frequently traded because they have a personal attachment to it. *Investors*, however, are less sentimental about their farm land, and are more prepared to sell land if need be. The *Traditionals'* relationship with their land can't be thought of just in financial terms as it is more involved and more complicated than that. To some extent their relationship involves all of the other

dimensions considered in this analysis; that is family, water, community and profit. Owning their land allows them to feel part of the community but more than this, the land in combination with water allows them to make a profit so that they can achieve their family goals.

There were no questions in the survey regarding equity levels, nor were there suitable de facto measures that could be used for this purpose. Because *Expanders* are building their businesses it could be possible that their equity levels are quite low. This could affect how participants respond to the statement "Being involved in farming is more important than owning a particular piece of land". With low levels of equity they would not own much of their farm; they therefore rationalise their response by agreeing with the statement, even though it is not their desired goal. This could also be the worthwhile subject of future research.

The statement "I would like to buy or develop enough land for my family to remain or to become farmers" could cause misleading responses. It is a family dependent statement—therefore if the participant did not have children, or had adult children, they would find the statement difficult to respond to accurately, which reduces its validity. This could even be the case if they had already set up their family members on farms of their own. It may be possible that with its emphasis on family it is more a measure of the family dimension than it is of the land dimension.

A key statement for differentiating between the groups is the statement "If my farm doesn't generate a reasonable financial return (compared to alternative investments) I would consider selling it". It indicates the relative importance that each of the groups place on the ownership of the farm. *Investors* are more dispassionate about their land ownership and more prepared to sell. In contrast *Traditionals* have the opposite approach and *Expanders* fall between the other two groups. While this is a statement related to land it could also be seen to be informing the dimension of profit.

While every participant would probably agree, at least to some extent, that improving their farm increases the farm value, there are a range of responses to the statement "Improving my farm is only important because it will increase future sale value". The *Traditionals,* because they are less strongly motivated by money, are more likely to disagree with this statement. *Investors* and *Expanders* are more likely to agree with the

statement. *Expanders,* having potentially less equity in their farm because of their business growth, may be more acutely aware that maintaining or increasing the value of their farm is important. *Investors* agreement with the statement fits with their profit-maximising approach.

Results for water statements

With regard to the dimension of water *Expanders* tend to agree with the statement Q.69 "People that buy and sell water regularly are just greedy for money". In contrast *Investors* are likely to disagree and *Traditionals* are neutral.[1]

Expanders are more likely to agree with the statement Q.72 "If I had unused water I would rather use it to expand my irrigation than to sell it at an attractive price". *Investors* and *Traditionals* are both neutral towards this statement.

Expanders are more likely to agree with the statement Q.73 "If I had unused water I would probably not sell it because I would expect the price to increase in the future", In contrast *Traditionals* are likely to disagree with the statement and *Investors* are neutral.

Discussion of the water dimension

The statement that "People that buy and sell water regularly are just greedy for money" relies on participants self-defining what regular sales of water mean for them. Being 'greedy for money' is also a value judgement that may mean different things to different people. *Investors* disagree with the statement because the ability to buy and sell water freely is important for them.

The statement "If I had unused water I would rather use it to expand my irrigation than to sell it at an attractive price" is a multi-component statement that may have been difficult

[1] This result is interesting because tables 39 and 40 show that *Investors* have sold and will sell water and *Expanders* have bought and will buy more water. However, the responses could also be related to the term 'buy and sell regularly', which tends to indicate buying and selling water in a speculative way. Their purchases and sales may have been one-off occurrences to adjust their access to water and hence not conducted for speculative reasons. This comment may also reflect the reality of trade versus perceived pressures from the community to resist trade. (Individuals may be happy to trade, but in response to the hype about trade they are reluctant to admit to others or even themselves that this might be their preferred option).

to respond to. Despite the possible difficulties with interpretation *Expanders* agree most strongly and this is likely to be because they want to grow their businesses.

Because it is hard to reconcile the contradictory messages of these two statements they may cause confusion. That three water-related value and attitude statements were removed from the analysis because of their uniform responses, and that only three of the five statements used in the cluster analysis achieved significance for the cross tabulation indicates that water is not a great differentiator between groups or that the questions were not designed in a way which was able to capture this differentiation. It is likely, however, that this finding reinforces Hatfield-Dodds et. al. (2007, p. 46) who suggest that "when it comes to water culture, groups have more similarities than differences".

Results for community statements

In considering the dimension of community all groups agree to some extent that Q.75 "Being a member of the local community is very important to how I think of myself as a person" although *Expanders* are a little more likely to agree with this statement than the other groups.

Each of the cluster groups tend to agree with the statement Q.77 "My values and attitudes are similar to most people in my community", but once again the *Expanders* are the most likely to agree.

The *Investors* and *Traditionals* are likely to disagree with the statement Q.78 "It is not especially important to me whether I am a member of my community or not". *Expanders* also disagree but not to the same extent.

Discussion of the community dimension

The value and attitude statements relating to the dimension of Community (see Table 26) have low although acceptable chi-square values and low Cramer's V values (0.15-0.16) which means that the associations between the community value and attitude statements and the cluster groups are not very strong.

Because most farmers seem to regard the community as being important to them it somewhat counters any arguments that 'business-oriented' farmers ignore the

community. The response of *Expanders* shows that community is somewhat more important to them than it is to the other groups. They feel that they belong to the community and that this belonging is important. Because they are actively expanding it may mean that they are more dependent on the assistance and acceptance of their community and because they have a higher expectation of family continuity they would also expect a longer term relationship with the community.. They are likely to be less self-reliant than the *Traditionals* who are more likely to have been on their properties for over twenty-five years and the *Investors* who are less involved in farming for the lifestyle reward, and more for the financial reward.

Demographic and property characteristics

In the previous section the cluster analysis groups were described using the same value and attitude statements on which they were clustered. This has added useful detail to the understanding of the cluster groups by showing the different ways in which they value the dimensions of family, land, water, community and profit. Examining the demographic and property characteristics (see Tables 27-35) highlights some of the differences between the groups that are not directly related to their values and attitudes. These tables include, the proportion of ground water entitlement use for the five years prior to the survey, the farmers' property and production characteristics including the area and occurrence of each irrigation method, the farmers' age and number of years spent farming as an owner or manager, their expectation of family succession, as well as, when they left school and the highest level of education they achieved.

The large standard deviations of Tables 28, 29 and 30 indicate that the data have high variability and that not many data points are clustered around the mean. Because the standard deviation is also influenced by outliers the three cases that behaved as outliers and substantially distorted the results were removed to reduce this disruption. The two variables that showed the most disruption from these outliers are *the total farmed area* and the *groundwater entitlement* variables (see Table 28).

Table 27: Proportion of ground water entitlement use for the five years prior to the survey

N=210	*Investor*		*Traditional*		*Expander*		All	
	No.	%	No.	%	No.	%	No.	%
No use	28	33	25	36	16	28	69	33
Up to 20% use	8	9	7	10	7	12	22	10
21-40% use	7	8	10	14	8	14	25	12
41-60% use	10	12	11	16	6	11	27	13
61-80% use	16	19	9	13	10	18	35	17
81-100% use	7	8	4	6	4	7	15	7
Over 100% use	9	11	3	4	5	9	17	8
Total	85	100	69	100	56	100	210	

Substantial numbers of farmers in each of the cluster groups have made no use of their groundwater entitlement. The *Traditionals* are the most likely not to have made any use of their water while *Expanders* are the most likely to have made use of their water (see Table 27). This is important because it could be assumed that licence holders who are inactive irrigators (those irrigators who are not using their water at all) may be more likely to sell their water. There are differences in how the cluster groups use their entitlements. More *Investors* use greater amounts of their entitlement but fewer *Traditionals* use large amounts of their entitlement. *Expanders* are represented in all water use categories at similar levels to their overall proportions in the sample (27%).

Table 28 shows some of the property differences between the cluster groups. The mean farmed areas are quite similar between groups, but much of the other information points to between group differences. *Traditionals* have markedly less groundwater entitlement than the other groups. There are also some differences in the proportion of the groundwater entitlement that is used between groups. *Investors* use the highest proportion and *Traditionals* the least.

The mean ground water entitlements for *Traditionals* are substantially less than they are for both *Investors* and *Expanders* (see Table 28). For *Traditionals* the mean use, expressed as a percentage of the mean entitled amount, is lower than for either of the other groups. A smaller percentage of the *Traditionals* are cotton growers, and those who do grow cotton do so over markedly smaller areas. Compared to *Investors* or *Expanders* a slightly larger percentage of *Traditionals* grow pasture for seed, hay, or silage. They are

more likely to grow irrigated pasture for grazing, and when they do this they grow it over much larger areas than either of the other cluster groups.

Expanders, like *Investors,* are slightly more likely than *Traditionals* to have surface water entitlements in addition to their ground water entitlements. If they have surface water entitlements these are larger than the *Traditionals* but much smaller than the *Investors.*

Table 28: Property characteristics

N=209	*Investor*[a]				*Traditional*[b]				*Expander*[c]				All		
	Mean	No	%	Std. Dev.	Mean	No	%	Std. Dev.	Mean	No.	%	Std. Dev.	Mean	N	Std. Dev.
Total farmed area	642	-		677	641	-		907	628	-		603	638	204	738
Prior to this year how much groundwater entitlement	782	-		894	483	-		423	738	-		815	674	207	758
Average annual groundwater usage[d]	600	58	68	752	318	43	64	331	535	41	72	603	496	142	619
How much surface water entitlements?[e]	1570	22	26	1707	871	14	21	1172	981	17	30	1051	1197	53	1401
Average annual usage of surface water[d]	807	17	20	749	528	10	15	318	578	11	19	490	671	38	661
This table has outliers removed, [a]n=85, [b]n=67, [c]n= 57, [d] for the five years prior to the survey, [e]average of those with surface water.															

Initially Namoi Valley irrigators only used surface water. Groundwater was, at that time, a less preferred and less affordable source of water, but in later times it was recognised as a more reliable source of water. This means that many groundwater irrigators for historical and other reasons, now (in the areas where surface water is accessible) use a mixture of both ground water and surface water. Therefore, although this study is focused on groundwater, the telephone survey also gathered information on surface water entitlements and usage. The survey found that *Investors* had larger entitlements of both surface water and groundwater. Greater numbers of *Investors* are cotton growers growing larger areas of cotton than either of the other cluster groups (see Table 29). *Investors* were less likely to produce pasture for seed, hay, or silage than the other groups while *Traditionals* had far larger areas devoted to these more customary agricultural practices. *Investors* have a much larger standard deviation for pastures for seed, hay and silage. This might indicate that they are bringing their *Investor* values to a different form of large, intensive and specialised production of these crops.

Table 29: Production characteristics

N=209	*Investor*[a]				*Traditional*[b]				*Expander*[c]				All		
	Mean	No.	%[d]	Std. Dev.	Mean	No.	%	Std. Dev.	Mean	No.	%	Std. Dev.	Mean	N	Std. Dev.
Cotton	322	25	29	248	179	11	16	101	268	11	19	154	277	47	207
Cereal	168	28	33	186	124	22	32	110	143	18	32	102	147	68	143
Pasture for seed hay or silage	73	18	21	147	28	18	26	26	58	13	23	57	52	49	94
Pasture for grazing	41	6	7	30	355	9	13	713	40	1	2	-	217	16	545
Fruit or nut trees, plantation or berry fruits	6	4	5	5	21	2	3	26	33	1	2	-	14	7	15
Vegetables	-	-	-	-	105	2	3	134	114	1	2	-	108	3	95
Other broadacre crops	184	14	16	231	412	7	10	351	60	6	11	72	217	27	271
This table has outliers removed, [a]n=85, [b]n=67, [c]n= 57, [d]percentage of each cluster.															

Slightly more of the *Investors* carry out flood irrigation and those that do so do it over larger areas than other groups. A slightly lower percentage of *Investors* use sprinkler irrigation but when they do so it is also over larger areas. Fewer *Traditionals* use flood irrigation and when they do, it is over smaller areas. Because most cotton in the Namoi Valley is grown using flood irrigation it is not surprising to find that as more *Investors* grow cotton they are also more likely to use flood irrigation (see Table 29 and 30).

Table 30: Area and occurrence of each irrigation method

N=209		*Investor*[a]				*Traditional*[b]				*Expander*[c]				All		
		Mean	No.	%[c]	Std. Dev.	Mean	No.	%	Std. Dev.	Mean	No.	%	Std. Dev.	Mean	N	Std. Dev.
Irrigation Type[d]	Flood irrigation	475	35	41	404	291	20	29	292	257	23	40	283	363	78	355
	Sprinklers	57	17	20	72	40	15	22	50	40	12	21	28	47	44	55
	Drip	9	4	5	3	40	1	1	-	-	-	-	-	15	5	14
	Other	227	3	3	162	135	2	3	21	200	1	2	-	191	6	112
This table has outliers removed, [a]n=85, [b]n=67, [c]n= 57, [d]In hectares, [e]% of group with that irrigation type (occurrence not area).																

There are differences between groups with regard to the individuals' ages (see Table 31). These differences are most striking between the *Investors* and the *Expanders* while the *Traditionals* are similar to the average for all participants. *Investors* are more likely to be represented in the prime working ages from forty to sixty-four. The category after retirement has a much greater representation from *Expanders* and much less from *Investors*.

Table 31: Farmers' age ranges and distribution

Age range	*Investor*		*Traditional*		*Expander*		All	
	No.	%	No.	%	No.	%	No.	%
30 years or younger	1	1	1	1	2	4	4	2
31 to 39	9	10	7	10	6	11	22	10
40 to 54	38	44	27	39	19	33	84	40
55 to 64	29	34	18	26	13	23	60	28
65 or older	9	10	16	23	17	30	42	20
All	86		69		57		212	
Age distribution								
65 or older	9	10	16	23	17	30	42	20
55 or older	38	44	34	49	30	53	102	48
40 or older	76	88	61	88	49	86	186	88
31 or older	85	98	68	98	55	97	208	98

Table 32 shows that the numbers of *Investors* and *Traditionals* decline in the category with more than thirty-five years of farming experience. *Investors* are much younger than *Traditionals*. On the other hand the number of *Expanders* actually increases into the thirty-five to fifty years of experience category which is the category who are likely to have accumulated enough wealth to expand as well as the time when the succession issue is decided upon. Table 34 shows more of the *Expanders* are certain about succession and fewer expect to have no succession; they are therefore keen to expand so that the next generation can operate a viable business.

Traditionals have slightly higher proportions in the forty to fifty-four and the fifty-five to sixty-four age groups than the *Expanders* however higher proportions of *Expanders* are found in the sixty-five and older group. Most of the farmers who are over forty-five years of age would probably be beginning to have a clearer idea of whether they could expect family succession. This is because, if they had children by the age of twenty-five the children would be at least twenty years old and starting to consider their future careers more seriously.

The age distribution (see Table 31) suggests that both *Traditionals* and *Expanders*—being older—should have a high level of certainty of family expectation. But when *Traditionals* show a slightly lower level of expectation it is likely to be because the farms are not viable for the next generation, and they don't have the finance to expand, or simply that they do not have any children interested in taking over the family farm.

Expanders seem to have viable farms, the means to expand and children who are interested in continuing on with the family farm business.

The *thirty-five to fifty years* of farming experience category (see Table 32)—the category that coincides with the number of years of work that a person would work if they were spending their whole working life as a farmer—contains a low proportion of *Investors*. The *Expanders* and *Traditionals* have equal proportions in the *up to fifteen years* of experience category but for each of the subsequent categories have changing proportions which are difficult to explain. It could be that for some people the membership of a cluster group does change over time; possibly as a result of the influences from family or due to their business's life stage. It might be that farmers start as *Investors* for the first part of their career until the time that the issue of succession has been clarified. If no succession is likely, they become *Traditionals*. If their farm is viable for the next generation they become *Expanders* as their need to expand their business to accommodate their successors becomes apparent. Also, the discrepancy between the age distribution (table 31) and the experience distribution (table 32) suggests that some *Investors* enter farming later in life, either as a strict business enterprise with no expectation of family succession or as an investment combining the lifestyle benefits from farming with the expectation of a capital gain.

Table 32: Experience—years spent farming as an owner or manager

Experience categories	*Investor*		*Traditional*		*Expander*		All	
	No.	%	No.	%	No.	%	No.	%
Up to 15	18	23	9	14	9	17	36	18
15 to 25	21	26	8	12	15	28	44	22
25 to 35	27	34	32	49	8	15	67	34
35 to 50	14	18	16	25	21	40	51	26
All	80		65		53		198	
Experience distribution								
Over 35	14	18	16	25	21	40	51	26
Over 25	41	52	48	74	29	55	118	60
Over 15	62	78	56	86	44	83	162	81

The expectation of family succession is another area where there are striking differences between cluster groups. *Investors* have the lowest expectation of family succession

followed by the *Traditionals* and then the *Expanders* (see Table 33). *Investors* are much more likely to have no expectation of family succession, whereas low proportions of *Expanders* have no expectation of family succession. *Investors* low expectation of family succession could be because they are younger than the other groups, but the analysis of the value and attitude statements for that cluster also shows that they do not place a lot of value on family.

Table 33: Expectation of family succession

	Investor		*Traditional*		*Expander*		All	
	No.	%	No.	%	No.	%	No.	%
Yes	12	14	32	46	33	58	77	36
No	40	47	16	23	6	11	62	29
Maybe	28	33	15	22	12	21	55	26
Don't know/refused	6	7	6	9	6	11	18	8

Participants were asked when they left school and then separately what the highest qualification was that they received. Larger numbers of *Investors* and *Traditionals* completed year twelve than *Expanders* (see Table 34). *Expanders* have also been farming longer and are more certain about family successions which might suggest that they come from more traditional farm families who did not look at formal schooling as an important thing.

Table 34: When left school

	Investor		*Traditional*		*Expander*		All	
	No.	%	No.	%	No.	%	No.	%
Year 12 not complete	43	51	38	58	44	79	125	61
Year 12 complete	41	49	28	42	12	21	81	39

Expanders may have compensated for their lower levels of schooling by attaining trade or TAFE qualifications in larger numbers than either of the other two groups (see Table 35). Overall, *Investors* are the group with the highest levels of education and are more likely to have completed year twelve and also more likely to have completed university studies. This lends support to the previous observation that they have entered farming later in life with an investment motivation either as a strict business or as a lifestyle/capital gain combination.

Table 35: Highest level of education achieved

	Investor[a]		*Traditional*[b]		*Expander*[c]		All	
	No.	%	No.	%	No.	%	No.	%
TAFE / Trade	24	28	29	42	21	37	74	64
University	22	26	14	20	5	9	41	36
Either TAFE or Uni.	46	53	43	62	26	46	115	54
[a]n=86, [b]n=69, [c]n= 57.								

The cluster groups have been described using the demographic and property characteristic data. *Investors* are more productive, using larger amounts of water over larger areas. They appear more business-like and are better educated with a lesser expectation of their farm continuing in family hands. The *Traditionals* appear more conservative in their business undertakings, they grow less valuable crops (instead of growing higher value cotton they are more likely to be growing crops such as pasture for grazing), and use smaller amounts of water on smaller irrigated areas. Because cotton is a crop that requires greater management resources the smaller amount that they grow may also be explained by differences in access to capital and differences in risk preferences. *Expanders* are harder to describe, their business productivity doesn't appear as large as *Investors* but they are more productive than *Traditionals*, and like *Traditionals* they have a high expectation of family succession. They have been farming much longer, which has potentially enabled them to have the financial ability to expand. For *Expanders* the certainty of succession also plays a part in encouraging them to further expand.

The next part of the analysis discusses the actual and intended land and water management behaviours of each of the cluster groups.

Management actions and intentions

This study has not been able to demonstrate that a statistically significant relationship exists between the values that *Investors*, *Expanders* and *Traditionals* hold and their responses to the questions indicating how they have acted in the past or intend to act in the future (see Table 36). The values that contribute to the grouping of these irrigators led to the expectation that their actions would differ according to which group they belonged to. It was expected that a cross tabulation of past actions and future intentions would clearly show differing behaviours between the cluster groups. But when the cross

tabulation was performed, in most instances the results were not found to be statistically significant. However, the results which achieved significance contributed to the key conclusions from this study, as will be discussed later.

Table 36: Relationship between management actions and intentions and clusters.

Actions of all clusters for last five years									Association	Significance	Chi-square[d]	Probability
	Investor[a]		*Traditional*[b]		*Expander*[c]		All					
	No.	%	No.	%	No.	%	No.	%				
Buy or lease land	29	34	25	36	23	40	77	36	0.05	0.43	0.65	0.72
Buy or lease water	16	19	9	13	12	21	37	17	0.01	0.86	1.52	0.46
Invest in WUE	33	38	32	46	27	47	92	43	0.07	0.25	1.49	0.47
Invest in Storage	28	33	18	26	22	39	68	32	0.03	0.60	2.25	0.32
Increase irrigation	14	16	11	16	8	14	33	16	-0.02	0.73	0.14	0.93
Reduce irrigation	26	30	19	28	9	16	54	25	-0.12	0.06*	3.99	0.13
Sell or lease land	8	9	9	13	4	7	21	10	-0.01	0.80	1.32	0.51
Sell or lease water	10	12	9	13	1	2	20	9	-0.11	0.08*	5.47	0.06*
Intentions of all clusters for next five years												
	Investor		*Traditional*		*Expander*		All					
	No.	%	No.	%	No.	%	No.					
Buy or lease land	16	19	19	28	12	21	47	22	0.03	0.57	1.82	0.40
Buy or lease water	16	19	13	19	13	23	42	20	0.03	0.57	0.44	0.80
Invest in WUE	21	24	22	32	18	32	61	29	0.07	0.30	1.34	0.51
Invest in Storage	17	20	16	23	14	25	47	22	0.04	0.48	0.51	0.77
Increase irrigation	10	12	6	9	9	16	25	12	0.03	0.56	1.51	0.46
Reduce irrigation	13	15	6	9	6	11	25	12	-0.06	0.32	1.63	0.44
Sell or lease land	18	21	8	12	5	9	31	15	-0.14	0.03*	4.81	0.09*
Sell or lease water	15	17	11	16	6	11	32	15	-0.07	0.28	1.33	0.51
*Significant at 0.1, [a]n=86, [b]n=69, [c]n= 57, [d]The critical value for chi-square at p= 0.1 and d.f. = 2 is 4.60, n=212.												

Most of the responses to the actions and intentions data gained from the survey do not show a statistically significant relationship with cluster group membership.

This could be because:

- The cluster groups do not effectively represent participants' values.
- There is no relationship between the cluster groups and the actions and intentions data.
- The survey questions did not effectively elicit participants' actions and intentions.
- The survey questions did effectively elicit participants' actions and intentions, but the actions and intentions were modified by situational factors such as the introduction of the Water Sharing Plan and the drought.

Some of these possible explanations for the actions and intention data not having a significant relationship with the cluster groups appear more likely than others. Intuitively, the cluster groups should be representative of participants; the value and attitude statements which determined the cluster groups were developed with the assistance of six agricultural extension professionals. They were then tested with a group of irrigators and slightly modified as a result (Kuehne, Bjornlund & Cheers 2007). They have similarities to other value and attitude statements or questions used by other researchers (Maybery, Crase & Gullifer 2005; Morrison et al. 2008) who have successfully developed and deployed similar instruments. In addition the results discussed in the previous sections of this chapter show that these cluster groups do successfully represent the organising of individuals into groups with different values. This explanation for the lack of a relationship should therefore be discounted.

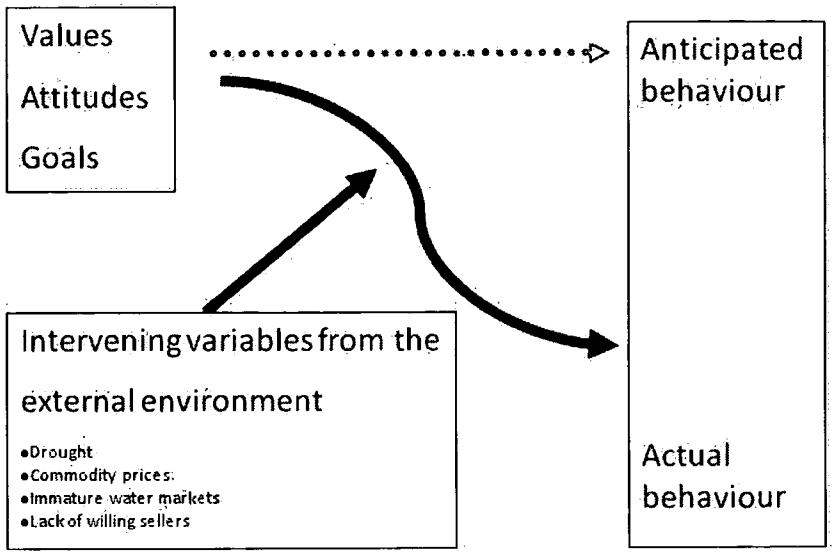
It would seem that the cluster groups do effectively represent three groups of farmers differentiated by values. It would therefore seem on the face of it that there should be a more striking relationship between the cluster group and the actions and intentions data. The value constructs of the factor analysis also indicate that this should be the case. The property and personal characteristics, because they point to certain differences between the cluster groups, suggest that the groups have behaved differently to each other to develop these differences. It remains distinctly plausible that there should be a

relationship between cluster group membership and actions and intentions data. It could be, however, that even significant differences in values are thwarted by economic realities.

The possibility that the survey questions did not successfully uncover participants' actions and intentions or that there are a number of intervening variables that haven't been addressed in this study (because it was beyond the purposes of the study to do so) seems much more likely. The problem with these questions was that the specific actions described in the question could take many forms. No attempt was made to quantify the amount of activity associated with each question, such as: how much? how often? or for how long? For other questions no effort was made to identify how extensive, or how much money, was spent on investments in irrigation efficiency, or investments in water storages. While each cluster, when presented with these questions, may have been likely to answer in a similar way the lack of detail is likely to have worked against differentiating the behaviours between cluster groups.

The possibility that situational factors such as drought might become intervening variables that subvert the expected outcomes also seems plausible (see Figure 10). The interviews were conducted at a time of great stress for these irrigators; with 1) an on-going severe drought, 2) low cotton prices, 3) a newly introduced but immature groundwater market, 4) a newly introduced water sharing plan, and 5) predominantly reluctant traders of groundwater. Their behaviour may have been much different without these influences.

Figure 10: Influence of situational factors on behaviour



It appears that the most likely explanation for the lack of statistical relationship between the cluster groups and the actions and intentions data is a combination of two factors as well as the context of the study at the time. The survey questions may have been too coarse to reveal the finer details of farmers' actions and intentions. The factor analysis described in the earlier part of this chapter identified clear value constructs and a greater number of significant relationships between value constructs and management actions and intention data which somewhat negates this conclusion. In addition the situational factors may have also intervened to distort the results.

Even though statistical significance is not present it is still worthwhile to examine the data for whatever information it can provide (see Table 36). McCloskey and Ziliak point to the value of taking a broader approach when they argue that:

> [n]o economist has achieved scientific success as a result of a statistically significant coefficient. Massed observations, clever common sense, elegant theorems, new policies, sagacious economic reasoning, historical perspective, relevant accounting: these have all led to scientific success. Statistical significance has not (McCloskey & Ziliak, p 112).

Before examining the individual cluster groups a simple comparison of participants' past actions with their future intentions (see Table 36) was made using their responses to questions fifty-seven and fifty-eight of the telephone survey (see Appendix C). This comparison suggests that licence holders might be responding to the uncertainty

associated with the WSP as well as the drought, low commodity prices and rising input prices. Compared to past actions fewer expect to buy or lease land and more expect to buy or lease water in the future. Fewer expect to make WUE improvements, invest in storages, or increase irrigated area, than have done so in the past. However fewer expect to reduce their irrigated area than have already done so. Perhaps the most important comparison is that more expect to sell or lease their land or water than have done so in the past.

The data related to the individual cluster groups do offer interesting and relevant information. Over the last five years *Investors* are more likely than any of the other groups to have reduced their irrigation area, or sold or leased some of their water (see Table 36). During this same period more *Traditionals* have sold or leased land and more have sold or leased water, but not to the same extent as *Investors*. At the same time fewer *Expanders* than the other groups have reduced their irrigation area, or sold or leased land. Even though they may have bought more water they have not expanded the size of their irrigated area.

In the next five years, more *Investors* expect to reduce their irrigated area, and sell or lease land, and/or sell or lease water (see Table 36). More *Traditionals* expect to buy or lease land, but fewer *Expanders* expect to sell or lease land, or sell or lease water.

In the five years prior to the survey there are differences between the management actions of the cluster groups conforming to expectations based on their values (see Table 37). It appears that *Expanders* are more likely to have maintained their irrigation area in the face of reductions to water entitlements by purchasing more water (see Table 37). The *Investors* and *Traditionals* have been more likely to sell their water and reduce their irrigated area over the last five years.

Table 37: Principal land and water management actions of the last five years

	Investor	***Traditional***	***Expander***
Water	Sold	Sold	Purchased
Land			Purchased
Irrigated Area	Reduced	Reduced	Maintained

Licence holders' intended actions over the next five years also show some differences that fit with those that might be expected from each of the cluster groups (see Table 38). The *Investors* are behaving as business people and moving their investments elsewhere. They take a more economically rational approach and make financial adjustments according to economic signals. The *Traditionals* are remaining in farming—but more so as dryland farmers—by buying more land to make up for the loss of income from the reductions in water entitlements. The *Expanders* are continuing as irrigators by purchasing more water to such an extent that they are more likely to increase their irrigated area. This suggests that in the face of economic hard times and uncertainty over future water supply the *Expanders* are still pushing ahead because their primary goal is not profit-maximizing but the continuation of the family farm.

Table 38: Principal land and water management intentions of the next five years

	Investor	***Traditional***	***Expander***
Water	Sell		Purchase
Land	Sell	Purchase	
Irrigated Area	Reduce		Increase

This section has discussed the land and water management actions and intentions data and showed how there are different behaviours between the cluster groups. The next section draws together all of the information that has been discussed in the preceding sections to develop a profile for each cluster group.

Profiling the *Investors*

Investors are influenced by a different combination of values to the other groups (see Table 39). They are the group least focused on family; instead they have a greater focus on profit. They have a moderate attachment to land and are in favour of water trading. They are more likely to be sellers of water than the other groups.

Table 39: Characteristics of the cluster groups

	Principal characteristics	Secondary characteristics
Investor	Not family focused Profit focused Moderate attachment to land Favour water trading	Use more of their groundwater Have larger amounts of surface water More likely to grow cotton Younger, less experienced Lesser expectation of succession More educated
Traditional	Family focused Not focused on profit Strong attachment to land	Smaller amounts of groundwater More likely to grow pasture Higher expectation of succession
Expander	Family focused Profit focused Not attached to land Community is important Favour water trading	Highest expectation of succession Less educated Oldest and most experienced

Investors do not feel that it is important for them to have their family involved in their farm business; therefore they do not encourage their family members' involvement in the business. Not surprisingly they also do not believe that their family is committed to farming or to the farming way of life.

They do not have strong views about bank finance being the sole way to ensure business growth. This could be because this statement ignores other potential sources of finance and focuses only on the banks. It might be that, as higher educated and more sophisticated business people, they are thinking more broadly than just obtaining finance from banks. They are also likely to have more personal finance from better paid off-farm jobs and savings from a longer period working in professional jobs.

They are less likely than other groups to sell off-farm investments at a loss in preference to reducing on-farm investments. They are more likely than *Traditionals* to invest wherever they can achieve the largest financial gain but they do not do this to the same extent that the *Expanders* do.

They are more likely to think that it's acceptable to buy and sell land to achieve their goals. Further illustrating this point they are less likely to care if they need to sell their

'home block' (they may not even associate with a 'home block' in the same way that *Traditionals* or *Expanders* do). They do not have strong views about whether regular buying and selling of land is an acceptable activity. They are more likely to think that owning the land is more important than operating the farm business. They are less likely than others to have intentions of buying more land to achieve family goals, and they would consider selling the farm if it became unprofitable. They are also less likely to consider land values when they make farming decisions. They have no concerns with the frequent trading of water.

The *Investors*' values differ to the other groups but they also have demographic differences to the other groups. They appear to be operating larger businesses more actively. They are more likely to possess both surface and groundwater. More are cotton growers, and those that do grow cotton grow larger amounts of it. They are much less likely to irrigate pasture. Those with flood irrigation have nearly double the irrigated area compared to that of the other groups. Those that use sprinklers for irrigation also do it over larger areas than the other groups.

Investors also differ in their personal characteristics. Compared to the two other cluster groups they have a much smaller proportion in the over 65 age group but a higher proportion in both the 40-55 and 55-64 age groups. Compared with other groups, *Investors* tend to have fewer years of farming experience. *Investors* are quite sure that they do not have any expectation of family succession. More have completed a university degree than either of the other two groups.

The previous section describes how the personal, property and business characteristics of the *Investor* group differ on a range of factors to the other groups, but their farm management actions also differ. Over the last five years more have reduced their irrigated area and sold or leased their water than other groups. In the next five years more expect to reduce their irrigated area and sell or lease land; an intention which complements the values that they hold.

Profiling the *Traditionals*

The *Traditionals* are family-focused, not focused on profit, and have an attachment to land and a more conservative business approach (see Table 39).

Their responses indicate that they tend to view farming as a business that should involve family; they believe that their family is committed to farming and the farming way of life. It appears quite important to them that their family is involved in the farm business. More than any of the other groups they actively encourage their families to become involved in the farm business.

They tend to disagree that bank finance is necessary for the growth of their farm business. It is possible that as their businesses are likely to have been in family hands for some time they are able to finance their growth from their profits. They are not just participating in farming to develop a business they also have other objectives such as those related to family. Rather than selling any part of their farm, they would sell off-farm assets at a loss, but not to the same extent that *Expanders* would do this. Unlike both of the other groups their investment in farming is not so much for financial gain.

They do not think that regular buying and selling of land is as acceptable an activity as the other groups find it to be. They won't sell their 'home block' as readily as the *Investors* would sell theirs; overall the buying and selling of land for profit does not fit with their paradigm. They think that owning the land is important in itself, it's not just so that they can operate a farming business. They do want to buy more land, but this is done for family purposes, and fewer intend to purchase land when compared to the *Expanders*. They definitely would not sell their land just because their business profitability declined, and they do not make improvements to their farm just to increase its sale value. They do not intend to keep unused water with the expectation that the price would increase.

The *Traditionals* also differ to the other two groups in their demographic characteristics. They have less groundwater entitlement than the other groups, and use a smaller proportion of what they have. Fewer grow irrigated cotton, and if they do grow cotton they are more likely to grow smaller quantities of it. More so than the other groups, they are likely to use their irrigation water to grow pasture rather than cotton. This could be because their land is less suitable for cotton production but it is more likely that they represent the traditional mixed farming properties with a greater reliance on grazing. (As the area was previously grazing country, growing pasture is an activity that would have been common in the Namoi Valley prior to the development of widespread irrigation and the cotton industry).

This group has more farmers aged sixty-five or over than the *Investors* but not as many as the *Expanders*. Three quarters of this group have over twenty-five years of farming experience, while only half of the *Investors* and the *Expanders* have over twenty-five years of farming experience. This does change for the over thirty-five years of farming experience category which is dominated by larger numbers of *Expanders* (at the same time as there are fewer *Investors*). Greater numbers of *Traditionals* have achieved a trade or a TAFE level of education than the other groups. This group has a strong expectation of family succession, but not quite as strong as that of the *Expanders*.

Almost half of the *Traditionals* (a little fewer than the *Expanders*) expect family succession. A quarter of all *Traditionals* expect no family succession which is half the number of *Investors* expecting no succession but twice as many as the *Expanders*.

Their management actions and intentions suggest that they might be tending to move out of irrigated agriculture in preference for dryland agriculture. This action allows them to remain farming and at the same time satisfy their family succession goals. (They even may become more profitable in the longer term as water becomes scarcer and consequently more expensive). Over the last five years they've both sold or leased land and sold or leased water. Over the next five years they expect to buy or lease more land, but not more water.

Profiling the *Expanders*

Expanders are family focused (see Table 39). They are also focused on profit but unlike *Traditionals* they do not have a strong attachment to land. *Expanders* think that farming is a business that should involve family; they believe that their family is committed to farming and the farming way of life. The goal of family involvement in the farm business is important for them. While they are likely to actively encourage family members to be involved in the farm business, they are not likely to do this to the same extent that the *Traditionals* would. *Expanders* view bank finance as a necessary way to achieve business growth. They are more likely than others to be farming to develop a business for themselves or their family. They indicate that they are not motivated by profit-maximisation when they say that they would be much more likely to sell off-farm investments at a loss than to sell any part of their farm. However they go on to express profit-maximising motives when they choose to invest their money where they can achieve the largest financial gain. Similar to *Investors* they will be more likely to readily

buy and sell land but unlike *Investors* they are not as prepared to sell their 'home block'. They are interested in farming as a pursuit rather than as a way to own land. If they were to buy more land it would be done for family purposes. They would be reluctant sellers of land if it was unprofitable, but not as reluctant as the *Traditionals* are. They consider land values when they make farming decisions. They think that frequent traders of water are greedy. If they had unused water they would choose to use it for expansion rather than sell it. Alternatively they would rather keep the water because of its value as an investment. They appear to obtain some of their identity from their community, and think that their values are quite similar to those of the rest of the community.

Their property and demographic characteristics also set them apart from *Investors* and *Traditionals*. They use similar amounts of groundwater to the *Investors*, but use a slightly lower proportion of their entitlement. They also grow slightly smaller areas of cotton than the *Investors*. They have a higher percentage of members in the sixty-five years or older category and in the category with the longest farm experience. They have the highest level of expectation of family succession. The reason that *Expanders* might have a higher degree of certainty of succession could be because they have been farming for longer and therefore may have a better financial base to expand from and more viable farms to pass down to the next generation. In addition it is closer to the actual time of their succession so the issue might be more urgent and more real.

They have lower levels of university education than the other groups. They have higher proportions of TAFE or trade certificates than the *Investors,* but lower proportions than the *Traditionals*. This could be because they have larger more viable farms than the *Traditionals* and greater certainty of the viability of family succession and have therefore placed less emphasis on formal education relative to on-the-job training undertaken on the family farm.

Their management actions and intentions appear to be driven by their values, attitudes and goals. In the last five years they are more likely to have purchase or leased more land and water allowing them to maintain their irrigated area. In the next five years they are more likely than the other groups to buy more water and expand their irrigated area.

For the *Expanders*, *Traditionals* and to a lesser extent *Investors,* different production possibilities arise when family labour is available. However, the key point is that for many irrigators the reason that these possibilities for expansion are explored is not

because family labour exists but because they have a goal of developing their business further. For them the business needs to be able to support more than one family and also be suitable for handing on down to their successor/s. It is not so much about exploiting a resource, as about being driven by a goal.

A simple way of differentiating between the groups which recognises their key influences is according to their expectations of family succession and their approach to profit-maximisation (see Table 40).

Table 40: Dominant influences for each of the cluster groups

Investor	Low expectation of family succession – Moderate regard for profit-maximisation
Traditional	Higher expectation of family succession – Low regard for profit-maximisation
Expander	Highest expectation of family succession – High regard for profit-maximisation

Relationship between value constructs and cluster groups

The cluster groups of *Investor*, *Traditional* and *Expander* have been described in the previous sections. The cluster groups—which are different to the value constructs which are groupings of values held by farmers each to a greater or lesser extent—have much to offer in differentiating farmers' behaviour. This section discusses how the value constructs derived from the factor analysis match up with the cluster groups. To examine the relationships between the value constructs and cluster group membership a cross tabulation was performed (see Table 41) between the value constructs of *Succession*, *Caretaking* and *Commerce* and the cluster groups of *Investors*, *Expanders* and *Traditionals*. The purpose of this cross tabulation was to identify which of the value constructs related most closely to which of the cluster groups.

The results from this cross tabulation clearly show the influence of the overlapping value constructs. Because of the way that factor scores are generated each case receives a factor score ranging between low and high. As not all cases have the same scores they can be viewed as associating with each of the value constructs to varying extents. To ensure that the value constructs were clearly defined the 70th percentile was chosen as the point for dichotomizing the data. Those respondents above the 70th percentile were identified as being the 30% of all cases most strongly associated with that value construct. Incorporating more cases by decreasing the percentile cut-off point gives a less clearly

defined result, whereas using fewer cases results in not having enough people to draw meaningful conclusions. Table 41 shows the percentage of the 30% of cases most strongly associated with each value construct, that in turn belong to each of the cluster groups.

Table 41: The proportional representation of the 30% most strongly associating with each value construct within each cluster group

Value construct / cluster group	[a]Investor n=86	Traditional n=69	Expander n=57	Chi-square	Significance
Succession	2.3 %	43.5%	56.1%	55.6	.00
Caretaking	34.9%	29.0%	24.6%	[b]1.8	.40
Commerce	30.2%	8.7%	63.2%	42.7	.00

[a]The 30% most strongly associated with the value constructs are represented by the factor scores above the 70th percentile group, [b]The critical value for chi-square at p= 0.1 and d.f. = 4 is 7.78.

Of the sixty-four cases strongly associating with the *Succession* value construct only 2.3% (2 cases) fit within the *Investor* cluster group. Because of the way the factor scores are dichotomized these results are best interpreted as convenient measures useful for making comparisons between the groups (see Table 42 and 45). Other choices of cut-off points will change the percentage figures of table 41 but not the underlying relationships. When examining the *Investor* group it is obvious that the *Succession* value construct is not strongly represented. It is, however, strongly represented in the *Traditional* group, and even more strongly in the *Expander* group. The *Expander* group has the highest proportion of those rating highly on two of the three value constructs. This could suggest that the *Expanders* are more strongly influenced by their values. They associate more strongly than the other cluster groups with the two value constructs which contain the most important values used for differentiating the three clusters.

The chi-square value for the *Caretaking* value construct was below the critical value of 4.60 and does not have statistical significance (see Table 41). The proportional representation of the cluster groups for this value construct is more uniform than for either of the other value constructs.

The *Commerce* value construct is not represented very strongly in the *Traditionals* cluster group. It is, however, strongly represented in the *Investor* group and has a very strong representation in the *Expander* group.

Table 42: Dominant value dimensions influencing each cluster group

		Values		
Cluster group	*Investor*	**PROFIT**	FAMILY	LAND
	Expander	**PROFIT**	**FAMILY**	LAND
	Traditional	PROFIT	**FAMILY**	**LAND**
Shaded cells represent the most dominant values				

Closing comments

This study involved three data collection exercises: a mail-out survey, personal interviews and a telephone survey. The study approach has been iterative, with subsequent methods building on the results of those methods preceding them. Illustrating this, the initial aim of the research was to: "identify and examine those factors other than profit-maximisation that influence farmers' management behaviour". By the end of the study this initial aim had been refined to two aims, the first was to "investigate and compare the influence of non-profit-maximising values and profit-maximising values on farmers' management behaviour", and the second was to "construct a typology that illustrates how farmers' management behaviour differs according to the values that they hold".

The sequential methods built a developing body of findings. Firstly, the mail-out survey showed that farmers were not only motivated by profit; but that there was also a range of other influences acting on their behaviour. The personal interviews made these influences much clearer. For some farmers, profit-maximisation was a strong influence, but others reported a range of influences including community, lifestyle, family, land and water, as well as profit-maximisation.

Secondly, the analysis of the telephone survey demonstrated that three value constructs (see Chapter Six) could be shown to influence farmers' behaviour—*Succession*, *Caretaking* and *Commerce*. It was shown that, depending on their preferences, farmers could lean towards one or more of these value constructs.

Thirdly, cluster analysis was conducted to group farmers according to how they valued the dimensions of family, land, water, community, lifestyle and profit. Three plausible groups were formed—*Investors*, *Expanders* and *Traditionals* (see Table 44). Each had differing personal, property and production characteristics, and each was likely to behave in different ways.

Even though it could not be statistically demonstrated that these groups have differing farm management actions and intentions, with respect to the majority of actions tested, based on the values that they hold, the indication from all of the assembled evidence suggests that they do. Further, there were statistically significant differences in the past and future intended management actions with respect to buying and selling both land and water, and expanding or reducing the irrigated area. These differences are consistent with the hypothesised differences based on the underlying values of the three cluster groups. Hence, the null hypothesis that there is no relationship between farmers' non-profit-maximising values and their behaviour is unlikely. The next chapter draws conclusions from these results and makes recommendations for alternative policy approaches and for future research.

CHAPTER EIGHT

8 Conclusions and Recommendations

Introduction

This chapter begins by summarising the context, importance and relevance of the study. It then discusses the findings and the study's strengths and limitations as well as the conclusions and the recommendations for future research.

Policy problem addressed by this study

At the beginning of this dissertation it was suggested that the environmental reforms that are underway in Australia—which are aimed at protecting stressed water resources—will lead to increasing water scarcity for agricultural and other users. These reforms are being implemented at a time when irrigated agriculture in Australia needs to play an increasing role in food production for an expanding world population.

The most recent development in the Australian water reform process is the Rudd Government's $12.9bn 'Water for the Future' plan (Wong 2008). This plan, in common with all water reform policies since the 2004 advent of the National Water Initiative (CoAG 2004), relies in part on water markets as a mechanism to reallocate water to the environment, and also to more efficient and productive users of the water. From the time water markets (and their requirement for the separation of land and water titles) were first suggested as a method for water entitlement reallocation, irrigators (perhaps under pressure from the irrigation lobby) have been, at least initially, reluctant to embrace them. The Federal Government's intention to purchase $3.1 billion of water entitlements (or approximately 15% of the average annual diversion by irrigators) over a ten-year period (Young & McColl 2007) is a new policy initiative that has been undertaken in a cautious and provisional fashion.

With this slow start to environmental water buyback increased pressure will be placed on purchases in subsequent years to achieve the overall required volumes. However, research (ACIL Tasman 2008; Waterfind 2008) continues to suggest that irrigators will not be participating in water markets in the numbers required for the government to achieve its intended policy goals, at least at the current prices offered for water.

For the government to return sufficient water to the environment to achieve its sustainability targets, irrigators will be expected to participate in the water markets to a greater extent than they have ever done previously. The findings of this study that farmers vary in systematic ways means that the voluntary involvement of irrigators in selling

water to the government for environmental purposes may be encouraged if they are approached in a way that takes account of their values, attitudes and goals concerning family, land and profit and to a lesser extent water, community and lifestyle.

The topicality of this thesis is how the understanding of influences on Namoi Valley irrigators' management behaviour, other than a sole emphasis on profit-maximisation, can be used to inform water reform, not only in the Namoi Valley but in other parts of Australia as well.

The study argument

The gap in knowledge that this dissertation addresses is how the dimensions of family, land, water, community, lifestyle and profit interact to influence the behaviour of farmers. Farmers have not been grouped previously using this combination of values.

The argument of this dissertation is that, "irrigators' behaviour is better predicted by considering the combination of values they hold toward family, land, water, community, lifestyle and profit, rather than the extent to which they are motivated by profit-maximisation alone".

The argument has been supported by the findings of the study. Using the recommendations from this study, policy makers could design policies and programs which better take account of the full range of influences on farmers' behaviour. In the context of the water entitlement buyback scheme of the federal government's 'Water for the Future' plan this might result in the increased uptake of water purchase offers among reluctant sellers (Wong 2008).

Methods for this study

The research methods were a mail-out survey to uncover and explore issues, followed by personal interviews to further develop the ideas gathered from the analysis of the mail-out survey. The analysis of the final method—the phone survey—grouped the values that farmers hold towards the dimensions of family, land, water, community, lifestyle and profit using factor analysis. The value and attitude statements of the survey were then analysed using cluster analysis to group farmers according to their values and attitudes. Both of these methods of analysis were extended using cross tabulations between the

cluster groups and the demographic, personal, business, and actions and intentions data also from the telephone survey.

Findings

The first stage of the research—the mail-out survey—found that farmers' responses to the WSP were to varying degrees influenced by their values concerning the dimensions of: family, land, water, profit, community and lifestyle. Apart from identifying these dimensions the analysis did not show how important the dimensions were, either in their own right, or relative to each other, or which combinations of these dimensions were important.

The second stage of the research, the personal interviews, were used to develop a greater understanding of the history and the problems of the region, and to further develop issues uncovered from the mail-out survey. As the mail-out survey found that farmers' intended responses to the WSPs were often not solely influenced by profit-maximisation the personal interviews were used to examine influences other than profit-maximisation. The personal interviews also provided the background information that allowed the questions and statements of the telephone interviews to be perceived as credible, relevant, and therefore worthy of consideration by participants.

The first hypothesis, developed from the initial analysis of the personal interviews, was that the behaviour of farmers could be seen as fitting on a continuum that ranged between two 'ideal types'; the *Investor* and the *Custodian* (see Figure 11) (Kuehne & Bjornlund 2006a). This was a useful, yet simple, way to conceptualise the influences on farmers' behaviour. *Investors*' management decisions were seen as being driven by a pursuit of financial goals while *Custodians'* decisions were influenced by a desire for a continuation of the family farming lifestyle and a concern for the land and water resource. Simple and easy to describe, the failing of this approach was that it neither recognised the complexity of farmers' motivations nor allowed them to be described and explained in detail. Placing a farmer on this continuum gave no information that would help to explain underlying influences on their behaviour. So it was therefore not a very useful model for understanding the complexity of their behaviour. It also was not very useful for devising alternative or improved ways of motivating farmers. The continuum inferred that farmers

who were increasingly influenced by the profit-maximisation values of the *Investor* also experienced a proportionate reduction in influence from the values of the *Custodian.*

This simplistic and provisional concept assumed that these two types are polar opposites so that as one measure increased the other decreased. More detailed examination of the personal interviews showed that influences on farmers' behaviour were more complicated than those that could be represented by a simple continuum. This important conclusion from the study suggests that future research should start from the stance that the topic is complex, and that there will be no simple explanations. If only two 'ideal types' were found to be present, a better alternative to a continuum would have been two separate scales that allowed farmers to possess varying and independent amounts of the values contained within each of the 'ideal types', see Figures 11 and 12.

Figure 11: Continuum developed from the mail-out surveys and the personal interviews

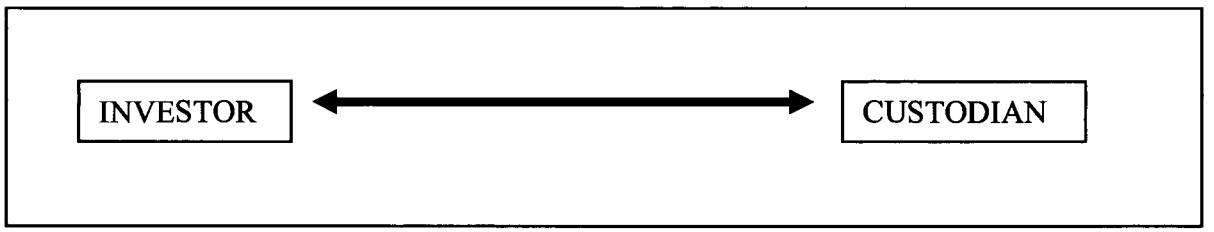
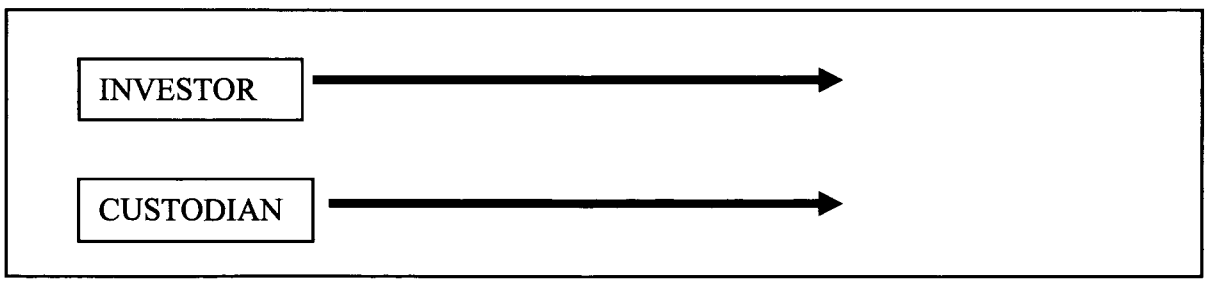


Figure 12: Revised scale for the Custodian-Investor continuum



The *Custodian-Investor* continuum was not the end point of the research but instead it provided a convenient and provisional starting point for conceptualising the influences on farmers' behaviour.

The third stage of the study, the telephone survey, gathered participants' responses to fifty value and attitude statements. The value and attitude statements were used to develop value constructs which irrigators might associate with, and to cluster irrigators

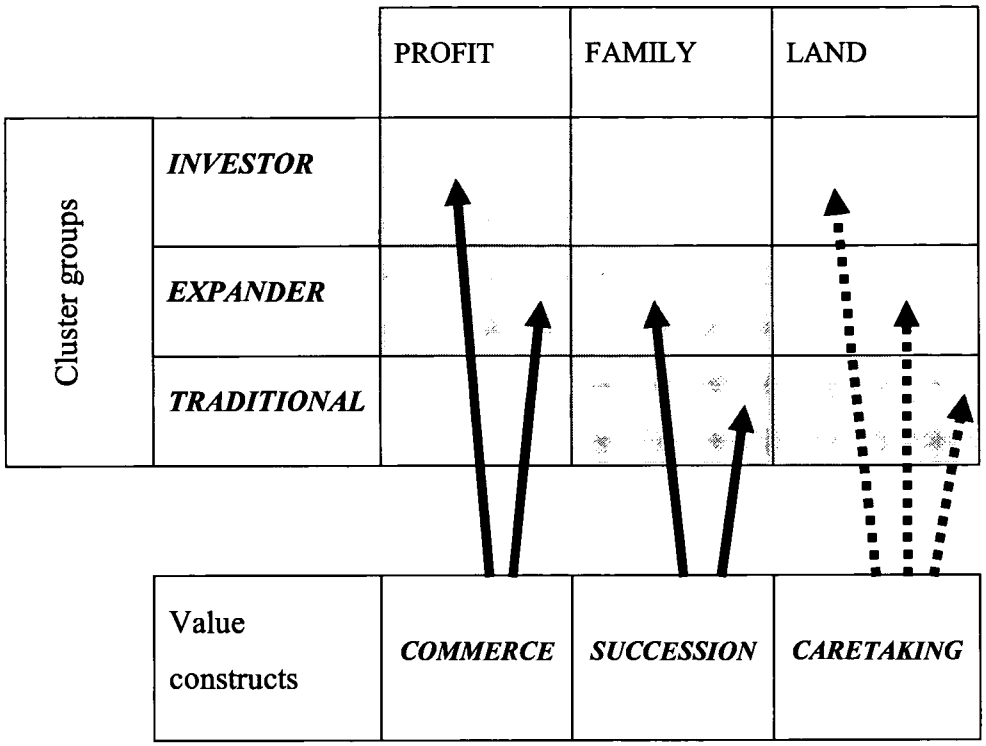
who held similar values into distinct groups. Investigations were undertaken to examine whether these value constructs and groups exhibited different forms of behaviour.

Twelve of the fifty value and attitude statements of the telephone survey were factor analysed so that value constructs incorporating the value dimensions of family, land, water, community, lifestyle and profit could be formed. Three value constructs were identified and were described as; *Succession*, *Caretaking* and *Commerce*.

The *Succession* value construct included individual value and attitude statements that focused on the value of family. The *Caretaking* value construct contained value and attitude statements focused on good land husbandry, responsible water use and a preparedness to accept that family might choose careers other than farming. The *Commerce* value construct contained value and attitude statements that were more clearly focused on the achievement of profit, without an emphasis on family succession. These value constructs were not mutually exclusive but were held by participants in greater or lesser amounts. It was as though there were three constellations of values each influencing their behaviour according to whether the individual leaned more toward one or another. Because the differences between those associating strongly with each of the value constructs were not always straightforward they demonstrated the complexity of the influences on farmers' behaviour.

Factor analysis showed how the values held by farmers could be grouped, how they overlapped and how they influenced farmer behaviour. However to group these farmers according to the values that they held cluster analysis was used. Using twenty-nine suitable value and attitude statements a cluster analysis result was obtained with three plausible clusters; *Investors*, *Expanders* and *Traditionals*. The results from the personal interviews were used to confirm that the choice of cluster groups was sound. In most cases it was found that there was a credible match between what the interviewee had indicated that their values might be and their cluster group membership. Detailed examination of the cluster groups using cross tabulations with the demographic, personal, and actions and intentions data were conducted. The dimensions of water, community and lifestyle were not found to be as important for defining the cluster groups as were the dimensions of family, land and profit (see Figure 13). The *Investors* are defined most strongly by profit, the *Expanders* by a combination of profit and family, and the *Traditionals* by a combination of family and land.

Figure 13: The representation of the value constructs in each of the cluster groups



The connection between the value constructs formed from the factor analysis and the groups obtained from the cluster analysis are shown in Figure 13. All participants interacted with each of the value constructs to a greater or lesser extent, however, for ease of interpretation only the strongest, most prominent interactions with the value constructs are shown in Figure 13. The *Commerce* and the *Succession* value constructs have the most obvious interactions with the cluster groups, while the role of the *Caretaking* value construct is much less distinct.

Figure 13 is important for understanding how the value constructs interact with the cluster groups and for understanding the role of the most important value dimensions in each of the cluster groups. The principal characteristics of the cluster groups (see Table 43) which have been developed from the twenty-nine value and attitude statements used for the cluster analysis provide a more detailed understanding of cluster groups. The secondary characteristics have been derived from comparisons made between the demographic, personal, business, and actions and intentions data, and the cluster groups.

Table 43: Characteristics of the cluster groups (same as Table 39)

	Principal characteristics	Secondary characteristics
Investor	Not family focused Profit focused Moderate attachment to land Favour water trading	Use more of their groundwater Have larger amounts of surface water More likely to grow cotton Younger, less experienced Lesser expectation of succession More educated
Traditional	Family focused Not focused on profit Strong attachment to land	Smaller amounts of groundwater More likely to grow pasture High expectation of succession
Expander	Family focused Profit focused Not attached to land Community is important Favour water trading	Owners are older, more experienced Highest expectation of succession Less educated

Investors are most strongly influenced by the values that they hold regarding profit. They are not strongly influenced by the values that they hold toward family or land. They do not take a sentimental approach to farm ownership; rather, they are prepared to sell land when it represents a financially attractive opportunity. They are much younger and are more recent entrants to the farming industry. They grow more profitable crops and have more narrow profit-maximising goals, which are likely to include the realisation of a capital gain at the end of their farming career. They are therefore also far less likely to expect family succession. Reflecting these values, they have been more likely to sell or lease land and water in the past and also anticipate doing so in the future.

Traditionals are strongly influenced by the values that they hold toward their family and also the values that they hold with regard to land. *Traditionals* are likely to be established farmers with a traditional crop mix. They have a lesser drive towards generating profit and further business growth compared to the other groups. Nearly half of the *Traditionals* expect to have family succession; however nearly one quarter of that same group are also certain of not having succession. They don't see land as being a tradable commodity, instead it appears that it might satisfy other needs for them, which were not identified or explored by this study. They have a greater emphasis on dry land farming and tend to use

their water for lower value use such as pastures for grazing. It could be that there are two different types of farmers: those with larger viable traditional family farms already with succession arranged and those who do not expect family succession but still reflect the underlying family values. The latter type would therefore have no ambition to develop their farm any further as they just want to remain on the farm as long as they can. At retirement their farm would be sold to non-family members to support their retirement. Under current drought and policy conditions they seem to be in the process of shifting their enterprise balance so that they rely more heavily on dry land activities and less on irrigation.

Expanders are influenced by profit, but also by family concerns. They are not strongly influenced by the values that they hold towards land. They are older and have been active in farming much longer. They are therefore much closer to the actual time of intergenerational change and therefore have a much higher level of certainty of family continuity. Given their longer time in farming they are also likely to have the largest asset base and are more likely to have the financial means to expand ensuring that the new generation has a viable resource base. They have therefore been more likely to buy or lease more land and water to maintain their irrigated area, and in the future expect to continue to buy or lease more water to expand their irrigated area to meet the need of the next generation.

Strengths and limitations of this study

The strength of this study is that it has been iterative, using successive methods—both qualitative and quantitative—to focus on the problem of identifying the influences of non-profit-maximising values on farmers' behaviour. Another strength of the study is that the topic came from the researcher's observations and interests formed over a twenty-five year farming career. This previous career enabled greater access to the study group who are a disaffected group of irrigators, and also provided a background which allowed greater insights when examining the data. The combination of a long farming career followed by an academic career therefore allowed the researcher to be involved in, and yet disconnected from the research.

Limitations to this study are that the research was undertaken with groundwater licence holders at a time of change in policies concerning water and water trading. It may have

been that the surveys were affected by this policy uncertainty as well as the continuing drought and low cotton prices. These results could well be different with other farmers in another policy context.

Devising the questions for a telephone survey such as this is difficult, time consuming and requires compromise. The aim of the survey was to first gather demographic information and then to measure the intended value dimensions using the participants' responses to the value and attitude statements. This was done by wording the questions and statements in such a fashion that they were understood and responded to in a way that accurately revealed the participant's beliefs. In addition, the total number of questions was constrained by the need to provide a survey that could be completed by irrigators before it became unduly arduous. The survey was designed so that it was in a form that maintained the cooperation of a group of people who were expected to be reluctant participants, as shown through earlier stages of the research (Kuehne & Bjornlund 2008b).

The most important limitations to this study were that its primary objective (being part of an ARC Linkage grant) was to study the management decisions of ground water irrigators in response to the WSP. Other limitations were that (1) the limited potential for ground water trading in the Namoi Valley made it difficult to examine the behaviour of farmers regarding water trading, (2) the relatively small sample size may be responsible for some lack of statistical significance, and (3) survey questions could have benefited from further testing (but this was beyond the study budget). However, despite these methodological criticisms the study found three convincing value constructs that were shown to influence farmers' decisions and underpin three cluster groups. The cluster groups were useful in explaining the non-profit-maximising influences on farmers' behaviour.

Another lesson from this study is the need to develop a new instrument to measure farmers' non-profit-maximising values. That the instrument needs further refinement was shown by cluster groups which were not as effective as expected in explaining farmers' behaviour. There are good reasons to use existing instruments when they are appropriate:

> The development of valid and reliable instruments takes time, patience, and knowledge...It is only when reliable and valid instruments are not available to measure a particular construct of interest that we might turn our attention, albeit reluctantly, to instrument development (Pett, Lackey & Sullivan 2003, p. 13).

The rudimentary stage of development of this instrument has played a part in reducing the strength of the relationships. Nevertheless the encouraging results provided by this study show that further development of the instrument is warranted.

Policy implications from this study's findings

The most relevant, and most immediately useful, application of the results from this study is to explain why irrigators might be reluctant participants in the federal government's water entitlement 'buyback' scheme. However, it is not only limited to this situation; the results may also have applications when programs and policies are designed to assist farmers through periods of structural adjustment or other periods of change, or when new technologies or management practices are introduced for adoption. There are two main ways that the results of this study could be useful for informing policy design.

The first is to design policies which take into account the motivations provided by each of the value constructs. The importance of the value constructs is that they illustrate the influences on management behaviour which are derived from the main idea of the value construct. (The value constructs are groupings of like values that are connected, congruent and consistent with, and supportive of, the value construct's main idea). However this focus on one main idea means that, for most farmers, each value construct is only able to explain part of what influences their behaviour. Most farmers are influenced by each of the three value constructs to a greater or lesser extent. Even though most farmers are pursuing objectives associated with more than one value construct—what Hatfield-Dodds et al. (2007, p.44) call 'multiple contested values'—policies and instruments could still be designed to allow farmers to achieve the objectives aligned with a specific value construct. Whether a specific farmer will react to the particular policy or instrument will depend on how that farmer's decision is influenced by the value construct at that particular time. The policy maker will know that by designing a particular instrument or policy in a specific way—one that is sympathetic to the nuances of farmers— the policy will be more effective in influencing farmers who hold that value construct.

The second way to design policies is by visualising an actual farmer such as described in the cluster groups. The cluster groups are distinct groups of farmers who are influenced by a range of values. The cluster groups were not formed using the factor scores (which explain 52% of the variance) but they were formed using the original data in a way that

reflects, but does not replicate, the values found in the value constructs (see Figure 13). Therefore, (within the limits imposed by the choice of cluster variables) the cluster groups are able to explain a more complete range of influences on the individual than the value constructs can.

The cluster groups, because they are more representative of reality, are more appropriate for thinking about people. The best approach may be to design policies with the cluster group members in mind but with the awareness that they are farmers who are influenced by various combinations of value constructs.

The usefulness for policy development arises from understanding that each of these three groups may behave differently when presented with the opportunity to sell water to the government, participate in other similar reform programs, or adopt a certain technologies or management practices. When this is acknowledged it becomes possible to consider developing more sympathetic, and consequently more effective, policies and programs tailoured to the actual values and attitudes of farmers.

Using the sale of water as an example, the next section describes the different ways in which the cluster groups may behave.

The *Investor* can be expected to make decisions based on the financial benefits associated with the sale of their water. They will make these investment decisions recognising that water plays an important part in achieving their businesses goals of profit (the *Commerce* value construct). An approach that the government could employ to ensure greater participation from this group would be to ensure that profitable business opportunities can be preserved, even if they sell their water.

One of the interviewees from this group illustrated his feelings about how the sale of water fitted into his retirement planning, suggesting, "When I want to retire to the Gold Coast ... that water licence alone is going to be worth a hell of a lot".

The *Expander* will be less likely than the *Investor* to sell their water as it plays a part in achieving both of their goals: profit (the *Commerce* value construct) and family succession (the *Succession* value construct). The water is used to generate a profit which is a fundamental part of developing a viable business for family successors. The government could gain greater participation from this group by developing programs and policies that recognise that their motivation is a combination of profit and family. Any

programs or policies, developed to appeal to this group, would be more likely to be successful if they allowed family goals to be achieved along with goals of profit.

An interviewee from this group described how he would not consider selling his water because it was useful for his sons in continuing the business, stating "... I don't believe we will ever sell the water licenses... I want the boys to carry on with it; they've helped build it...".

The *Traditionals*, who are primarily motivated by family succession (the *Succession* value construct), need the water to provide a viable business for family successors. Water for them is tied to the achievement of family goals. If the government wants this group to engage in water sales they could consider developing programs and policies which allow them to continue as farmers, and even to further develop the family farm but to do this with the absence of water. Because they have a feeling for the land (the *Caretaking* value construct) and the farming culture they could be encouraged to remain as farmers without water by paying them to provide ecosystem services (as suggested by Bjornlund (2004).

Illustrating the important relationship between land, water and family for the *Traditional,* one interviewee from this group stated that "[n]ow my son's put his name on a piece of dirt; I would never consider selling my water".

The government could take advantage of these findings by developing policies that achieve the intended effect by providing for the different motivations of each of these three groups. This has started to some extent with the 'Small Block Irrigators Exit Grant package' announced on 2 November 2008 and targeted at water purchases from small irrigators, but with the condition that they remain on their properties (Department of the Environment Water Heritage and the Arts 2008).

Given that some of the groups described in this study find permanent sale of water to be an objectionable concept it may be that the government should consider temporary purchases of water to achieve their aims. This needs to be the subject of further research. Questions which need to be addressed to better understand the potential for this option are:

- What are the factors that affect or impact upon decisions to trade allocations in the Australian allocation market at different times within a particular trading year?

- How do these decision-making factors vary between trading years and what causes this variation?

- Can forecasting of likely future trade decisions in the water allocation market provide a basis for strategic trading by Australian government entry in the allocation market as part of its' buy-back scheme? (Loch, personal communication, 3 May, 2009)

An additional policy approach that may be useful in situations where farmers are reluctant to sell their water permanently is the use of options contracts (Hafi et al. 2005). Used for environmental purposes these would allow the government to buy a specified quantity of water at a specified price when certain pre-arranged conditions of water availability were met. The use of options has the advantage that the farmer retains ownership of the water, while it is available for the environment under certain climatic conditions when it is deemed most useful. The disadvantage with this option occurs if the current MDB drought becomes the new norm or something similar; at which time they are unlikely to be very useful. A policy option that is already being pursued as part of the government's "Water for the future" plan (Wong 2008) is investment in water use efficiency improvements. This is one of the options which rely on the voluntary participation of irrigators and is likely to be most attractive to the *Expanders*. These are the farmers who because they see a future for their family as irrigators, would be prepared to make further investments in their business.

Another policy option, that has been discounted by the government (Wong 2008) but may need to be revisited after considering the results of this study, is that of compulsory acquisition of water entitlements. Even though the government has maintained that water will only be returned to the environment through purchases from willing sellers, the evidence suggests that there are unlikely to be adequate willing sellers to meet the government's goals (Young & McColl 2007).

The questions asked at the beginning of this thesis were, 1) why does the assumption of profit maximization fail to adequately describe farmers' behaviour and what might provide a better alternative? and 2) can farmers be categorized according to the values that they hold concerning family, profit, land, water and community and, if so, how? The thesis has shown that there are more values influencing farmers' behaviour than just

profit-maximisation, and that farmers can be grouped according to which of these values influence them.

The hypothesis

It was not possible to conclusively confirm the hypothesis that "irrigators' behaviour is better predicted by considering the combination of values they hold toward family, land, water, community, lifestyle and profit, rather than the extent to which they are motivated by profit-maximisation alone", but the evidence strongly points in this direction. The evidence suggests that the values that farmers hold influence their behaviour. The attempt to group farmers into distinct cohorts according to the values they hold was also successful, but the relationship between these groups and their actions and intentions was less conclusive. The factor analysis showed more statistically significant relationships between values and actions and intentions, whereas the cluster analysis had fewer statistically significant relationships and was less conclusive in confirming a link between the combinations of values that individual farmers hold and their management actions and intentions.

Evidence has been produced that the null hypothesis might be false; that values in addition to profit-maximisation are at work; and that these values are primarily focused on family, land and to a lesser extent community, lifestyle and water. However the extent and means by which these values influence behaviour is a question for further research.

Recommendations for future research

The need for research into the non-profit-maximising values of farmers has been identified by Shucksmith and Herrmann (2001, p. 39) who suggested that to "comprehend their motives and diverse behaviours we need to gain an insight into farmers' own ways of seeing the world".

The findings of this study have shown that the influence of family, and whether family succession is already agreed upon or at least a possibility, is a potent force affecting the behaviour of farmers. Future research should be undertaken to examine the relationship between farmers and their successors and how this relationship influences existing farmers' management behaviour. The current study has not gathered enough data about the participants' family situations to explore these relationships in any greater detail. The survey did not gather information on whether farmers had children, or if they did, the ages of the children, whether or not the children are currently working on the farm, and

the intentions of the children regarding working on the farm. After conducting interviews with farmers and their successors, Taylor et al. (1998) found that the expectations borne from this relationship influenced much of farmers' behaviour, and suggested that it should be the subject of future research. The importance of exploring these issues further has again been emphasised by the findings of this study.

This study has also found that farmers might associate with different value constructs at different life stages, and as a result of different phases of the development of their farm business (Fairweather and Keating (1994) had also suggested a similar possibility). Further research could be conducted which takes the results of this study as the starting point for a longitudinal panel-based survey.

This study has made encouraging first steps in examining the values related to family, land and profit, and to a lesser degree community, water and lifestyle and their relationship with famers' behaviour. These values need to be examined in greater detail so that they are effectively understood. Future work is needed to:

- validate, extend and test the results of this study
- investigate the extent to which farmers' non-profit-maximising values actually influence their management behaviour
- investigate the directionality of the relationships between farmers' non-profit-maximising values and their management behaviour
- group farmers into typologies depending on the values influencing their decisions; identify how farmer types differ in their management behaviour; identify how value constructs vary between industry groups; determine the proportion of all farmers that belong to each group
- investigate how these values are formed, how entrenched they are and how (or if) they can be influenced and changed.

Some of these aims could be achieved using a case study approach focused on a small number of cases from each of the types identified by this study. Some of the aims could also be achieved through the use of experimental economics, where different groups of farmers are presented with a range of incentives packages in a controlled environment.

The value constructs, the cluster groups, and the relationships discussed in this thesis show consistent trends in the data. The consistency of the trends strongly suggests that the above questions would be beneficially pursued in future research.

In the meantime because policy makers can't wait around for future research results to be delivered before they act—it would be prudent if they were to take what has been found from this study into account when designing policies and programs.

Closing comments

The song 'Farm on the freeway' written and recorded by Ian Anderson from the band *Jethro Tull* and released on the 1987 album *Crest of a Knave* touches on some of the issues that this thesis has considered. There is the theme regarding work that is done by the father for the son. A recurrent theme is that it's not about the pursuit of wealth, but rather, there are other things that are more important to this farmer. The song mentions the quality of the land and what it can produce; and repeatedly emphasises that the rewards that come from being a farmer are greater than the income that can be gained from the sale of the property.

> Nine miles of two-strand topped with barbed wire
> laid by the father for the son.
> Good shelter down there on the valley floor,
> down by where the sweet stream runs.
> Now they might give me compensation...
> That's not what I'm chasing. I was a rich man before yesterday.
> Now, all I have got is a cheque and a pickup truck.
> I left my farm on the freeway.
>
> They're busy building airports on the south side...
> Silicon chip factory on the east.
> And the big road's pushing through along the valley floor.
> Hot machine pouring six lanes at the very least.
> Now, they say they gave me compensation...
> That's not what I'm chasing. I was a rich man before yesterday.
> Now, all I have left is a broken-down pickup truck.
> Looks like my farm is a freeway.
>
> They forgot they told us what this old land was for.
> Grow two tons the acre, boy, between the stones.
> This was no Southfork, it was no Ponderosa.
> But it was the place that I called home.
> They say they gave me compensation...
> That's not what I'm chasing. I was a rich man before yesterday.
> And what do I want with a million dollars and a pickup truck?
> When I left my farm under the freeway.

(Anderson 1987)

Like the sentiments of this song, this study has found that, for many farmers it's not just about making money, it is also about their family and it's about their farm (the land).

CHAPTER NINE

9 Bibliography

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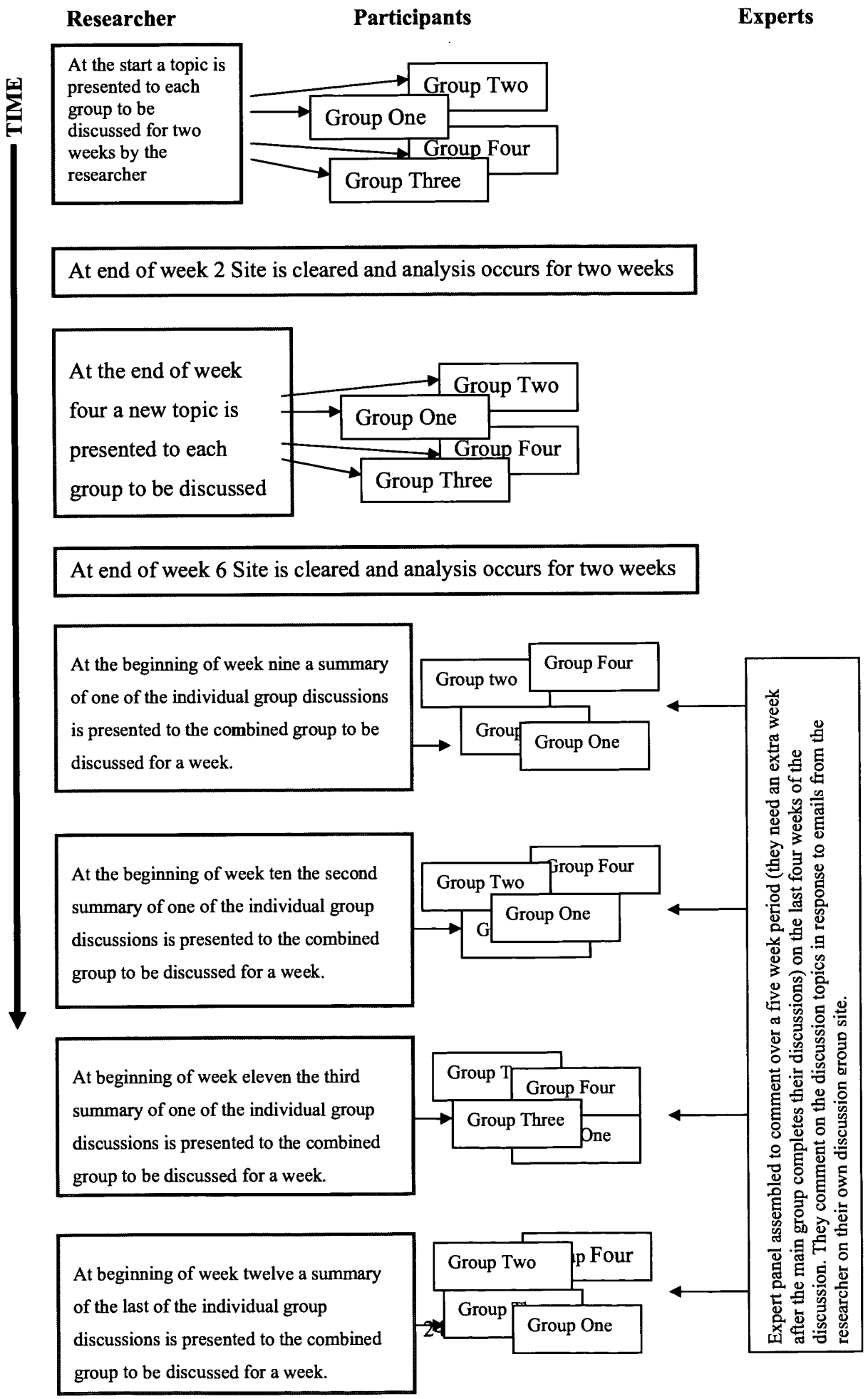
Appendix A – Web-based discussion groups

Figure 14: Web-based discussion group plan



Discussion paper for group A

You probably remember filling out a survey form, which I sent to you during the second half of last year. Not surprisingly, a strong response from the survey was that the Water Sharing Plan (WSP) process has left licence holders frustrated, confused and uncertain. The survey also showed that licence holders like you are considering undertaking a number of different activities in response to the impending implementation of the WSP.

Following on from the survey, I visited the Namoi Valley in September of last year and talked to a wide range of people affected by the plans. For example, I talked to large irrigators with high history of uses, irrigators with low history of uses, inactive licence holders, affected community members, professionals and others. It would be no surprise to say that I found the situation to be exceedingly complex and with no simple solutions.

This web-based discussion group is the next stage in the research. It is designed so that it will add to the information and the understanding that I've gained through the surveys and personal interviews. By participating in this discussion group you will have a chance to have your views heard, find out what other irrigators intend to do and what they think about your intended actions; you will also have an opportunity to influence how policy is made and implemented in the future. In the first round members of the discussion groups will all have a similar histories of use. In subsequent discussion groups I will then share the outcome of the discussions in all the groups and have a chance to hear how high HOE, low HOE, inactive licence holders, and community members intend to manage and live with the WSP and have discussions across the groups.

With these discussion groups, I am trying to understand what influences you and other irrigators when you are making these important decisions associated with the WSP. I also want to get your response to the actions of others to get a discussion going about how to deal with the cuts to water entitlements. I realise that it is a very complex situation because every licence holder is unique and exposed to different magnitudes and timing of cuts. Management responses by irrigators are therefore likely to differ.

It is clear that for many of you the WSP will introduce significant stress on your operations. For some of you, unfortunately, it could mean an end to, or a substantial reduction, in your business operation.

What I would like you to discuss in this group is –

- How big is the cut to your entitlement?
- How big a cut in actual water use are you likely to suffer from this?
- What are your concerns about the process?

- What are you thinking about doing in response to the WSP?
- What's your reason for doing it?
- What factors did you take into account?
- Who did you talk to?
- Why would you consider doing different things to others?
- What are your concerns about the way cuts to entitlements are being made?
- How do you perceive that the WSP's are going to impact on the wider community?
- Anything else you think might be important or relevant.

The licence holders that responded to my initial survey indicated that they might consider carrying out some of the following activities.

- Reduce irrigated area
- Improve WUE
- Install a centre pivot
- Change crops
- Seek out surface water
- Construct more on-farm storage
- Reduce cotton plantings
- Capture more overland flows
- Conserve soil moisture by less tillage
- Buy water
- Invest elsewhere
- Start doing contracting

- Sell or Trade water
- Buy more dryland farm land
- Consider selling farm

There are many ways to respond and there are many possible combinations of responses. Consequently, there are many possible postings and arguments for your course of action. There are no right ways of doing this. I would like you to initially log onto the web and provide a contribution along the lines I have discussed above. I would then like you to log on again as often as possible to comment on other irrigators' intended actions and reasoning and even respond to other irrigators' comments on your planned actions. Also, I assure you that the postings are totally anonymous and you cannot be identified by anyone apart from my supervisor and I.

Thanks for your time and your opinions,
Regards
Geoff Kuehne

Appendix B – Mail-out survey package

- Mail-out survey
- Cover letter
- Newspaper article
- Postcard reminder
- Second reminder

PLEASE START HERE

❶ If you have received duplicate copies of this survey could you please fill out and return all of the blue sheets (like this one) in the envelope provided, and just fill out one main questionnaire for your business as a whole.

❷ **Please check your address for accuracy and correct any errors.** ▶

Is this the main contact name and address for your business? Yes ☐ No ☐

↳ Go to Q.3

Is this a duplicate address? Yes ☐ No ☐

↳ **Please complete only one main questionnaire and return all blue sheets in the same envelope.**

❸ **As this is just the first stage in my research could I approach you for further information by –**

Email Yes ☐ No ☐ Maybe ☐

↓

Personal interview Yes ☐ No ☐ Maybe ☐

↓

Telephone Yes ☐ No ☐ Maybe ☐

↳ **Your email address is** _____

↳ **Your phone number is** ☐☐ ☐☐☐☐ ☐☐☐☐

↳ **Your fax number is** ☐☐ ☐☐☐☐ ☐☐☐☐

↳ **Mobile number (optional)** ☐☐☐☐ ☐☐☐ ☐☐☐

The confidentiality of your information -

If you answered NO to all of the above questions this form will be separated from the questionnaire and all information allowing it to be linked again will be removed.

If you did not answer NO to all of the above questions this form will still be separated from the questionnaire, but will be coded and stored separately to the questionnaire in a locked filing cabinet to ensure that only the researchers working on this project are able to re-establish the link between the two documents.

❹ **Would you like to receive a summary of the survey results** - Yes ☐ No ☐

COULD YOU PLEASE NOW FILL OUT THE MAIN QUESTIONNAIRE.

MAIN QUESTIONNAIRE - (have you filled out the blue sheet/s first?)

If you are either the sole or the joint primary decision maker for your business could you please fill out this survey and return it in the enclosed envelope as soon as possible.

Not all questions will have clear-cut answers, but an approximate answer is more helpful than no answer at all. This survey should take less than ten minutes to complete. If the space allotted is insufficient please use the space on the last page; your extra effort and information will be appreciated.

Firstly I would like to ask some questions about you -

Q.1 What is your age? (please circle)
(15-19) (20-24) (25-29) (30-34) (35-39) (40-44) (45-49) (50-54) (55-59) (60-64) (65-69) (70-74) (75-79) 80+

Q.2 How many years have you been farming as an owner or manager? ..... ☐☐

Q.3 How many more years do you expect to be actively farming? ..... ☐☐

---fold--- ---fold---

Q.4 How many years have you owned or managed this current property? ..... ☐☐

Q.5 Do you have a succession plan in place? - Yes ☐ No ☐ Not applicable ☐

Q.6 What is the highest level of education you have completed? _____

Q.7 How many full time equivalent employees (paid and unpaid) work in your business, including yourself and your family? ..... ☐☐

Q.8 How many years have you been the primary decision maker for this business? ... ☐☐

I would now like to ask some questions about your property -

Q.9 What is the size of your total area farmed? ..... ☐☐☐☐☐ hectares

Q.10 Do you currently irrigate land with groundwater? ..... Yes ☐ No ☐ → Go to Q.18

Q.11 Do you also irrigate with surface water? ..... Yes ☐ No ☐ → Go to Q.13

---fold--- ---fold---

Q.12 Approximately what percentage of your average water use is groundwater? ..... ☐☐ %

Q.13 In an average year prior to the implementation of the Water Sharing Plan (WSP) what was the size of your total irrigated area? ..... ☐☐☐☐ hectares

Q.14 What is the size of your total area developed for irrigation? ..... ☐☐☐☐ hectares

Q.15 In an average year, prior to the implementation of the WSP, what did you mainly produce from your irrigated areas?

a. Cotton ..... ☐☐☐ hectares
b. Crops for human consumption ..... ☐☐☐ hectares
c. Livestock fodder / grain ..... ☐☐☐ hectares
d. Other _____ ☐☐☐ hectares

I would now like to ask some questions about the Groundwater Water Sharing Plan –

Q.16 If you did not make any management changes in response to the WSP, would you expect your annual gross income to be changed and, if so, by approximately how much?

$_____ ☐ Don't know

Q.17 Approximately how much do you expect to invest to counter the effects of the WSP?

$_____ ☐ Don't know

Q.18 How much of your management time has been spent on understanding and responding to the Water Sharing Plan?

Very much .....a. ☐

Much.....b. ☐

Some.....c. ☐

Little.....d. ☐

Very little.....e. ☐

Q.19 All businesses have threats or external pressures that they need to respond to. For example a farm machinery dealer might be concerned about the effects of the foreign exchange rate or grain price fluctuations.

Could you firstly indicate how seriously you view the WSP as a threat to your business by circling a number on the scale below.

Could you then please identify the other main issues or threats to your business, and also indicate how they compare to the WSP by circling the relevant number.

	Not serious							Very serious
Ground Water Sharing Plan	1	2	3	4	5	6	7	
a.	1	2	3	4	5	6	7	
b.	1	2	3	4	5	6	7	
c.	1	2	3	4	5	6	7	
d.	1	2	3	4	5	6	7	

Q.20 Depending on your business position, and the severity and the timing of the cuts (if any) to your entitlements, the implementation of the WSP could be an opportunity that you can take advantage of, or a threat that you need to counter. For example you might be considering buying or selling land or water. What are the most important actions that you are planning to take in response to the WSP changes?

a._____

b._____

c._____

d. Not sure / undecided ☐ I will be taking no action ☐ → Go to Q.23

Q.21 What sources of information have been the most useful for you when you were thinking about the above actions?

a. _____

b. _____

c. _____

Q.22 When you were considering the above actions, what would have made your decision easier to make?

a. _____

b. _____

c. _____

d Don't know ☐

Q.23 If you were in charge of implementing the WSP, what would you have you done differently?

_____

_____

_____

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_____

Q.24 Which of the following best describes your current level of optimism for the future of your business, compared to what it was like before the WSPs were first suggested?

Much more optimistic.....a. ☐

More optimistic.....b. ☐

The same optimism.....c. ☐

Less optimistic.....d. ☐

Much less optimistic.....e. ☐

Q.25 In an honest appraisal, which of the following do you think best describes your ability as a farm manager compared to other similar farmers?

Much better .....a. ☐

Better.....b. ☐

Similiar.....c. ☐

Worse.....d. ☐

Much worse.....e. ☐

Q.26 When you purchased your most recent piece of farm machinery, what factors did you consider leading up to the decision to purchase?

a._____

_____

b._____

_____

Q.27 Thinking of the country as a whole, if you were given the responsibility of returning Australia's water use to a sustainable level what actions would you take?

a._____

_____

_____

_____

_____

b._____

_____

_____

_____

_____

c._____

_____

_____

_____

_____

Q.28 Most people say that when farmers make large one-off decisions (like the sale or purchase of a farm) they are mostly influenced by the financial implications of their decisions. What other important factors do you think might have an influence on farmers' decision making in these instances?

a. _____

_____

b. _____

_____

c. _____

_____

Because some of my research involves using the Internet I would now like to ask some questions about your Internet usage –

Q.29 In an average week how many times do you use the Internet?..... ☐☐

I never use the Internet ☐ → Go to Q.32

Q.30 Approximately how many minutes is your average Internet session? ..... ☐☐

Q.31 What is the biggest problem that you encounter when using the Internet?

_____

I would like to ask one final question

Q.32 Are you able to summarise what the WSP means to you? (This can also be how it affects your farm, your family, or your community).

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Dear Licenceholder 9-7-05

I would like to invite you to participate in a research project that I am undertaking.

Firstly, just a little bit about myself. Until recently I was a broad acre farmer at Coonalpyn, 2 hours southeast of Adelaide, growing cereals, legumes, and canola. Since selling the farm I started university study, and found the experience quite enjoyable. I finished a Masters of Business Administration last year and was pleased when this study led me to obtain a 3-year PhD scholarship. I was even more pleased when I found out that, for my research, I would be working with farmers. (You will notice that I have copied an article from the "Namoi Valley Independent" on to the back of this letter).

The research task that I have been given is to identify and examine the decisions that groundwater licenceholders in the Namoi Valley, like yourself, are making in response to the implementation of the Groundwater Sharing Plan. I understand that your responses might be hard to identify, and will be liable to change, due to the uncertainty associated with the yet to be finalised structural adjustment package.

The research involves four separate stages – a mail back questionnaire, personal interviews in August 2005, followed by web based discussion groups later in the year and then a telephone survey early in 2006. All of the stages of the research are easy to be involved in; it's just answering questions about what you have done, or intend to do, or how you feel about certain things. The results of the research should help others including government departments and other researchers like myself to better understand how farmers make decisions, and how they are responding to the implementation of the water sharing plans. It has been suggested that the results will be helpful for "getting it right" in other irrigation districts, and also with other natural resources that are facing reductions in access. Ideally it would result in better relationships all round and better outcomes for everybody.

Participation in the research is voluntary, you can be involved in as little or as much of this project as you wish; but I would hope that, at the least, you would have the time to fill out this questionnaire. You may withdraw from the research at any time without any implications for yourself; there is no obligation for you to continue.

All records will remain confidential. Personal information that could lead to the identification of an individual will be removed from the research results. All information collected as part of the study will be retained for seven years and will be stored in electronic or hard copy at the office of the School of Commerce.

Participants who indicate their interest in the initial questionnaire will be provided with a summary of the research findings by mail at the completion of the project.

Also, if, at anytime, you have any ethical concerns regarding this research or need questions answered about your rights please contact the executive officer of the UniSA ethics committee Ms Vicki Allen, by phone on (08) 8302 3118 or fax (08) 8302 3921 or email: vicki.allen@unisa.edu.au.

If you have any queries about the research in general please feel welcome to get in contact with me, either by phone or email.

Regards



Geoff Kuehne

Phone: (08) 83029188, Mobile: 0417 831 591
Email: Geoff.Kuehne@unisa.edu.au

Ex-farmer now Uni researcher

Geoff Kuehne, an ex-farmer, is to conduct research on Namoi Valley irrigators looking at management response to their reduced water entitlements.

Geoff has been given a job to conduct research with the irrigators of the Namoi Valley but he's not a graduate fresh out of Uni; he is a softly spoken ex-farmer, who has now become a university researcher.

Geoff has had a 25-year career as a wheat-sheep farmer at Coonalpyn, two hours south east of Adelaide, and because times were getting tougher and there were no successors to take over the farm, he decided to sell.

"I enjoyed farming and selling was probably the biggest decisions that I've made; but in the end it has actually been one of the best.

"At times I miss the farm, but I see this as another chapter in my life and I'm also really encouraged by the thought that the work I do on this project will ultimately be useful for other farmers.

"My research is aimed at finding out how irrigators in the Namoi are planning to respond to the water sharing plans; its about what decisions they are going to make and what things they consider when they make them.

"I've always been curious about how things work, and why they are like they are, so in some ways the life of a researcher is not as big a change as one might think."

One of his first jobs after farming was operating a spray rig for the Adelaide City Council spraying the parklands and the streets of the CBD.

"That was some of the most unusual spraying that I have done, you didn't just have to be constantly avoiding trees and people but also bins, statues and park benches".

He then went on to work as a Project Manager for a community group on the River Murray. Undertaking environmental survey work, managing a native plant nursery and a tree-planting program as well organising and managing a volunteer workforce.

After completing a part-time MBA he received a scholarship with University of SA to undertake PhD research on the topic 'understanding irrigators management response to reduced water entitlements', with the study area being confined to the Namoi Valley.

"Since January I have visited the area a couple of times and find it fascinating, it's a real change from the dry land farming that I'm used to and it"s obvious that the irrigators here have got to deal with some pretty significant issues arising from the water sharing plans."

His work starts in July when he'll send a reply paid survey out to all groundwater irrigators followed by follow up farm visits in late August.

"When I was farming I'd often be surprised at how little people really understood about farmers.

Most people don't really get out of their comfort zones and find out what's really going on.

"But I reckon there's a lot of expertise and insight in rural communities concerning the economic, environmental and social changes that are underway.

"I hope I can do something to harness this knowledge so that it's useful for future decisions about irrigation and farming in general."

This research is being done as part of a larger project that is being undertaken by UniSA looking at the effect of water scarcity and rural social hardship and examining the role that water markets might play in the irrigation areas of Australia.

Further information is available from Geoff Kuehne

0417 831 591

email:geoff.kuehne@postgrads.unisa.edu.au

NORTH WEST MAGAZINE

MAY 30, 2005

POSTCARD - FIRST REMINDER

25th July 2005 "Research into Reduced Water Entitlements"

Last week a questionnaire seeking your opinions about the water sharing plans, was mailed to you along with all of the other groundwater licence holders in the Namoi Valley.

If you have already completed and returned the questionnaire to me, please accept my sincere thanks. If not, could you please do so today. I am especially grateful for your help because it is only by asking people like you to share your experiences that I can understand the impacts and consequences of the water sharing plans.

If you did not receive a questionnaire, or if it was misplaced, please call me on (08) 83029188 or 0417 831 591 and I will get another form in the mail today.

Geoff Kuehne PhD Student
Centre for Regulation and Market Analysis University of SA, GPO Box 2471, SA, 5001

University of South Australia | crma Centre for Regulation and Market Analysis

Postage Paid

[redacted]
BOGGABRI
NSW
2382

LETTER - SECOND REMINDER

University of South Australia | crma Centre for Regulation and Market Analysis

8th Aug 2005

[redacted]
BOGGABRI
NSW
2382

About four weeks ago I sent a questionnaire to you that asked about your experiences with the Namoi Valley groundwater water-sharing plan. To the best of my knowledge it has not been returned yet.

The comments of people that have already responded include a wide variety of responses to the WSP's. Many have put forward their opinions of the WSP both favourable and unfavourable. I think the final results are going to be very useful for governments when undertaking this process in other areas.

I am writing again because of the importance that your questionnaire has for helping me to get accurate results. Although I sent questionnaires to every groundwater licence holder in the Namoi Valley it is only by hearing from nearly everyone that I can be sure that the results are truly representative.

A comment on the survey procedure. After filling out the questionnaire anyone who no longer wishes to be involved with this research will have their identifying information removed from the questionnaire. Protecting the confidentiality of your information is important to me.

I hope you will fill out and return the questionnaire soon, but if for any reason you prefer not to answer, please let me know by returning a note or the blank questionnaire in the enclosed reply paid envelope.

Yours Sincerely

Geoff Kuehne

Phone: (08) 83029188, Mobile: 0417 831 591; Email: Geoff.Kuehne@unisa.edu.au

Appendix C - Telephone survey

Question # 1

Good Afternoon/Evening, my name is ..... and I am calling on behalf of Geoff Kuehne and Henning Bjornlund, from the University of South Australia. I am not selling anything. We are conducting a 20 minute survey on farmers planning intentions as part of a project examining irrigator's management response to reduced water entitlements. We stress that we are collecting this information for research purposes only and greatly value your opinion.

Are you the sole or one of the joint decision makers for the business?

If "no" ask to speak to the person who is. Arrange call back time if appropriate. If no-one available or refuse then thank and terminate.

Question # 2
Firstly, I would like to ask you some questions about your property. What is the size of your total farmed area?

Question # 3
How much groundwater entitlement is attached to this farm business?

Question # 4
Over the last five years what was your average annual usage of groundwater for irrigation?

Question # 5
1 Zero
2 Not Zero

Question # 6
Do you have surface water entitlements?
1 Yes
2 No
3 Don't Know/Refused

Question # 7
How much surface water entitlements is attached to this farm business?

Question # 8
Over the last five years what was your average annual usage of surface water for irrigation?

Question # 9
1 Zero
2 not Zero

Question # 10
In an average year, how many hectares do you irrigate the following crops, starting with COTTON?
Question # 11
How many hectares of CEREALS do you irrigate?

Question # 12
How many Hectares of PASTURE OF SEED, HAY & SILAGE do you irrigate?

Question # 13
How many Hectares of PASTURE FOR GRAZING do you irrigate?

Question # 14
How many Hectares of FRUIT TREES, NUT TREES, PLANTATION OR BERRY FRUTIS do you irrigate?

Question # 15
How many Hectares of GRAPES do you irrigate?

Question # 16
How many Hectares of VEGETABLES (EITHER FOR COMSUMPTION OR SEED) do you irrigate?

Question # 17
How many Hectares of OTHER BROADACRE do you irrigate?

Question # 18
Now we want to ask you about the type of irrigation you practice. How many hectares of your irrigation is FLOOD?

Question # 19
How many hectares of your irrigation is SPRINKLERS?
Question # 20
How many hectares of your irrigation is DRIP?
Question # 21
How many hectares of your irrigation is OTHER?

Question # 22
Do you have a written business plan?
1 Yes
2 No
3 Don't know/refused

If yes how many years does it cover?
1 1 year
2 2 years
3 3 years
4 4 years
5 5 years
6 Between 5 & 10 years
7 Between 10 and 15 years
8 Between 15 and 20 years
9 More than 20 years
10 Don't know/refused

Question # 24
Are you or any member of your household a member of the following organisations?
1 Landcare or Waterwatch or similar
2 Farming organisation
3 RFS, SES or the Ambulance Service or similar
4 Service clubs such as Lions, Rotary etc
5 Don't know/refused

Question # 25
How often within the last 12 months did you or any member of your household attend an agricultural field day, demonstration or seminar?
1 Once

2 Twice
3 Three times
4 Four times
5 Five times
6 Between 5 and 10 times
7 More than 10 times
8 Don't know/refused

Question # 26
How often within the last 12 months did you or any member of your household seek paid or unpaid professional farming advice?
1 Once
2 Twice
3 Three times
4 Four times
5 Five times
6 Between 5 and 10 times
7 More than 10 times
8 Don't know/refused

Question # 27
Do any of your household members have off-farm work?
1 Yes
2 No
3 Don't know/refused

Question # 28
If yes, how big a proportion of your household income comes from off-farm work?
1 Less than 25%
2 25 - 50%
3 51 - 75 %
4 76% - 100%
5 Don't know/refused

Question # 29
I would now like you how much you are agree or disagree with the following statements. Some of the statements may not be a perfect match with your situation but if you could offer an opinion that you feel is a close as possible, it would be appreciated. Please state whether you strongly agree, agree, neither agree or disagree, disagree or strongly disagree.

Question # 30
Family should be an integral part of the farming enterprise.

Question # 31
Farming is a business that should not involve family.

Question # 32
My family is fully committed to farming as an occupation and way of life.

Question # 33
Farming is all about conducting a business.

Question # 34
I would like some or all of my family to continue farming.

Question # 35

It is not important to me whether members of my family continue operating the farm.

Question # 36
Farmers should support family members to do the kind of work they are good at whether this is farming or not.

Question # 37
Farmers should consider how their farming decisions will affect their family.

Question # 38
Farmers should encourage family members to be involved in the family farm.

Question # 39
Farmers should encourage family members to get a good education or develop a skill before deciding on their careers.

Question # 40
Profit is important to me, not for its own sake but for its role in achieving farming or family goals.

Question # 41
Financial gain is the only reason for my involvement in farming.

Question # 42
It is best to avoid reliance on financing from banks.

Question # 43
Bank finance is the only way to ensure business growth.

Question # 44
I am only farming to develop a business for myself or my family.

Question # 45
I am only farming because it gives me a good financial return.

Question # 46
I would rather sell off-farm investments at a loss than sell any part of my farm.

Question # 47
Most of the money I make is invested back into the farm.

Question # 48
I always consider alternative places to invest my money other than my farm.

Question # 49
I always invest any money I make where I can achieve the largest financial gain.

Question # 50
It is OK to buy and sell land regularly if it helps me to achieve my farming goals.

Question # 51
Owning my farm means more to me than just an investment.

Question # 52

If I were to sell land I would never consider selling my 'home block'.

Question # 53
I will readily buy and sell any of my land when opportunities arise.

Question # 54
Being involved in farming is more important than owning a particular piece of land.

Question # 55
Owning land provides security for my family and I.

Question # 56
My land is just something I use to generate an income.

Question # 57
In the last 5 years have you:
1 Bought or leased more land
2 Bought or leased more water
3 Invested in more efficient irrigation and drainage systems
4 Invested in more water storage
5 Increased your irrigated area
6 Reduced your irrigated area
7 Sold or leased some of your land
8 Sold or leased some of your water
9 Don't know/refused
10 Other

Question # 58
Within the next 5 years, do you plan to:
1 Bought or lease more land
2 Bought or lease more water
3 Invest in more efficient irrigation and drainage systems
4 Invest in more water storage
5 Increase your irrigated area
6 Reduce your irrigated area
7 Sell or lease some of your land
8 Sell or lease some of your water
9 Don't know/refused
10 Other

Question # 59
Of the actions we have just been talking about, which have been mostly prompted by the introduction of the GROUND WATER SHARING PLAN?
1 Buy or lease more land
2 Buy or lease more water
3 Invest in more efficient irrigation and drainage systems
4 Invest in more water storage
5 Increase your irrigated area
6 Reduce your irrigated area
7 Sell or lease out some of your land
8 Sell or lease out some of your water
9 Don't know/refused
10 Other

Question # 60
How much you agree or disagree with the following statements. Some of the statements may not be a perfect match with your situation but

if you could offer an opinion that you feel is a close as possible, it would be appreciated. Please state whether you strongly agree, agree, neither agree or disagree, disagree or strongly disagree.

Question # 61
My most important goal is to leave my land in better condition for future generations.

Question # 62
I would like to buy or develop enough land for my family to remain or to become farmers.

Question # 63
If my farm doesn't generate a reasonable financial return (compared to alternative investments) I would consider selling it.

Question # 64
Improving my farm if only important because it will increase future sale value

Question # 65
I consider land values when I make farming decisions.

Question # 66
I believe that my right to use the water also brings with it a responsibility to use it wisely.

Question # 67
I should be able to use my irrigation water however I choose.
Question # 68
People that buy and sell water regularly are just greedy for money.

Question # 69
I would never consider selling any of my water unless it was absolutely necessary.

Question # 70
I would seriously consider my water if I was offered substantially more than market price.

Question # 71
If I had unused water I would rather use it to expand my irrigation than to sell it at an attractive price.

Question # 72
If I had unused water I would probably not sell it because I would expect the price to increase in the future.

Question # 73
If I had unused water I would probably not sell it because it is good drought security.

Question # 74
Being a member of my local community is very important to how I think of myself as a person.

Question # 75
I would be very sorry to move away from my local community.

Question # 76
My values and attitudes are similar to most people in my community.

Question # 77
It is not especially important to me whether I am a member of my community or not.

Question # 78
I am an integral part of my local community.

Question # 79
Freedom associated with being ones' own boss is important.

Question # 80
Working outdoors is important to me.

Question # 81
Peace and quiet from living in the country is important for me.

Question # 82
Farm work gives me a real sense of fulfilment.

Question # 83
I find that farming is a stress-free occupation.

Question # 84
Finally, a few more questions about yourself to ensure we have interviewed a good cross section of people.

Which age group do you fall into?
1 30 years or younger
2 31 to 39 years
3 40 to 54 years
4 55 to 64 years
5 65 or older
6 Refused

Question # 85
What is your ancestry or ethnic origin?
1 English
2 Italian
3 German
4 Asian
5 Don't know/refused
6 Other

Question # 86
How many years have you been farming as an owner or manager?
1 1 to 2 years
2 2 to 5 years
3 5 to 10 years
4 10 to 15 years
5 15 to 25 years
6 25 to 35 years
7 35 to 50 years
8 More than 50 years
9 Don't know/refused

Question # 87
How many years do you expect to be actively farming?
1 1 to 2 years
2 2 to 5 years
3 5 to 10 years

4 10 to 15 years
5 15 to 25 years
6 25 to 35 years
7 35 to 50 years
8 More than 50 years
9 Don't know/refused

Question # 88
Counting yourself as No1, how many generations have your family been farming?
1 1 to 2 years
2 2 to 5 years
3 5 to 10 years
4 10 to 15 years
5 15 to 25 years
6 25 to 35 years
7 35 to 50 years
8 More than 50 years
9 Don't know/refused

Question # 89
Will any of your family members continue your farm business after you retire?
1 Yes
2 No
3 Maybe
4 Don't know/refused

Question # 90
When did you leave school?
1 Year 10 or earlier
2 Year 11
3 Year 12
4 Don't know/refused

Question # 91
After leaving school did you obtain any University or TAFE qualifications?
1 Yes
2 No
3 Don't know/refused

Question # 92
What is the highest qualification you received?

Question # 93
How many full time equivalent family members (paid or unpaid) including yourself work in your business?
1 One
2 Two
3 Three
4 Four
5 Five
6 Six
7 Seven
8 Eight
9 Nine
10 Ten
11 Eleven
12 Twelve
13 More than 12

14 Don't know/refused

Question # 94
How many full time equivalent other than family work in your business?
1 One
2 Two
3 Three
4 Four
5 Five
6 Six
7 Seven
8 Eight
9 Nine
10 Ten
11 Eleven
12 Twelve
13 More than 12
14 Don't know/refused

Question # 95
Gender (by observation)
1 Male
2 Female

Question # 96
Thank you for your time. In case you missed it my name is..... from the University of South Australia. Should you have any queries on this survey, our toll free contact number is 1800 801 857. As part of our quality control, my supervisor will be recontacting a percentage of respondents to verify the interview was conducted. For this purpose may I confirm your first name/last name and phone number?