ONE SIZE DOES NOT FIT ALL — RECOGNIZING HETEROGENEITY IN AUSTRALIAN FARMERS

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ABSTRACT

Farmers are heterogeneous, but policy makers are often criticized for treating them as a uniform group. A range of unique factors determine their decision making and their responses to new policy initiatives.

Water scarcity has led to a necessary re-allocation of water among competing users. Provision of water for urban, recreational, and environmental purposes is being done at the expense of the irrigation sector; making it increasingly necessary to encourage effective communication between policymakers and irrigators. The shortcoming of the current one-size-fits-all approach to water management and planning is that it doesn't work for everybody, creating avoidable conflicts between users, compromised outcomes and significant social and community impacts.

Irrigators in Australia's Namoi Valley are facing significant reductions in water entitlements from recent water reforms. An assumption behind the policy is that irrigators are a uniform group who will respond to these reductions in an economically rational fashion. Irrigators have however indicated that they do not intend to behave in this way.

This research explores the influence of farmers' values, attitudes and goals, toward land, water, profit, family, and community on their behavior. Our findings suggest that farmers can be categorized into a typology according to how they associate with three value constructs; *Family Lifestyle* and *Conservation*.

This research will allow policy makers and service providers to communicate better with farmers by using more complementary and more meaningful approaches. The management responses of irrigators are then likely to be more in line with policy expectations reducing the economic, social, environmental, and political impacts of new policy initiatives.

INTRODUCTION

The Namoi Valley in New South Wales (NSW), Australia has a relatively brief history as an irrigation region. Agriculture first began in the mid 1840's when the region was used for the grazing of cattle and sheep along with some wheat production, continuing to the 1960's when the

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area was well known for wool production. Irrigation was not very widespread and usually used in drought years or as a way to "finish off" crops (NGMC 2001).

Due to the variability of Australia's climate large scale irrigation reliant on surface water supplies requires rivers that are regulated. Moves to regulate the Namoi River were taken with the commencement of construction of the 425 GL (345,000 acre-feet) Keepit Dam in 1940. However construction was disrupted by the Second World War and only completed in 1961 (IESC 1969). The dam was built to replace supplies of livestock water previously obtained from declining availability of artesian bore-water; and the authorities had no plans to use it for any other purposes (Kahl 2006).

Up until around 1970, in Australia, the supply of water was in excess of demand (Freebairn 2005) and the price of water was almost zero. It was also suggested that irrigators were slow to take advantage of the water made available from Keepit dam, because of widespread flooding rains between 1949 and 1960 (IESC 1969).

Interest in the potential of cotton growing in Australia had existed from the time of white settlement, but was made more attractive by the financial incentives provided by the government in one form or another between 1951 and 1969 (Pigram 1970). In 1961 Paul Kahl and his neighbour Frank Hadley, two cotton growers from California's San Joachim Valley, visited several regions in Australia looking for alternative opportunities for cotton growing. Kahl and Hadley settled at Wee Waa in the Lower Namoi Valley and in the 1961-62 season grew the regions first commercial cotton crop (Kahl 2006) using water from the new Keepit Dam.

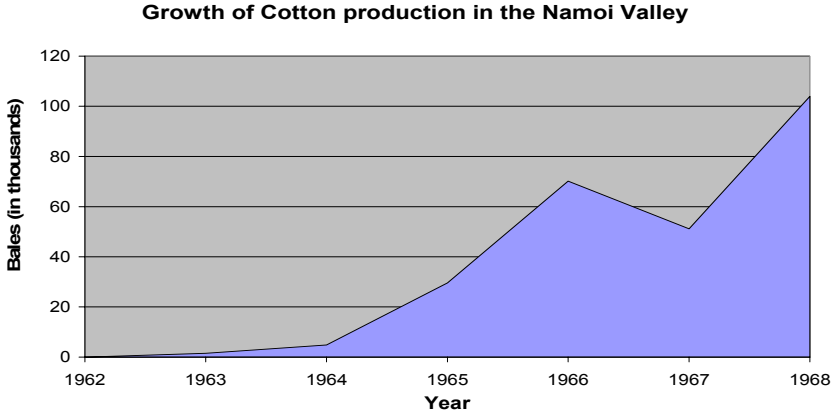

Figure 1: Growth of the cotton industry in the Namoi Valley [adapted from (Pigram 1970)]

Development proceeded quickly, with some fluctuations due to the variability of cotton prices, (See Figure1). Within 7 years there were 65 cotton growers in the valley, with nearly half of them being Americans. In addition to their cotton growing expertise the Americans also brought with them bore construction knowledge and experience and access to technology and capital, (IESC 1969; NGMC 2001; Kahl 2006). The irrigation industry in the Namoi Valley experienced continued growth so that by 2000-01 it covered an area of 119,040 hectares. Of this area

approximately 40,000 hectares are irrigated using groundwater depending on seasonal conditions. Cotton accounts for 78% of the total irrigated area but this also varies according to the expected availability of water and the price of cotton relative to the alternative crops that are able to be grown (Powell et al. 2003).

Groundwater was not the preferred source of water due to the cost of pumping, however, the drought of 1965 sparked a vigorous search for groundwater as an alternative to surface water. Groundwater was developed both by those with surface water, who wanted a more reliable supply, and by those without access to surface water. The policy of the NSW Government was to freely allocate licences to extract groundwater even though the total quantity of licences allocated exceeded the renewable resource. It was never considered a possibility that all of the licenses would be activated. This was done before water scarcity emerged, and also at a time when it was considered that exhausting the aquifer was a reasonable policy, at least in the short term, (NGMC 2001). In some ways these actions are understandable as it was the same department that had been responsible for encouraging the use of the water resource from the beginning.

Local irrigators had since the early 1980s warned against the over allocation of groundwater entitlements, and the consequences manifested itself during the drought years of 1992-3 to 1994-5 when it was recognised that the annual aquifer extraction, had increased to almost double the annual average aquifer recharge (Kuehne & Bjornlund 2006b) resulting in falling water tables and in some cases stock and domestic bores that no longer had access to water.

To satisfy the requirements of the national water reforms (CoAG 1994), as well as to counter the effects of the over allocation of entitlements, and in some cases an over extraction of water the NSW Government introduced Water Sharing Plans (WSP). When reducing allocations a decision needed to be made between two methods: i) “history of extraction” (HOE), where those that had demonstrated use over a period of years suffer smaller reduction than those who have been allocated water but have not used it; and ii) “across the board” (ATB) reductions which requires that cuts are made to water entitlements regardless of whether it has actually been used or not. Each method has advantages and disadvantages and impacts licence holders differently depending on how much of their entitlement they have been using.

After much friction in the affected communities and several changes between the two methods of entitlement reduction a decision was made to adopt the HOE method. One of the main reasons for this choice was that it causes less disruption to existing production as it retains more of the productive capacity with those who have developed their land to use their water entitlement (the active irrigators). It was therefore suggested that it will have a smaller socio-economic effect on the communities supported by the local irrigation industry.

It was policy makers expectations that the negative socioeconomic impact of cuts to water entitlements would be reduced by inactive and low value irrigators selling their entitlements to the active and higher valued producers. These expectations are based on the assumption that irrigators make rational economic decisions. However, evidence suggests that this is seldom the case, and that farmers are heterogeneous with different values and attitudes and that these

influence the benefits that they derive from using their water. There is therefore evidence that farmers make decision in an attempt to maximize their benefits from using the water taking these various values into account and not simply to maximize their economic gain.

A better understanding of the values and attitudes influencing the Namoi Valley irrigators will provide more reliable indications of their likely management responses to the WSP which can then be used to predict the socio-economic outcome of the reductions in water entitlements. The benefits gained from understanding the components of farmers' heterogeneity will be better designed policy instruments that are more effectively tailored to take into account the different values influencing water users' decision making.

LITERATURE REVIEW

The literature, both within the economics (Gasson & Errington 1993; Fairweather & Keating 1994; Gomez-Limon & Riesgo 2004); psychology (Maybery, Crase & Gullifer 2005); social and health psychology (Conner & Norman 1995); social and community (Vanclay, Mesiti & Howden 1998; Bjornlund 2002); water management (Kuehne & Bjornlund 2006a, b); and farm decision making (Willock et al. 1999) disciplines, suggests that farmers' management responses to any new policy instrument will not be based solely on economically rational decisions but will depend on the values, attitudes and goals of those farmers and their production characteristics.

The study by Maybery et al. (2005) found that three different values determine farmers' response to policy instruments: economic, conservation and lifestyle. They suggest that before introducing new instruments policy makers should understand these values and how they affect the decision making of farmers and therefore affect the final impact of the policy. Bjornlund (2002) found that irrigators in Victoria (Australia) use water markets to achieve three different objectives depending on their position in the structural adjustment process. Gomez-Limon and Riesgo (2004) grouped irrigators in Spain, within a homogeneous area in terms of soil, climate and other factors, and found that their reactions to price changes varied significantly according to the management criteria used in their planning. Kuehne and Bjornlund (2006a; 2006b) found that irrigators in the Namoi region of Australia were planning to make different management decisions in response to a new WSP depending on their perception of themselves as a farmer, either as an investor or as a custodian of the land.

This literature suggests that to determine how farmers are likely to respond to new policy instruments it is important to understand the nature of farming and the values of farmers within the area.

METHODOLOGY

Using the information gained from a mail-out survey and personal interviews (Kuehne & Bjornlund 2006b) the hypothesis was formed that farmers are not homogenous, but that their behaviour is influenced by their values, attitudes and goals towards family, profit, land, water, lifestyle and community. A survey instrument was developed to gather demographic information as well as information on past management actions and future management intentions. The

survey also included a set of value and attitude statements against which the respondents were asked to rate their level of agreement using a one to five Likert-scale. A focus group consisting of six agricultural extension professionals was conducted to further refine the values, attitudes and goals statements.

From a potential sample of 478 groundwater licence holders 175 were contacted between November 30th and December 11th 2006. Of these, 34 did not fit the criteria for participation, and 20 refused to participate. The survey was administered to 121 ground water licence holders by telephone. The average length of time taken to complete the 96 questions of the survey was 17 minutes.

One of the limitations of this research is that it creates a typology of a particular group of people that is temporally relevant; it is a construct that describes a group of people at the time of the survey. It may not be transferable to other groups at other times. The way the 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 statement regarding the willingness to sell water may be influenced by the 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 be much more inclined to sell water to pay down debts. Each may have a similar long-term view of water but be responding in this instance 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 it needs to be repeated in different contexts and at different times.

ANALYSIS

The data was tested for suitability for factor analysis. The KMO measure of sampling adequacy is 0.676 which although not optimal, is still higher than the accepted minimum for factor analysis of 0.5. Bartlett's test of sphericity was used to test the null hypothesis that the variables in the population correlation matrix were uncorrelated (Foster, Barkus & Yavorsky 2005); the significance level of 0.000 allowed the null hypothesis to be rejected. This indicates a strong relationship among the variables and shows that the data is suitable for factor analysis.

Factor analysis was chosen as method of analysis to discover the latent dimensions within the data by summarizing and reducing the data. A small set of variables (three per factor) were combined so that they were able to explain what was common to the larger set of variables in a more concise fashion.

Factor analysis was conducted, (Table 1), using the Principal Axis Factoring extraction method. This correlation-focused approach was used to identify latent constructs and revealed three interpretable factors with eigenvalues of 2.82, 1.62 and 1.36 accounting for 31.4%, 18.0% and 15.1% of the variance respectively. The total variance accounted for by the three factors was 64.6%. Promax rotation with Kaiser normalization was chosen because correlations between factors were large enough that covariance between factors was able to be assumed. Internal consistency reliability was 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). Lower alpha scores for factors 2 and 3 can be explained in part because the number of items per component has a distinct effect on the Cronbach's alpha, (Cortina 1993).

Table 1: Factor analysis results

Variables		Factor Communalities & Cronbachs' Alphas					
		[a] Com.	alpha	Com.	alpha	Com.	alpha
Factor A	Family should be an integral part of the farming enterprise.	.714	[b].697				
	My family is fully committed to farming as an occupation and way of life.	.718	.715				
	I would like to buy or develop enough land for my family to remain or to become farmers.	.784	.652				
Factor B	People that buy and sell water regularly are just greedy for money.			.645	.636		
	I would never consider selling any of my water unless it was absolutely necessary.			.595	.594		
	If I had unused water I would probably not sell it because it is good drought security.			.720	.527		
Factor C	My most important goal is to leave my land in better condition for future generations.					.544	.584
	I believe that my right to use the water also brings with it a responsibility to use it wisely.					.628	.555
	Farmers should encourage family members to get a good education or develop a skill before deciding on their careers.					.668	.491
Cronbach's Alpha Score			.768		.677		.637

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

The variables that contribute to Factor A are all related to the family. They reflect respondents' 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. We named this value construct "*Family*".
The variables that make up Factor B are related to how the respondents value water. They describe their feelings about water - that it should be retained and not treated as a tradable commodity, that it has a value that is much more than just its economic worth. The important issue is their attitude and values towards it which are ones of "*Conservation*". Variables making up Factor C; are a goal of practicing 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.

To further analyse the data, Chi-square tests were performed to identify how the 50% of irrigators with the highest factor score on each factor differed significantly from the remaining 50%. For the value statements not included in the three factors see table 2, 3, and 4, for past and future adjustment activities see table 5 and for property characteristics see table 6. To reduce the problem of inadequate cell counts and a tendency for respondents to avoid neutral responses, the five-point Likert scale was collapsed into three categories.

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 is an indication of the resources available to the researcher. To provide a measure of importance correlations were also performed using Pearson correlation coefficients. 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.

RESULTS & DISCUSSION

The following sections builds a profile of the 50% of irrigators who have the highest factor scores by comparing them to the lowest 50%, for each of the three factors. The discussions are based on the findings reported in tables two to six.

Factor A: Family

Much of what these people do (Table 2) is influenced by the value that they place on family and how they see their family being connected to the family farm. They are firmly focused on their family; they believe that family should be an integral part of the farming enterprise; they want their family members to be closely involved in operating the farm. For them farming is more than just operating a business. They believe that the natural way of things is for their family to be 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.

Because farming is of such importance to them they gain a distinct sense of fulfillment from undertaking farm work. Illustrating the importance they place on growing the farm business, if they needed to make a choice to free up capital they would reduce off-farm investments (even if this meant selling them at a loss) before they would consider reducing the equity that they have in their farm. When making investment decisions they do not search for the best financial returns; instead they will invest profits back into the farm and are unlikely to consider the returns offered by any other alternative investments.

They have a relationship with the land that is beyond the purely economic. They are unlikely to consider selling their farm if it became unprofitable. Although unprofitability is a distinct disadvantage it is not a reason for them to give up. But if a situation arose where they were required to sell land it is most unlikely that they would willingly sell their home block; it has added meaning for them. For these people owning their land also provides them with a sense of security. Because they are aiming to grow their farm businesses for their family members they would be reluctant to sell any unused water but would rather use it to expand their business. Being a member of their community is important for them; they consider that they share the same values and attitudes as others in the community. Their willingness to participate in the

community is demonstrated by more of them being members of community-based service organisations such as Lions or Rotary.

Table 2: Other value statements Factor A

	[a] **Value Statements – Family**	Sig.	[b] Means Custodian	Std. Dev.	Means others	Std. Dev.	Correlation with factor scores	Rating of Correlation
Family	Farming is a business	.053	1.20	.546	1.42	.694	-.179	Low-Mod
	Not important for family to continue farming	.000	1.75	.967	2.29	.882	-.285	Low-Mod
	Family should be involved in the farm	.010	2.51	.791	2.04	.902	.267	Low-Mod
Profit	Reduce investments not equity	.002	2.36	.843	1.78	.877	.322	Mod-Subst.
	Always consider alternative investments	.076	2.15	.953	2.50	.808	-.200	Low-Mod
Land	Would never sell the home block	.004	2.00	.938	1.47	.766	.295	Low-Mod
	Owning land provides security	.032	2.81	.536	2.49	.808	.232	Low-Mod
	Sell unprofitable farms	.039	1.95	.964	2.32	.870	-.203	Low-Mod
[c]W	Unused water used to expand	.000	2.53	.812	1.96	.893	.317	Mod-Subst.
[d]C	Community is important	.090	2.73	.660	2.62	.687	.082	Trivial
	Values and attitudes are the same as others	.029	2.78	.555	2.49	.744	.218	Low-Mod
[e]L	Farm work is fulfilling	.001	2.91	.381	2.54	.743	.305	Mod-Subst.

[a] 50% highest of saved factor scores for each component. [b] Rating scale is 1 Strongly disagree through to 5 Strongly agree. [c] Minimum expected cell size violated. [c]Water. [d] Conservation. [e]Lifestyle.

Their property and personal characteristics indicate that these farmers are people who operate considerable commercial businesses (Table 5-6). They operate fewer small farms and are more likely to have large farms. In keeping with a commercial orientation toward farming fewer are smaller users of groundwater but more are larger users. Congruent with a focused and commercial approach to agriculture more are members of farming organisations. More are moderate users of paid farm advice but few are heavy users. Initially this might suggest disinterested or less progressive farmers but it is more likely that it is indicative of the familiarity and expertise they have with agriculture, and that this counters their need for paid farm advice. Because their goal is to develop a successful farm business for their family and combined with larger farms fewer are either able to, or need to, participate in off-farm work.

With an ultimate intention of having the farm business survive through succession to family members more are in the under fifty-five age group while fewer are over fifty five years old. With family succession as such a firmly entrenched goal, passing the farm on to the next generation may happen sooner than for others who may not be so firmly fixed on this type of business succession. A consequence of the desire to ensure that there is a viable farming business to hand on to family is the requirement of obtaining more land. Fewer have sold or leased land

and more have bought or leased more land in the last five years or intend to do so in the next five years. In some cases improving water use efficiency (WUE) can be a viable alternative to purchasing more land. More have improved their WUE in the last five years or intend to do so in the next five years. An allied investment that can assist with improving WUE is the construction of larger water storages which allow the storage of water at times when it is freely available to be used at times when it is more usefully used for production. More have invested in larger water storages in the last five years or are planning to do so in the next five years.

Factor B: Lifestyle

Those who strongly identify with this value construct view their lifestyle as being of prime importance (table 3).

Table 3: Other value statements Factor B

	[a] **Value Statements – Lifestyle**	Sig.	[b] Means Lifestyle	Std. Dev.	Means others	Std. Dev.	Correlation with factor scores	Rating of Correlation
Family	Farming is about business	.001	2.86	.468	2.45	.786	.302	Mod-Subst.
	Family should be involved in the farm	.070	2.45	.832	2.11	.896	.192	Low-Mod
Profit	Financial gain is most important	.015 [c]	1.46	.853	1.27	.635	.125	Low-Mod
	Best to avoid bank finance	.142	2.41	.888	2.08	.971	.178	Low-Mod
	Farming to develop a business	.035	2.23	.927	1.78	.933	.235	Low-Mod
Land	Readily buy and sell land	.163 [c]	1.71	.903	1.81	.974	-.055	Trivial
	Farming is more important than owning land	.158	2.30	.829	2.00	.875	.175	Low-Mod
	Owning land provides security	.086	2.53	.812	2.77	.559	-.169	Low-Mod
	Improving farm increases sale value	.011	2.26	.936	1.78	.914	.253	Low-Mod
[d] W	Sell water at a good price	.008	1.45	.768	1.93	.910	-.278	Low-Mod
Lifestyle	Peace and Quiet is important	.033 [c]	2.95	.286	2.72	.635	.227	Low-Mod
	Farm work is fulfilling	.167	2.83	.492	2.62	.710	.171	Low-Mod

[a] 50% highest of saved factor scores for each component. [b] Rating scale is 1 Strongly disagree through to 5 Strongly agree. [c] Minimum expected cell size violated. [d] Water

Due to this motivation they suggest that people who buy and sell water regularly are just greedy for money. Their intention is to only ever consider selling any of their water as a last resort. They are willing to forgo income that they could have gained from selling or leasing unused water so that they have better security against drought. Being offered a good price for their water is little incentive for them to sell it.

They have what could appear as a contradictory orientation; both valuing lifestyle and at the same time focusing on their farm as a business. Although they think that their family should be involved in the farm, they also suggest that the most important thing about farming is financial gain. Their involvement in farming is done with the aim of developing a business. Their

involvement in farming is more important to them than owning land; and they do not believe that owning land gives them a sense of security. Despite this they do gain a sense of fulfillment from farming and enjoyment from the peace and quiet associated with rural living. For them the benefits in making improvements to their farm are not only intangible non-economic rewards but also the building of capital gains.

The production and personal characteristics of these people are of those who might be more oriented to lifestyle benefits. More have smaller farms and fewer have large farms (Table 5-6). Despite their orientation toward the *Lifestyle* value construct 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 a primary income. Perhaps in keeping with landowners who have entered agriculture after other careers fewer are moderate users of paid farm advice and more are heavy users; they apparently recognise the benefits of using the knowledge of others. Fewer are under fifty five years of age and more are over. This could be due to them entering the industry after careers other than farming. This does not appear to be a dynamic category; for example, fewer have bought or leased land, fewer have improved their water use efficiency and many fewer have sold water in the last five years or intend to do so in the next five years.

Factor C: Conservation

Those who strongly identify with this value construct are not primarily motivated by financial gain; instead they express conservation values. This includes an important land husbandry goal aimed at leaving their land in better condition for future generations. In a similar way although they believe that they have a right to use water, they also acknowledge at the same time they have a responsibility to use it wisely. Their belief that water is both a right and a responsibility does not preclude them from selling it when necessary; they don't see a need to keep unused water as drought security. They do not wish for their family to be an integral part of the farm but suggest that it is important for them to get a good education or develop a skill before finally deciding on their careers. They will support family in pursuing work they're good at even if this does not involve agriculture. 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. Because they think of it in a way beyond being only used to provide an income they are reluctant buyers and sellers of land. Most of the profit that they generate from their farm business is not re-invested in the farm.

Table 4: Other value statements Factor C

	[a] **Value Statements – Conservation**	Sig.	[b]Means Conserv.	Std. Dev.	Means others	Std. Dev.	Correlation with factor scores	Rating of Correlation
Family	Family should be integral	.127	2.26	.936	2.45	.807	-.110	Low-Mod
	Support family in work they're good at	.082 [c]	2.96	.258	2.881	.532	.174	Low-Mod
	Family members should get a good education	.026 [c]	3.00	.0	2.83	.489	.231	Low-Mod
Profit	Financial gain is most important	.004 [c]	1.15	.515	1.59	.882	-.293	Low-Mod
	Only farming for the financial return	.177 [c]	1.20	.576	1.34	.680	-.115	Low-Mod
	Most money is invested in farm	.131 [c]	2.70	.720	2.83	.522	-.109	Low-Mod
	Owning farm is more than an investment	.176 [c]	2.85	.515	2.67	.700	.144	Low-Mod
Land	Will readily buy and sell land	.163 [c]	1.71	.903	1.81	.974	-.055	Trivial
	Land just provides an income	.130 [c]	1.66	.914	2.01	.974	-.183	Low-Mod
	Goal is to leave land better for the future	.077 [c]	2.98	.129	2.81	.562	.197	Low-Mod
Water	Water is a right & a responsibility	.157 [c]	3.00	.0	2.96	.179	.129	Low-Mod
	Keep unused water for drought	.064	2.53	.812	2.67	.625	-.096	Trivial

[a] 50% highest of saved factor scores for each component. [b] Rating scale is 1 Strongly disagree through to 5 Strongly agree. [c] Minimum expected cell size violated.

The production and personal characteristics of these people suggest that they might be more traditional farmers, undertaking lower valued activities such as irrigated hay production.

Table 5: Actual or intended farm adjustment activities of each value construct

Family	Sig.	[a]Comparisons	Correlation with factor scores	Rating of correlation
Have or will buy or lease more land	.000	More have or will	.327	Mod-Subs.
Have or will improve WUE	.060	More have or will	.158	Low-Mod
Will invest in more water storage	.025	More have or will	.194	Low-Mod
Have or will sell or lease land	.018	Fewer have or will	-.208	Low-Mod
Lifestyle				
Have or will buy or lease land	.038	Fewer have or will	-.178	Low-Mod
Have or will improve WUE	.087	Fewer have or will	-.140	Low-Mod
Have or will sell water	.004	Many fewer have or will	-.261	Low-Mod
Conservation				
Have or will irrigate more	.110	Fewer have or will	-.131	Low-Mod
Have or will sell or lease land	.183	More have or will	.101	Low-Mod
Have or will sell water	.173	More have or will	.106	Low-Mod

[a] Comparison between the 50% of irrigators identifying most strongly and the 50% identifying the least strongly for each respective group.

Fewer have either small or large quantities of groundwater entitlements most have moderate quantities (Table 5-6). Demonstrating an attachment to community they are enthusiastic participants in the activities of service organisations. Being more traditional farmers they are

modest users of paid farm advice. Perhaps as an indication of the profitability of their businesses many more engage in off-farm work.

Adding weight to the argument that they have a more traditional focus, their families are likely to have been farming for more than three generations. They are less likely to have successors and appear to be a group that is in decline; fewer have increased the size of irrigated land, more have sold or leased land and more have sold or leased water in the last five years or intend to do so in the next five years.

Table 6: Property characteristics of each value construct

Family	Sig.	[a]Comparisons	Correlation with factor scores	Rating of correlation
Farm size	.131	Fewer small more large farms	.183	Low-Mod
Groundwater entitlements	.199	Fewer small more large amounts of water	.163	Low-Mod
Groundwater usage	.034	Fewer are smaller more are large users	.222	Low-Mod
Flood irrigation area	.167	More are smaller fewer are large flood irrigators	.047	Trivial
Member of farm organisations	.084	More are members	.157	Low-Mod
Member of service organisations	.118	More are members	.125	Low-Mod
Seek paid farm advice	.039	More are moderate users fewer are heavy users	-.178	Low-Mod
Have off-farm work	.028	Fewer participate	.190	Low-Mod
Age group	.158	More under 55 fewer over 55	-.108	Low-Mod
Lifestyle				
Farm size	.197	More small fewer large farms	-.164	Low-Mod
Flood irrigation area	.085	More with no flood irrigation and fewer with over 150 Ha	-.238	Low-Mod
Seek paid farm advice	.074	Fewer moderate users more are heavy users	.182	Low-Mod
Age group	.004	Fewer under 55 more over 55	.256	Low-Mod
Conservation				
Groundwater entitlements	.087	Fewer use small or large quantities most are moderate.	-.040	Trivial
Hay grown	.020	More are hay producers	.242	Low-Mod
Sprinklers	.048	More use sprinklers	.202	Low-Mod
Member of service organisations	.060	More are members	.158	Low-Mod
Seek paid farm advice	.015	More are moderate users fewer are heavy users	-.220	Low-Mod
Have off-farm work	.001	Many more have off-farm work	-.306	Mod- Subs
Generations family farming	.088	More are more than 3 generations	.021	Trivial

[a] Comparison top 50% with bottom 50% of each factor score.

Differences Between Value Constructs

This research has shown that there are differences in the values, attitudes and goals that these farmers hold and that these differences do lead to important variations in their behaviours. We have developed three value constructs; *Family*, for family focused farmers whose prime aim appears to be the continuation of the farm business; *Conservation* for those farmers who are

motivated to look after the land and water resource and; *Lifestyle* for those farmers who are attracted to farming for what it offers in terms of lifestyle rewards.

Emtage et al. (2006, p. 88) reviewed the literature on the typologies of Australian farmers and found that most result in "a traditional or conservative type, a smallholder or hobby farmer type, a progressive type, a resource limited type and a comfortable type." Maybery, Crase & Gullifer (2005) suggest three influences on farmers' behaviour; economic, conservation and lifestyle. The literature often does not acknowledge the influence of families, although some do find support for the idea that family influences are much stronger than economic. Gasson (1993, p. 112) states, "Rational decisions are made within a framework which 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 does not appear to be profit maximisation but rather the continuation of the business in the family (Gasson & Errington 1993). Fairweather & Keating (1994) describe three similar styles, the business like dedicated producer, the flexible strategist who tries to balance business and lifestyle and the environmentalist who tries to behave with an environmentally conscious approach, although they also suggest that family is central to all three styles and that profitability is not as prominent as they might have expected.

Irrigators differ in their regard for water according to the value constructs that they associate with. If, for example, in the interest of reform, water is required to be purchased from them, differing approaches will be required. The reluctant water sellers of the *Family* construct are not primarily motivated by profit. Traditional financial incentives are unlikely to be influential. The other reluctant sellers of water; the *Lifestyle* construct view losing their water as diminishing their lifestyle. But on the other hand, because they are also balancing business goals, they could be influenced by a well-presented business case. Those associating with the *Conservation* value construct are not motivated by profit but more so by conservation concerns. Overall these less profitable farmers could be prepared to sell water if they believed it was the "right thing to do".

CONCLUSIONS

This research has shown that there are between-farmer differences with regard to their values attitudes and goals, that these can be described using a typology and that these differences can be used to predict or explain their behaviour. Further research is required into how these values are formed, how entrenched they are, what would cause them to change, and how likely this is? We also predict that policy instruments that are tailoured to suit the between group variability of farmers identified in this research, and that of others, are more likely to be adopted by farmers as anticipated by policy makers and actual policy outcomes and impacts are therefore also more likely to be aligned with policy expectations.

The alternative to history of extraction reduction, across the board reductions, relied on water being widely traded from inactive to active users of water. The findings in this paper suggest that for this to be successful would require policies to be tailored to suit farmers who are motivated by the value constructs of *Family*, *Conservation* or *Lifestyle*. In the absence of this, the decision of the government to reduce entitlements according to history of extraction was the best choice not on grounds of equity and fairness, or any other criteria, but simply because adjustment

through water trading was unlikely to happen with the result that the adjustment process of active irrigators would have been much more difficult and more disruptive to their production increasing the negative socioeconomic impact in the affected communities.

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REFERENCES

Bjornlund, H 2002, 'The socio-economic structure of irrigation communities - water markets and the structural adjustment process', *Journal of Rural Society,* vol. 12, no. 2, pp. 123-145.

CoAG 1994, 'Council of Australian Governments' Communique', 25th Feb 94.

Conner, M & Norman, P 1995 *Predicting health behaviour: research and practice with social cognition models*, Open University Press, Buckingham ; Philadelphia.

Cortina, J 1993, 'What is coefficient alpha? An examination of theory and applications', *Journal of Applied Psychology,* vol. 78, no. 1, pp. 98-104.

De Vaus, D 2002, *Surveys in social research*, 5th edn, Allen & Unwin, St. Leonards, N.S.W.

Emtage, N, Herbohnn, J & Harrison, S 2006, 'Landholder typologies used in the development of natural resource management programs in Australia - A review', *Australasian journal of environmental management,* vol. 13, no. 2, pp. 79-94.

Fairweather, J & Keating, N 1994, 'Goals and management styles of New Zealand farmers', *Agricultural systems,* vol. 44, pp. 181-200.

Foster, J, Barkus, E & Yavorsky, C 2005, *Understanding and using advanced statistics: A practical guide for students*, SAGE publications, London.

Freebairn, J 2005, 'Principles and issues for effective Australian water markets', in *The evolution of markets for water: Theory and practice in Australia*, ed. J Bennett, Edward Elgar Publishing Limited, Cheltenham, UK.

Gasson, R & Errington, A 1993, *The farm family business*, CAB International, Wallingford.

George, D & Mallery, P 2003, *SPSS for Windows step by step: a simple guide and reference 11.0 update*, Allyn and Bacon, Boston

Gomez-Limon, J & Riesgo, L 2004, 'Water pricing: analysis of differential impact on heterogenous farmers', *Water resources research,* vol. 40, no. 7, pp. 1-12.

International Engineering Service Consortium 1969, *An economic study of Keepit Dam*, The New South Wales Water Conservation and Irrigation Commission, NSW.

Kahl, P 2006, *Cotton pickin' pioneer*, Paul Kahl, Taren Point, NSW.

Kuehne, G & Bjornlund, H 2006a, 'Custodians' or 'Investors': Classifying irrigators in Australia's Namoi Valley', in *Sustainable Irrigation Management, Technologies and Policies*, eds. G Lorenzinni & C Brebbia, WIT Press, Southampton, pp. 225-235.

Kuehne, G & Bjornlund, H 2006b, 'Frustration, confusion and uncertainty; qualitative responses from Namoi Valley irrigators.' *Water,* vol. 33, no. 4, April 2006, pp. 51-55.

Maybery, D, Crase, L & Gullifer, C 2005, 'Categorising farming values as economic, conservation and lifestyle.' *Journal of Economic Psychology*, no. 26, pp. 59-72.

McLean, J & Ernest, J 1998, 'The role of statistical significance testing in educational research', *Research in the Schools,* vol. 5, no. 2, pp. 15-22.

Namoi groundwater management committee 2001, *Draft water sharing plan for upper and lower Namoi groundwater sources*.

Pigram, J 1970, *Industry in Australia - Cotton*, Longman, Croydon, Vic.

Powell, R, Thompson, D, Chalmers, L, Gabbott, A, Stayner, R & McNeill, J 2003, 'A socio-economic analysis of the impact of the reductions in groundwater allocations in the Namoi Valley -The impact of the Namoi groundwater sharing plan', September

Vanclay, F, Mesiti, L & Howden, P 1998, 'Styles of farming and farming subcultures: appropriate concepts for Australian rural sociology? ' *Rural Society,* vol. 8, no. 2, pp. 85-107.

Willock, J, Deary, I, Edwards-Jones, G, Gibson, G, McGregor, M, Sutherland, A, Dent, J, Morgan, O & Grieve, R 1999, 'The role of attitudes and objectives in farmer decision making: Business and environmentally oriented behaviour in Scotland.' *Journal of Agricultural Economics,* vol. 50, no. 2, May, pp. 286-303.