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The primacy of human capital and social capital in influencing landholders' participation in programmes designed to improve environmental outcomes*

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Increasing landholder participation in environmental programmes is often essential for achieving desired levels of restoration and protection, as well as the economic goals of efficiency and equity. Previous literature has identified sociodemographic property and attitudinal variables that influence participation. Using qualitative research, we identify variables relating to human capital (business orientation and information seeking behaviour) and social capital (trust in those delivering programmes and connectedness with other landholders) that have been seldom or never identified as influencing participation. New scales are developed and existing scales refined for measuring these constructs, and their influence on past and future participation is examined together with a range of other constructs. The effect of these variables is examined using a survey of Australian landholders, and the results demonstrate the primacy of variables relating to human and social capital in influencing past and future participation.

Key words: adoption, incentives, latent variables, market-based instruments, natural resource management.

1. Introduction

Understanding how to increase landholder participation in market-based instrument (MBI) and incentive programmes is important from both ecological and economic perspectives. From an ecological perspective, if an area is environmentally sensitive or important, achieving high levels of landholder participation may be critical. For example, in areas that are important for landscape connectivity or biodiversity and where there are problems with groundwater recharge, achieving high levels of landholder participation may be essential for achieving ecological outcomes. From an economic perspective,

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achieving reasonable levels of participation is important as participation is related to the economic goals of efficiency and equity. In terms of equity, if only certain kinds of landholders participate (e.g. high-end landholders), then the equity outcomes from using a programme may be negative. For these reasons, it is important to understand how programmes can be designed and delivered to increase participation.

This paper focuses on understanding the types of landholders who participate in MBIs and incentives. Understanding the characteristics of participants is important for better targeting of promotions as well as for instrument design and selection. The advantage of knowing landholders who more often participate is that promotional efforts can be focused on them. Also, understanding characteristics of *non*-participants can provide insight into modifications to programmes and communications needed to encourage involvement. In this study, we investigate the effect of a range of landholder and other characteristics on past and planned participation in various agri-environmental programmes. Past research has focused on effects of socio-demographic, farm property and attitudinal variables. We seek to encompass and extend this literature by examining the role of other variables related to social and human factors that have been seldom or never examined in terms of their effect on participation. These include trust, connectedness, business orientation and information seeking behaviour. Intriguingly, these four new variables are found to be far more important in explaining past behaviour than attitudinal variables.

2. Literature review

Defrancesco *et al.* (2008) and Hynes and Garvey (2009) provide useful overviews of the literature of the determinants of participation in agri-environment schemes. During the 1980s and 1990s, most literature focused on sociodemographic and structural (property) factors. More recent literature adds to this by examining how attitudes about instruments provoke behavioural responses and how programmes fit into farming systems. Some literature proposes that Reasoned Action Theory provides the conceptual framework for modelling participation as it outlines a basis for relating behavioural intentions to attitudes (Ajzen 1988). Relatedly, in the psychology literature, the Theory of Planned Behaviour (TPB) was proposed to predict the likelihood of an individual performing a given behaviour (Ajzen 1991). Under this model, psychological constructs (attitudes, norms, perceived behavioural control and behavioural intention), as well as ability (actual behavioural control) influence the likelihood of a behaviour being undertaken. Whilst these frameworks propose a number of constructs that influence participation, they are not exhaustive and exclude constructs previously found to be empirically relevant.

Effectively, the literature points to a substantial number of previously empirically identified determinants loosely grounded in a Reasoned Action theoretical base. Consequently, the rest of this review is focused on the

empirical literature. Previous empirical studies have examined the effect on participation of: (i) sociodemographic characteristics, (ii) property characteristics, (iii) attitudes, (iv) human capital and (v) social capital.

2.1. Sociodemographic characteristics

A number of variables have been examined for their effects on participation, including age, education and children. In most studies, age was found to be negatively related to participation; though, there are exceptions (Lighthall 1995; Ducos and Dupraz 2006). Various studies have found education has a positive effect (e.g. Black and Reeve 1993). Dependent children were also found to be a positive predictor (Ducos and Dupraz 2006).

2.2. Property characteristics

Property size is the most studied predictor and has either a positive or negative influence on participation (Black and Reeve 1993; Allan *et al.* 2006). Whilst the influence of property size is unclear, studies have found that participation increases with the fit of the property to programme requirements and lower cost/time requirements from participation (Wynn *et al.* 2001; Clayton 2005).

2.3. Attitudes

Poor environmental attitude has often been cited as one of the most significant barriers to widespread adoption of sustainable land practices. However, there is evidence that environmental attitude has an ambiguous effect on participation (e.g. Vanclay and Lawrence 1995; Ducos and Dupraz 2006). Thus the importance of environmental attitude is potentially overestimated (Cary *et al.* 2002).

Another variable believed to influence participation is risk attitude or innovativeness. Conservation practices or modifications to conventional agriculture (e.g. integrated farming systems) perceived as risky would be less likely to be adopted by land managers, because risk reduces the expected benefits from adoption (Morris and Winter 1999; Cary *et al.* 2002). However, risk preferences vary (Cary *et al.* 2002), and those more willing to take risks may participate more readily in a programme.

A third psychographic variable potentially related to participation is economic motivation. Mayberry *et al.* (2005) developed a scale for measuring economic motivation amongst farmers and hypothesised that this attitude would affect participation in agri-environmental programmes, which was substantiated by Brodt *et al.* (2004).

Another construct in TPB for predicting adoption is perceived control. In this context, the factors likely to influence perceived control are financial and time constraints. Previous studies have found evidence that these are

constraints to the adoption of management practices (Cary *et al.* 2002) and programme participation (Clayton 2005).

2.4. Human capital

Landholders may be less able to participate in programmes depending on their previous participation, business orientation and information seeking behaviour. This reflects the ability or actual behavioural control component of the TPB. Studies have demonstrated that previous involvement in similar programmes (Clayton 2005) and involvement with government advisors (Ducos and Dupraz 2006) positively affect participation.

The literature recognises that landholders differ in business orientation (Vanclay and Lawrence 1995). Business orientation refers to landholders' use of recommended business practices, consultants and their propensity to undertake new initiatives. No previous studies have sought to examine the role of business orientation in influencing participation in agri-environmental programmes.

Finally, information seeking behaviour influences and reflects the development of human capital. Poor information access has been linked to low participation in environmental and other programmes (e.g. organic agriculture) (Korsching and Hoban 1990; Duram 2000). Furthermore, the literature highlights a relationship between acquisition of knowledge and skills, and the capacity to change and adapt (Frondel *et al.* 2006).

2.5. Social capital

There has been growing recognition of the link between social capital and environmental outcomes (Pretty and Smith 2004) as social capital provides communities with ability to coordinate action to achieve collective benefits (Coleman 1988). Social capital comprises a number of different constructs, including connectedness and trust in government and other institutions. Emerging literature suggests that in areas of high social capital landholders are likely to be more willing to participate in programmes.

Some studies have found evidence that a lack of trust can negatively influence participation (e.g. Ducos and Dupraz 2006). According to Pretty and Smith (2004), trust is important as it reduces the transaction costs associated with cooperation and can create social obligations for participation. Trust also reduces perceived risk.

Well-connected communities are more likely to sustain stewardship over the long term, particularly when the knowledge from these communities is used for conservation (Pretty and Smith 2004). In connected communities, social learning is more likely to facilitate spreading of new ideas. Connectedness increases observability, willingness to partner and positive social norms. In a developing country, Molinas (1998) found a link between connectedness and participation. In a developed country context, Morris and Winter (1999,

p. 203) indicate that connections between farmers, with extension officers and researchers feeding into this, are 'key to the successful transfer of technologies', whilst Warner (2006) demonstrates how social learning can be implemented through agro-environmental partnerships.

In summary, a range of variables has been identified in the literature as having the potential to influence landholder participation. Given that existing theoretical frameworks (e.g. Theories of Reasoned Action and Planned Behaviour) have not incorporated all relevant variables, and the previous conflicting findings, a contribution can be made by examining the effect on participation of the full range of variables identified in this literature review. A more comprehensive analysis is also important to avoid any statistical omitted variable bias and any erroneous attribution of importance to drivers that are a consequence of uncontrolled extraneous influences.

3. Methodology

A mixed methods design was used including expert interviews, focus groups and a quantitative survey.

Twenty-two expert interviews were conducted to provide insight from natural resource management practitioners, government officers, consultants and academics about the sorts of people more likely to participate in MBIs and incentives. In addition, eight focus groups were held in two Catchment Management Authority (CMA) areas in New South Wales (NSW) (Central West and Northern Rivers) and two Regional Body areas in Queensland (Condamine Alliance and Mackay-Whitsundays). The purpose of the focus groups was to provide information about the factors influencing participation, to assist in developing scales for several constructs and to assist in refining the questionnaire.

This was followed by a mail survey of about 6000 landholders (46.9% response rate) across three states (NSW, Queensland and South Australia) and five CMA/Regional Body areas (the four noted and Mt Lofty Ranges in South Australia). The sample of landholders was selected using random sampling and sample frames supplied by local and state government agencies. The questionnaire was distributed using the Dillman *et al.* (2009) approach, but excluding the final reminder and using a book on farm forestry as an incentive rather than a cash payment.

The questionnaire sought information on sociodemographics, property data, attitudes and constructs related to social and human capital. It also sought information on past participation in a range of MBIs and incentives, and interest in future programmes.

In the questionnaire, scales were included to measure business orientation, information-seeking behaviour, native vegetation management, connectedness, trust, satisfaction, environmental attitude, economic motivation, innovativeness, perceived time and capital constraints and stewardship (see

Table 1 Scales used in this study

Scale	Definition	Source
Formative		
Business orientation	Uses a range of business management practices	Developed for this study
Information seeking behaviour	Seeks to increase farming knowledge from various sources	Crase and Mayberry (2004), Mayberry <i>et al.</i> (2005)
Connectedness	How socially connected a landholder is with their community	Developed for this study
Native vegetation management	Use of best management practices for vegetation management	Crase and Mayberry (2004)
Reflective		
Trust	Confidence in governmental and social institutions	Cook and Gronke (2005)
Satisfaction	Satisfaction with last programme	Developed for this study
Environmental responsibility	Acceptance of environmental practices even if cost to landholders	Thompson (2002)
Economic motivation	Achieving profit primary motivation	Mayberry <i>et al.</i> (2005)
Innovativeness	Openness to change, willingness to try new technologies	Thompson (2002)
Perceived time constraints	Perceive insufficient time for additional/existing activities	Developed for this study
Perceived capital constraints	Perceive insufficient financial resources to experiment with new ideas	Developed for this study
Stewardship	Looking after the countryside primary goal of farming	Curtis <i>et al.</i> (2005)

Table 1). All of the scales are reflective apart from the first four, which are formative. Reflective measures have items that reflect slightly different aspects of construct, whilst formative measures are similar to indexes where items form different aspects of the construct. The scales are detailed more fully in Morrison *et al.* (forthcoming).

The reflective measures drew on scales previously developed by Curtis *et al.* (2005) for stewardship, Thomson (2002) for innovativeness and environmental responsibility, Mayberry *et al.* (2005) for economic motivation and Cook and Gronke (2005) for trust, as well as items developed from the qualitative research for the satisfaction, budget constraints and time constraints scales. The formative measures for business orientation and connectedness were developed through the qualitative research, whilst the scales for information seeking behaviour and native vegetation management were used in the ques-

tionnaire developed by Crase and Mayberry (2004) and Mayberry *et al.* (2005) but modified for use in this study. The literature on predicting environmental behaviours has largely focused on environmental attitudes. In this study, environmental behaviours were measured in addition to environmental attitudes, as the psychology literature indicates that past behaviour may be a better predictor of future behaviour than attitudes (e.g. Biel 2003).

To assess the accuracy of newly developed and established scales, both validity and reliability were tested. The face validity of the newly developed scales was tested in focus groups and through expert evaluation. In addition, discriminant and convergent validity was tested for all reflective scales. A measurement model for all reflective constructs was estimated by confirmatory factor analysis (CFA) allowing all reflective constructs to co-vary. Maximum likelihood (ML) was used explicitly recognising missing observations as part of the estimation process (Anderson 1957). This measurement model had satisfactory fit indices (comparative fit index, CFI = 0.907 and root mean square error of approximation, RMSEA = 0.044) (see Hair *et al.* 2010). Chronbach alphas provided evidence of the reliability of each of the reflective constructs with all alphas apart from stewardship > 0.6. CFA was used to examine the convergent validity of each of the scales, whilst discriminant validity was examined using the approach recommended by Fornell and Larcker (1981). Again there was evidence of discriminant validity for all constructs apart from Stewardship. In terms of convergent validity, only two individual standardised loadings were < 0.5, one from each of the stewardship and environmental responsibility constructs. Thus, for the majority of reflective constructs, there is evidence of convergent validity.

Regression analysis was conducted to identify the variables that influence participation in past and future programmes. Separate regressions were run to identify the effects of sociodemographic and property characteristics, attitudes and social and human capital variables on both past and future participation. Latent regression models were estimated by ML with robust (to non-normality and non-independence) standard errors and recognising missing observations for endogenous items. All reflective constructs are treated as latent variables with all factor loadings and measurement error variances explicitly estimated. Formative measures are used in their summative form. The logit link is employed for the dichotomous dependent variable (Muthén 1983). This procedure avoids the bias and inconsistency associated with including latent exogenous variables in standard regression latent models, such as occurs with simply including factor scores in a binary or ordered logit model (Train *et al.* 1987). All the reflective and formative constructs described earlier, apart from stewardship, were included in the regression. Stewardship was excluded as there was limited evidence of reliability and validity. Included in the sociodemographic characteristics are variables representing whether the respondent is a primary producer and the percentage of income earned off-farm; this is important given the large number of lifestyle

in the sample and the need to allow for the effect that they may have on model parameters.

In terms of the dependent variables for the regression analysis, past participation involved six different MBIs and incentive programmes (see Table 2). The programmes cover a range of environmental goals, programmes and scales. They include two national programmes and four catchment programmes. National programmes are Landcare and the Australian Government Envirofund. Landcare operates via devolved grants, which fund locally based groups that fund projects within their region, generally using cost share. Envirofund is a tender for projects that conserve biodiversity and promote sustainable natural resource use. The Central West CMA provides incentives for improving land, water and biodiversity. These include fixed grants and variable cost share (percentage cost share depends on extent of environmental gains). Condamine Alliance's Regional Investment Strategy includes the use of cost share and tenders for land management and biodiversity projects. The remaining programmes are available in Mackay-Whitsundays. The Rural Water Use Efficiency programme is a cost-share programme aimed at improving irrigation water use efficiency whilst Sustainable Landscapes is a variable cost-share programme focused on biodiversity and waterways management.

The dependent variables for future participation are interest in a fixed grant, variable cost-share or tender programme (measured on a five-point rating scale, 1 – not at all interested, 5 – very interested). To ensure identification for these single item dependent variable models, the variance of measurement error for the dependent variables is fixed *a priori* based on the average value of the reliabilities from the attitudinal constructs (Hair *et al.* 2010).

Table 2 Programme summary

	Focus	Programme	Scale
Landcare	Range of environmental projects	Devolved grant mostly distributed using cost share	National
Envirofund	Biodiversity, sustainable resource use	Tender	National
Central West CMA Authority Incentives	Land, water, biodiversity	Fixed grants, variable cost share*	Central West CMA
Condamine Alliance Regional Investment Strategy	Land management, biodiversity	Cost share, tenders	Condamine Alliance
Rural Water Use Efficiency programme	Irrigation water use efficiency	Cost share	Mackay-Whitsunday
Sustainable Landscapes programme	Biodiversity, waterways management	Variable cost share	Mackay-Whitsunday

*Per cent cost share depends on environmental gains at project site.

4. Results

4.1. Qualitative results

The qualitative research provided insight into the sociodemographic and farm level characteristics, as well as behavioural and attitudinal variables that influence participation.¹ In terms of sociodemographics, both experts and focus group participants thought younger landholders were more likely to participate, and experts thought more educated landholders were more likely to participate, which is consistent with the literature.

Regarding farm characteristics, length of time in farming and on a property were considered to be important predictors of participation. Interestingly, it was suggested farmers are more likely to participate if they have not been farming long or have not owned their property for a long period. Lastly, opportunity cost was noted in both expert interviews and focus groups as being important. Where the costs associated with participation are high, and/or payments low, participation is less likely, which is consistent with the literature (e.g. Ducos and Dupraz 2006).

For attitudes, some experts pointed to the quality of the relationship that a landholder has with the proponents of the incentive scheme, which is related to trust (Breetz *et al.* 2005; Ducos and Dupraz 2006). Focus group participants also pointed to not being frightened about control and interference, which is again related to trust. Both experts and focus group participants suggested that the more 'conservation conscious' a farmer the greater the likelihood of participation, although the literature suggests that the effect of environmental attitude on participation is ambiguous. Other experts suggested that profit-driven farmers are more likely to participate. Still other expert respondents and focus group participants suggested innovative, progressive and confident farmers are more likely to participate.

Lastly, three behavioural characteristics were suggested as being of some importance in explaining participation. Experts and focus group participants suggested that the more business driven or oriented a farmer, the more likely is participation. Focus group participants noted that being an efficient manager created time for participation. Second, experts noted that involvement in previous schemes is likely to influence participation (Clayton 2005). It was noted, however, that features of some programmes (particularly auctions) attracted people not involved in other MBIs or incentives, such as fixed-grant programmes. Third, a landholder's 'connectedness', demonstrated by participation in networks, was also raised by expert respondents as a characteristic influencing participation. This has seldom been mentioned in the literature.

Thus, the qualitative research confirmed much of the literature; however, it pointed to several constructs that have received little or no previous testing.

¹ More detail about the qualitative findings is available in Morrison *et al.* (2008).

These included business orientation, trust and connectedness. Given their potential importance, scales for measuring these constructs were developed in focus groups.

4.2. Quantitative results

4.2.1. Descriptive statistics

Prior to presenting the regression results, some statistics that profile the sample are presented in the first column of Table 3. The results indicate that 36.7% of respondents listed primary producer as being their main occupation and a quarter of respondents are lifestylers and do not make any income from their property. The average block size is 556 hectares, and on average respondents lease 102 hectares of farmland for agricultural purposes. Almost half of total income is earned off-farm (43.2%) and there is evidence of income stress (see sufficiency of income variable). The average time lived in the district and on the current farm is high, but there is evidence of property turnover. About 22% of participants had participated in an agro-environmental programme in the past 3 years.

4.2.2. Past participation

Binary latent logistic regressions were used to predict past participation in the six existing programmes (Table 2), and any programme in any catchment (this included programmes other than the main six investigated). The results are presented in Table 3, with standardised coefficients reported so the magnitude of coefficients can be compared.

The explanatory power of the models is satisfactory, with R^2 values ranging from 39% to 73%. All eleven attitudinal and behavioural variables, except for economic motivation and time constrained, have statistically significant impacts in at least one of the equations. All thirteen sociodemographic and property characteristics, except for family succession and equity, have statistically significant impacts in at least one regression.

The results for the attitudinal constructs are surprising given previous findings in the literature. Many of the reflective constructs used in the literature (e.g. innovativeness, economic motivation, environmental responsibility, time constrained, capital constrained) are seldom or never significant in these regressions. This is consistent with the general expectation that the failure to recognise measurement error in independent variables in regression analysis may overstate the importance of regressors; effectively measurement error is erroneously viewed as explained variation (e.g. Oczkowski 2001). These results suggest that some previous studies that have used summated or factor scores to measure latent constructs may be overstating the importance of these factors.

The variables that dominate are those identified in the qualitative research and for the most part developed for this study, including trust, business

Table 3 Binary logit and latent variable models showing influence of attitudinal and behavioural constructs and sociodemographic and property characteristics on past and future participation

	Past participation (binary logit)										Future participation		
	Any programme	Landcare	Envirofund	West CMA Incentives	CA Reg. Invest. Strategy	Rural Water Efficiency	Sustainable landscapes	Fixed grants	Cost share	Tender			
Attitudinal and behavioural constructs													
Business orientation	0.109*** (2.73)	0.130** (2.45)	0.139* (1.92)	0.211** (2.12)	0.087 (0.70)	0.218** (2.38)	0.118 (1.35)	0.076** (2.41)	0.108*** (3.49)	0.091** (2.48)			
Information seeker	0.195*** (4.90)	0.109*** (2.08)	0.128* (1.80)	0.339*** (3.17)	0.189 (1.46)	0.154 (1.54)	0.122 (1.12)	0.072** (2.30)	0.101*** (3.27)	0.056 (1.58)			
Connectedness	0.138*** (4.26)	0.117*** (2.95)	0.213*** (2.99)	0.058 (0.79)	0.051 (0.44)	0.113 (1.42)	0.140 (1.56)	0.008 (0.33)	0.022 (0.93)	0.054** (2.04)			
Native vegetation management	-0.125* (-1.76)	0.039 (0.47)	0.011 (0.07)	-0.088 (-0.81)	0.114 (1.17)	-0.060 (-0.36)	-0.193 (-1.05)	-0.009 (-0.42)	-0.010 (-0.46)	-0.014 (-0.53)			
Trust	0.325*** (3.41)	0.318*** (3.17)	0.102 (0.69)	0.272*** (2.66)	0.128 (0.57)	0.074 (0.50)	0.699*** (3.19)	0.211*** (4.09)	0.221*** (4.81)	0.086* (1.73)			
Satisfaction	-0.051 (-0.53)	-0.134 (-1.57)	0.106 (0.90)	-0.039 (-0.23)	40.307** (2.08)	-0.237 (-1.26)	0.078 (0.54)	0.071 (1.11)	0.076 (1.39)	0.083 (1.35)			
Environmental responsibility	0.049* (1.67)	0.031 (0.82)	0.141*** (2.58)	-0.088 (-1.36)	-0.203 (-0.97)	0.008 (0.13)	-0.020 (-0.28)	0.011 (0.25)	0.093** (2.12)	0.127** (2.55)			
Economic motivation	-0.082 (-1.47)	-0.082 (-1.10)	-0.048 (-0.45)	-0.043 (-0.39)	-0.070 (-0.34)	0.126 (0.38)	-0.053 (-0.51)	-0.064* (-1.72)	-0.064* (-1.72)	-0.004 (-0.09)			
Innovative	-0.026 (-0.45)	-0.120* (-1.75)	-0.003 (-0.02)	0.023 (0.227)	0.321* (1.82)	0.123 (1.00)	0.001 (0.01)	0.316*** (8.13)	0.259*** (6.79)	0.202*** (4.75)			
Capital constrained	0.000 (0.01)	0.003 (0.04)	0.093 (0.88)	0.082 (0.67)	-0.092 (-0.57)	0.113 (0.99)	0.249** (2.05)	0.115*** (2.69)	0.024 (0.55)	0.030 (0.61)			
Time constrained	0.042 (0.79)	0.073 (1.04)	-0.104 (-1.26)	-0.016 (-0.13)	0.147 (0.98)	0.106 (1.05)	0.113 (1.11)	-0.070* (-1.95)	-0.084** (-2.42)	-0.054 (-1.35)			

Table 3 (Continued)

Mean (SD)	Past participation (binary logit)					Future participation					
	Any programme	Landcare	Envirofund	Central West CMA Incentives	CA Reg. Invest. Strategy	Rural Water Efficiency	Sustainable landscapes	Fixed grants	Cost share	Tender	
Sociodemographic and property characteristics											
Hours/week worked	32.8 (25.2)	0.165*** (3.05)	0.163** (2.30)	0.064 (0.52)	0.098 (0.87)	0.321** (2.08)	0.076 (0.64)	0.024 (0.16)	0.038 (1.18)	0.088*** (2.65)	0.016 (0.40)
Years on property in district	32.1 (21.0)	0.124** (2.23)	0.056 (0.83)	0.162 (1.40)	0.153 (1.37)	-0.249 (-1.26)	0.013 (0.11)	0.319** (2.24)	-0.012 (-0.34)	-0.025 (-0.72)	-0.063 (-1.62)
Years on current property	23.1 (18.9)	-0.107** (-2.90)	-0.084* (-1.84)	-0.106* (-1.72)	-0.272*** (-3.43)	-0.027 (-0.24)	0.181** (2.25)	-0.101 (-1.08)	-0.048 (-1.39)	-0.055 (-1.57)	-0.024 (-0.64)
Farm family	70.1%	0.056 (1.45)	0.031 (0.60)	-0.023 (-0.32)	-0.074 (-0.60)	-0.051 (-0.40)	0.161 (1.64)	0.010 (0.12)	0.149*** (6.56)	0.133*** (5.90)	0.102*** (4.10)
Succession		0.076* (1.73)	0.094* (1.67)	0.025 (0.29)	-0.378** (-2.33)	0.192 (1.31)	0.344*** (2.70)	-0.217 (-1.58)	0.020 (0.96)	0.029 (1.27)	0.014 (0.54)
Total property area	556.4 ha (2549.5)	-0.041 (-0.95)	-0.014 (-0.27)	-0.005 (-0.06)	0.271** (2.01)	-0.109 (-0.81)	-0.157 (-1.64)	0.342** (2.54)	-0.004 (-0.15)	-0.041* (-1.66)	-0.022 (-0.84)
Total leased area	102.4 ha (951.6)	0.031 (-0.95)	-0.029 (-0.27)	0.057** (2.02)	-0.058 (-0.99)	0.080 (0.95)	-0.010 (-0.15)	0.013 (0.18)	0.041* (1.67)	0.039 (1.60)	0.018 (0.67)
Proportion off-farm income	43.2%	0.020 (1.25)	0.104** (2.48)	0.047 (0.78)	-0.061 (-0.76)	-0.159 (-1.54)	0.011 (0.11)	0.076 (0.88)	-0.023 (-0.70)	-0.020 (-0.66)	-0.012 (-0.35)
Sufficiency	3.1 (1.1)	-0.031 (-1.00)	-0.037 (-0.93)	-0.013 (-0.22)	-0.120 (-1.52)	-0.084 (-0.97)	-0.123 (-1.53)	0.006 (0.07)	0.030 (1.21)	0.009 (0.39)	-0.034 (-1.29)
Farm equity	73.1%	-0.008 (-1.00)	0.025 (0.65)	-0.037 (-0.66)	0.138* (1.69)	0.098 (0.87)	-0.132 (-1.53)	-0.100 (-1.16)	0.000 (-0.04)	-0.084*** (-3.05)	-0.031 (-1.01)
Age	54.8 years (11.6)	-0.008 (-0.27)	0.050 (1.50)	-0.016 (-0.40)	0.050* (1.72)	-0.172 (-1.50)	0.141* (1.77)	-0.106 (-1.01)	-0.064*** (-2.77)	-0.072*** (-3.05)	-0.052* (-1.93)
Gender (1 = F)	17.8%	0.050 (1.50)	-0.016 (-0.40)	0.063 (1.72)	0.092 (1.24)	-0.060 (-0.59)	-0.147 (-1.21)	0.073 (1.01)	0.125*** (4.32)	-0.072*** (-3.05)	0.070** (2.18)
Education	6.0 (2.4)	-0.016 (-0.51)	-0.058 (-1.38)	0.063 (1.16)	-0.106 (-1.06)	-0.059 (-0.59)	-0.121 (-1.21)	0.171** (2.11)	0.125*** (4.32)	0.057* (4.46)	0.040 (2.18)
Primary producer	36.7%	0.007 (0.21)	0.005 (0.11)	-0.056 (-0.88)	-0.064 (-0.78)	0.052 (0.46)	-0.074 (-0.84)	0.180** (2.28)	0.040 (1.19)	0.057* (4.46)	0.040 (2.18)

Table 3 (Continued)

	Mean (SD)	Past participation (binary logit)					Future participation			
		Any programme	Landcare	Envirofund	Central West CMA Incentives	CA Reg. Invest. Strategy	Rural Water Efficiency	Sustainable landscapes	Fixed grants	Cost share
Constant	2.499*** (9.78)	3.604*** (10.0)	3.586*** (7.08)	1.256** (2.28)	2.124* (2.48)	3.234*** (3.97)	3.479*** (3.98)	1.840*** (11.04)	1.428*** (8.58)	1.327*** (7.19)
R ²	0.392	0.397	0.503	0.622	0.489	0.632	0.732	0.439	0.461	0.242
N	1855	1855	1855	379	416	330	331	2235	2235	2235
% programme participation/ mean Y (1–5 scale)	23.7	10.9	3.8	18.2	7.7	14.8	14.2	2.96	2.72	2.17

For regression equations standardised parameter estimates with *t*-ratios in parentheses. ***, ** and * significance at the 1%, 5% and 10% levels. Location dummies in first three equations suppressed.

orientation, use of information channels and connectedness. These are consistently the most significant variables in explaining past participation and have the largest coefficients.

Interestingly, the importance of attitudinal constructs depends upon the programme. For example, environmental responsibility is an important driver only for the Envirofund, satisfaction is only important for the CA Regional Investment, and capital constrained only influences Sustainable Landscapes. It is noteworthy that the coefficient for innovative is negatively signed and significant for Landcare. This is intriguing and suggests those less innovative are more likely to participate in Landcare. Possibly because Landcare invokes social motives to encourage participation, Landcare has been able to reach a greater proportion of less innovative landholders.

The most important property characteristics influencing past participation are years on current property, total area and hours worked. There were mixed findings regarding effect of time respondents had lived on their current property. Years on current property was significant and negative in Landcare, Envirofund and Central West models, suggesting more recent purchasers are more likely to participate, which is consistent with Allan *et al.* (2006) and the expert interviews. This may be because after purchasing a property, landholders are more open to change or want to make changes to improve the sustainability of their property. However, years on current property was positively signed in the Rural Water Efficiency model, indicating longer-term residents were more likely to participate.

The positive influence of total area of property on participation in the Landcare and Rural Water Efficiency models is supported by Black and Reeve (1993), who found farm size was positively related to participation in Landcare. This may be because larger farmers are more commercially oriented, and these programmes are more closely aligned to sustainable production rather than environmental management. However, the negative influence of farm size identified for Central West CMA Incentives is supported by Clayton (2005) and Allan *et al.* (2006).

The numbers of hours worked and number of years lived in the district were each found to have a positive influence on participation in two or more of the regression equations, suggesting that those spending more time on their farms and having greater experience on them are more able and willing to participate. Whilst no previous studies have found that number of years in district influences participation, Allan *et al.* (2006) did investigate the effect of number of hours worked on a property and found similar results.

Three variables relating to finance were included: proportion of income earned off-farm, sufficiency of family income and farm equity. The proportion of income earned off-farm was only significant and positively related to participation for the Envirofund programme, which is consistent with the findings of Allan *et al.* (2006). Sufficiency of family income was significant and positively signed only for Landcare. However, farm equity was found to be insignificant for all programmes.

In terms of sociodemographics, age was only related to participation for the Central West CMA model. This contrasts with Wynn *et al.* (2001) and Allan *et al.* (2006). Gender was significant in two equations, indicating greater propensity to participate amongst women. Education also had a minor impact, being significant only for Sustainable Landscapes. Interestingly, a self-identified primary producer is only significant (and positive) for the Sustainable Landscapes model. This finding is in contrast to the finding of Allan *et al.* (2006), who found that identifying as a farmer had a negative effect on participation. It also contrasts with the finding for percentage income earned off-farm that had a significant and positive effect on participation in Envirofund. Overall, this indicates that being a lifestyle farmer can have a positive influence on participation in some programmes but a negative effect in others, even programmes that are environmentally focused.

In a broad sense, the relative unimportance (compared with previous studies) of the sociodemographic variables may in part be due to the comprehensiveness of the modelling undertaken in this study, where a large set of potential determinants was employed. In this effort to control for extraneous factors influencing results, fewer of the previously identified important sociodemographic variables have been found to influence participation.

4.2.3. Future participation

Latent variable regressions were estimated to show the effect of variables of interest on participation in future fixed grants, variable cost share and tenders, with the results reported in the last three columns of Table 3. The equations have moderate to fair explanatory power, with R^2 values ranging from 0.242 to 0.461. Consistent with the previous reported regressions, trust and business orientation are significant in all three regressions. However, in contrast, many of the reflective constructs identified in the literature are now significant. In particular, the coefficient for innovativeness is significant in all three equations and has the largest magnitude of any coefficient for each equation. Four more variables, economic motivation, time constrained, environmental responsibility and information channels, were significant in two of the three models. Capital constrained is significant only for the fixed grants model.

In contrast to the findings for past participation, some of the sociodemographic characteristics have gained importance. Being male and a higher education level increases likelihood of participation in all models, whilst being younger improves participation likelihood for fixed grants and cost share. Further, family farm succession is significant in all models. In contrast to the findings for past participation, all the property characteristics are either only important for one or insignificant for all equations.

5. Conclusion

Understanding who participates in MBIs and incentive programmes is important for ensuring programmes will achieve their goals, as well as the economic

goals of efficiency and equity. The literature on this topic suggests that participants are likely to be younger, educated and have dependent children; have a positive attitude towards the programme, are more innovative and less risk averse, and have fewer financial and time constraints; have properties where the programme is complementary to existing farm management; and have participated in previous programmes.

The qualitative and quantitative evidence from this study supports many but not all of these findings. Age and education were found to be better predictors of future rather than past participation, and there was qualitative evidence to suggest that those more innovative, economically motivated, environmentally conscious, have fewer financial constraints and participated in previous programmes are more likely to participate in future programmes.

The quantitative evidence relating to past participation differs somewhat from the predictions of the literature and the qualitative evidence. Innovativeness, economic motivation, environmental attitude and behaviour, and financial and time constraints were seldom significant in the regressions relating to past participation. The results suggested that those who had previously participated tended to have larger properties, work longer hours, are business oriented, seek more information, trust programme deliverers and are well connected. There was some, though less, evidence that participants are younger, more recently purchased their property and lived in their local district for a longer period.

Whilst a number of the variables suggested by the literature and the qualitative research did not prove to be significant in predicting past participation, they were relevant in predicting interest in future participation. Innovativeness was the most important predictor in all equations of future participation. Other important variables included business orientation, trust and family farm succession.

These results point to the importance of variables relating to human and social capital in explaining landholder participation. They suggest that in well-educated communities with substantial human capital, and in communities with high social capital, participation is likely to be high. There is some recognition of the importance of these variables in the literature; however, several of these constructs, such as business orientation, information seeking behaviour and connectedness, have seldom if ever been used to predict participation in agri-environmental programmes.

An interesting finding was that less innovative landholders tend to participate more frequently in Landcare. This is most probably because Landcare has sought community involvement through Landcare groups and uses incentives that are perceived to be fairly simple and equitable. Consequently, they have developed connectedness and in the process reached landholders that many other programmes have been less successful at reaching. This illustrates the importance of developing both social and human capital for encouraging participation from a wider range of landholders.

These findings have significant implications for the development of MBIs and incentives. They suggest that in areas of low participation and ecological importance, strategies for encouraging participation should go beyond modifying instrument choice or design, or improving communications. They suggest that over the long-term, participation can be improved through the use of strategies to develop human and social capital. This could include the use of extension officers, short-courses, field-days and workshops to build trust in problematic areas and develop human capital. Fairly simple instruments, such as fixed grants, could also be offered where there is much lower risk to build trust. The literature suggests that three antecedents of trust are communication, operational competence and a problem-solving orientation (Sirdeshmukh *et al.* 2002; Coote *et al.* 2003). Thus, carefully managed engagement in these sorts of activities should provide the opportunity for developing trust. Strategies could also be developed to improve connectedness (Pretty and Smith 2004). This could include the use of community and social meetings, as well as a mentoring programme.

Finally, this study has made several methodological contributions to the literature. New scales have been developed for measuring business orientation, connectedness, trust, time constraints, capital constraint and satisfaction. The use of the latent logit link and the inclusion of a large number of reflective scales as latent variables in the regression analysis to avoid the bias associated with using factor scores in discrete choice models have also been demonstrated.

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