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Strategies to encourage adoption: a case study of New Zealand farmers and their possum control practices

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ABSTRACT

Ecological scientists and policy agencies have identified possums (*Trichosurus vulpecula*) as a pest of both biodiversity and agricultural production. However it has been unclear whether farmers would take action to control possums for biodiversity reasons if their potential threat to agriculture was reduced. In 2002 a survey was made of New Zealand livestock farmers, of whom 85% had control measures in place. From the data, a regression model was developed for predicting farmers' intentions to control possum numbers. The model had a squared multiple regression co-efficient of 62%. The individual regression co-efficients all had F probabilities <0.001. It is apparent that possum control on farms is mainly undertaken to reduce the threat of bovine tuberculosis (Tb) in cattle. Farmers are also more likely to take steps to control possum numbers when they consider it will reduce pasture damage, contribute to an overall reduction in farm pests, and reduce damage to their fruit trees and gardens. Control is discouraged by risks of poisoning farm dogs and high costs. Policy agencies will need to work with scientists to provide the information landowners need to encourage their greater commitment to possum control even when the Tb threat has been reduced.

Keywords: adoption; possum; attitudes; Theory of Reasoned Action.

INTRODUCTION

An Australian marsupial the brushtail possum (*Trichosurus vulpecula*), was introduced to New Zealand in the mid 1800s to establish a fur trade. It has bred prolifically and established quickly to now occupy 95% of New Zealand's land area "with average densities up to 20 times greater in New Zealand than similar Australian habitats." They have become the number one vertebrate pest of New Zealand's biodiversity (PCE, 2000). The few published papers on New Zealanders' perceptions and attitudes towards possum control include studies by the Parliamentary Commissioner for the Environment (2000, 1998, 1994) and a MAF technical paper (Fitzgerald *et al.*, 1996).

In this study, the Theory of Reasoned Action (TRA), a theory of human behaviour, was used to assist with understanding the influence of attitudes upon the likelihood that farmers would act to control possum numbers on their properties (Ajzen and Fishbein, 1980; Fishbein and Ajzen, 1975). The Theory of Reasoned Action is based upon peoples' behaviour being strongly related to their attitudes towards that behaviour. People form attitudes by systematically deliberating on any information that they have about the consequences of following the behaviour being considered (Fazio, 1990). Hence, attitudes are an evaluation and a tendency to consider a behaviour as either good or bad. The more an individual expects that a behaviour has good consequences for themselves, the more that the individual will have a positive attitude towards that behaviour. Similarly, the more that an individual expects that a behaviour has undesirable consequences for themselves the more that they will have a negative attitude towards it. The likely consequences of a behaviour are known as beliefs (Eagly and Chaiken, 1993). Peoples' attitudes influence their behaviour through the formation of intentions to behave in certain ways. Applying the theory, this research identified and measured farmers' intentions,

attitudes, and beliefs towards possum control. The results can now be used to determine the parameters of future possum control research, and to target policy information for farmers.

MATERIALS AND METHODS

The research project had three steps combining qualitative and quantitative approaches (Zikmund, 1997) determining the nature and importance of factors influencing farmers' commitments to control possum numbers. The first step was to define a farmer's decision-making system for possum control as a way of standardising the behaviour being examined (Vennix, 1996). A system diagram was produced and used as a reference point in subsequent steps (Parminter & Wilson, 2002). The second step used this system as a basis for identifying farmers' attitudes and beliefs about possum control (Maani & Cavana, 2000). Standardised approaches were used in discussions with farmers to identify the possible consequences for them of taking action over possum control (Ajzen & Fishbein, 1980). Results from the second step were then used to develop a national survey for quantifying the influence of farmers' attitudes and beliefs upon their intentions. Multiple survey questions were used to determine each variable as follows.

1. Intentions (PCI) to implement possum control activities (2 questions).
2. Intrinsic attitudes towards possum control (IA) resulting from people weighing up the expected costs and benefits for taking action (3 questions). They are called intrinsic attitudes because they directly relate to the action under consideration.
3. Self identity (SI) and how much people consider possum control to be consistent with their image and how they want others to see them (3 questions).
4. Affective attitudes (AA) resulting from people wanting to enjoy any activities undertaken to control possums (2 questions). They are called affective to

distinguish these emotional responses from the more rational analyses that make up peoples' intrinsic attitudes.

5. Subjective norms (SN) and how people perceive the views of others towards the issue, especially family, peers and technical experts (3 questions).
6. Behavioural control (BC) to measure the degree to which people consider that they themselves have control over possum numbers on their own properties (2 questions).
7. Self efficacy (SE), is related to behavioural control and measures the degree of confidence that people have that (maybe with some effort) they can use their available resources to achieve the level of performance they desire in a behaviour (2 questions).

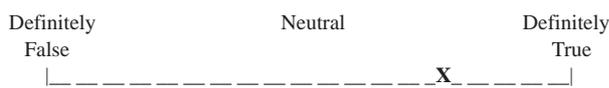
Beliefs questions were included in the survey to expand on peoples' intrinsic attitudes (12 beliefs), and subjective norms (3 beliefs).

The survey was posted to a random list of 1550 farmers generated from a national database of properties larger than 20 hectares in area. All the attitude and belief questions were quantitative with an underlying 20-point scale (Figure 1), anchored by two contrasting concepts (or semantic differentials) (Osgood *et al.*, 1957). An independent research company managed the survey and farmers returned the completed forms to them over a four-week period. The representativeness of the results was tested by comparing respondents' characteristics against population data held by the Ministry of Statistics. Results from later respondents were also compared with earlier respondents to see if there was an effect from early enthusiasts (Zikmund, 1997).

FIGURE 1: An example of the non-numerical scales used in this survey

AN EXAMPLE:

Over the next year I intend to control possums on my farm.



The person answering the question in this example has indicated that their feelings lie midway between being neutral and strongly agreeing with the statement.

Cronbach's Alpha Coefficient was used to check the internal consistency of the question sets (PCI, 6 regression variables and 4 beliefs) that were to be combined. This was done to ensure that the questions were measuring the same underlying concept (Ajzen & Fishbein, 1980). Standard TRA protocols were used to calculate PCI and attitudes (means of question sets) and beliefs (question means). Beliefs means were used to identify the main influences that underly attitudes. The effects of the six psychological variables on possum control intentions were assessed by stepwise linear regression (Lawes Agricultural Trust, 1993). Respondents were differentiated into 2 groups, adopters and non-adopters of possum control, based on the value of the mean of the 2 PCI questions: mean values of 12 or more were classed as adopters and mean values below 10 as non-adopters.

Differences in beliefs means between these groups were tested using the *t*-test (Snedecor & Cochran, 1989).

RESULTS

The response rate for the survey in this study was 33% (519 questionnaires received) over a 4-week period. Written survey responses of over 50% are considered reliable for most purposes and responses of 25% are typical after 4 weeks (Zikmund, 1997). Respondents were older (mean of 50 years compared with 44 years), more likely to be male (82% male compared with 67%), and more likely to be Maori (8% compared with 5%) than national farming statistics. The number of dairy farmers was lower (33% compared with 43%) and the average area of farms was also higher (343ha compared with 292ha) than national statistics. There was no significant difference in the results of late compared with early respondents.

Most farmers (85%) undertook possum control practices on their properties, generally by shooting or trapping, however, only 60% of farmers considered that they had possum numbers under control. The degree of control was unrelated to the amount of time and effort being spent on these activities (Pearson's Correlation of 0.05).

The internal consistency of the intentions and attitude questions was satisfactory with the calculated Cronbach's Alpha for each of the regression variables above 0.7 (Nunnally, 1978), indicating that respondents had given the measured concepts their expected meaning.

In order of reducing priority, the main factors influencing intentions for possum control were: intrinsic attitudes, self identity, affective attitudes, subjective norms and behavioural control. Self efficacy was found to be non-significant.

$$PCI = -4.6 + 0.5IA + 0.3SI + 0.2AA + 0.2SN + 0.1BC$$

The regression equation was calculated based upon the Theory of Reasoned Action ($R^2=62\%$). All the variables in the equation represent different psychological factors that influence human behaviour. They all use the same form of measurement unit described earlier (a 20-point scale). F-probabilities for both the constant and all variables were less than 0.001.

Farmers' intrinsic attitudes were especially related to their beliefs that controlling possums would reduce animal health problems in farmed livestock and be better for their garden and fruit trees. Farmers had a more positive attitude towards possum control if it could provide them with an additional source of income. The main differences between the beliefs of adopters and non-adopters of possum control were that the adopters believed that they could reduce animal-health problems ($P<0.001$), reduce pasture damage ($P<0.001$), and reduce damage to their gardens and fruit trees ($P<0.001$), have cleaner sheds and equipment ($P<0.05$), and be socially responsible by taking action ($P=0.01$). Non-adopters did not believe that possums would cause pasture damage, and did not hold the other beliefs (especially regarding effects on animal-health) as strongly as adopters. Non-adopters and adopters had similar beliefs about possum control providing an alternative source of income (a positive

effect) and increasing farm costs (a negative effect). Non-adopters associated possum control measures with poisoning farm dogs ($P < 0.05$) and creating unnecessary extra work ($P < 0.001$). Non-adopters believed that other people in their social network would not support them taking actions to control possum numbers ($P < 0.001$).

DISCUSSION

A previous meta-analysis of TRA applications found that squared multiple regression co-efficients for intentions of 40-50% were commonly being achieved (Sheppard *et al.*, 1988). Although no results from similar studies to this one are available, the statistical results of this study are comparable with figures obtained over a range of different issues. Recent applications of the TRA in studies into intentions towards casual sex (Conner & Flesch, 2001) career development (Giles & Larmour, 2000) and water conservation (Lam 1999) achieved squared multiple regression co-efficients of 61%, 65%, and 41% respectively.

In dealing with pest management, this study found that farmers are less likely to control possum numbers if there is no animal health benefit associated with doing so. Strategies for increasing the use of possum control practices by farmers when the Tb threat is reduced, should include information about possums' secondary effects and provide farmers with enjoyable ways of controlling their numbers. They will also need positive role models and supportive social networks to influence them through their social norms of what is desirable behaviour. Financial incentives will encourage more farmers to control possum numbers but will not counteract the effects of the other factors described above.

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