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Modelling General and Carbon Related Environmental Knowledge, Attitudes and Behaviour.

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Abstract

Using the theory of reasoned action, this study proposes a structural equation model that tests the relationships among carbon and environmental knowledge, attitude and behaviour. We found that carbon related knowledge is unrelated to attitudes, but general environmental attitudes drive both general and carbon related behaviours. The results suggest that specific environmental behaviour may therefore be more driven by general attitudes and knowledge, rather than by issue specific knowledge.

Key Words; Sustainability, Green, Environmental Knowledge, Carbon offsets
Modelling General and Carbon Related Environmental Knowledge, Attitudes and Behaviour.

Introduction

Global warming has gained global acceptance as an issue that needs to be addressed. While firms can reduce the amount of carbon they produce, they can also offset their production of carbon, by purchasing savings in other areas. There are many carbon offsets activities, which are defined as programs that implement a “measurable avoidance, reduction or sequestration of” carbon or greenhouse gases (Ramseur 2007, p. 1). One carbon offset represents the reduction of one metric ton of carbon dioxide. Offsets are purchased through carbon offset retail providers who then contract with developers of carbon offsetting projects. These retail providers vary in terms of their offerings, pricing and understanding of carbon offset programs and offset quality. At present there are a multitude of alternative offset providers and offset programs available (Clean Air-Cool Planet 2006). Given the complexity of carbon offsets and the newness of these programs there is the threat that consumers, while wishing to do the right thing, may be confused, misled, or simply make poor decisions based on an incorrect understanding of the intricacy of these programs (ACCC 2008). For example, consumers may believe that a firm investing in planting trees will reduce carbon. However, in reality any carbon savings will only occur in the future, assuming the trees grow to maturity.

Consumer environmental knowledge and attitudes have been researched for over 40 years in an attempt to provide insight and understanding into pro-environmental behaviour. The aim of this research is to examine the relationship between; general and carbon specific knowledge, attitude towards the environment, and their general and carbon specific behaviours for Australian consumers. The following sections provide the theoretical underpinnings of the research; an overview of the literature on environmental knowledge, attitudes and behaviours; the method and results, and directions for further research.

Literature Review and Hypotheses Development

Researchers have long suggested that behavioural intentions arise based on consumers’ knowledge and attitudes which stems from the theory of reasoned action (Ajzen and Fishbein 1977; Ajzen and Fishbein 1980). These links have been explored in a range of areas over the years (Ferrell and Gresham 1985) including environmental knowledge; attitudes and intentions (Diamantopoulos, Schlegelmilch, Sinkovics, and Bohlen 2003; Franj-Andres and Martinez-Salinas 2007; Kaiser, Wolfing, and Fuhrer 1999; Maloney, Ward and Braucht 1975; Ivy, Lee and Chuan 1998; Schlegelmilch, Bohlen, Diamantopoulos 1996). Ajzen and Fishbein (1980) proposed the theory of reasoned action (TRA), where behaviour is influenced by behavioural intentions, which are formed from attitudes towards a particular act and one’s subjective norms. The models have proposed that for an attitude to be formed individual factual knowledge is a precondition (Stutzman and Green 1982; Kaiser, Wolfing and Fuhrer 1999).

However, there have been growing criticisms of the link between behavioural intentions and actual behaviour. For example, Davies, Foxall and Pallister (2002) identified that there were in fact limited links between intentions to behave more responsibly and actual responsible behaviour. Other models have also been proposed that question the link between knowledge attitudes and behaviour. For example Reibstein, Lovelock and Dobson (1980) found that
behaviour in fact may also influence attitudes. Whereas, Cialdini, Petter and Cacioppo (1981) suggest that for some people, knowledge does not directly affect attitudes and therefore does not directly affect behaviour. They suggest this is more likely to occur when individuals are not highly involved in the issue, which may be the case for some people and the environment. Thus, while we use TRA, there are a number of criticisms of this approach and alternatives need to be examined in the future.

Environmental Knowledge

It is argued that knowledge about the environment must be present for environmentally responsible consumer behaviour to occur (Maloney and Ward 1973; Hines, Hungerford and Tomera 1986). Environmental knowledge can be general in nature such as awareness of environmentally friendly products or more specific knowledge on issues such as recycling or carbon offset programs. Research indicates that consumers who have greater knowledge are more likely to act in a positive way (Hines, Hungerford and Tomera 1986; Pickett-Baker and Ozaki 2008; Thøgersen 2000). However, several studies found no direct relationship between factual environmental knowledge and environmental behaviour (Maloney and Ward 1973; Schahn and Holzer 1990); with others such as Schann and Holzer (1990) proposing that applicable knowledge should have a moderating effect on the relationship between attitudes and self-report behaviour. Building on the TRA, we propose in this research that knowledge (e.g., general environmental knowledge or carbon offset knowledge) has a positive impact on consumers’ environmental attitude and consequently specific behaviour in regards to general environmental behaviours and behaviours related to carbon offsets.

Different measures have been used to assess consumers’ environmental knowledge. Some research has attempted to measure factual environmental knowledge, where consumers undertake factual tests to determine their knowledge level (Maloney et al 1975; Tanner and Kast 2003). Other authors measure consumers’ perception of their environmental issues or actions related knowledge (Tanner and Kast 2003), but do not consider factual knowledge (Schlegelmilch et al. 1996; Diamantopoulos et al. 2003). The third approach considers broader attitudinal issues to define environmental knowledge, for example, “it’s no use worrying about environmental issues: I can’t do anything about them anyway (Stone et al 1995: 608)”. Within this paper we examine consumers’ factual knowledge as it identifies what consumers actually know about the environment (Maloney et al 1975) and specifics of carbon offsets, rather than more general understanding of actions. We propose that specific environmental information can be related to specific decisions rather than broad generalities (Thogersen 2000), making factual environmental knowledge as the most appropriate for measuring consumers’ knowledge levels.

Environmental Attitude

Attitude towards the environment has been commonly found to be an antecedent to pro-environmental behaviour (Moloney and Ward 1973; Lynne and Rola 1988; Kaiser, Wolfing and Fuhrer 1999). Allport (1935, p. 810) stated that ‘an attitude is a mental and neutral state of readiness, organized through experience, exerting a directive or dynamic influence on individual’s response to all objects and situations with which it is related’. Attitudes are generally introduced as a mediating variable (Davies, Foxall and Pallister 2002) in measuring the relationship between knowledge and behaviour. Therefore, we propose that

H1a General environmental knowledge is positively related to attitude towards the environment.
H1b Carbon offset knowledge is positively related to attitude towards the environment.
Environmental Behaviour

Behaviour has been known to stem from consumer attitudes. Bohlen, Schlegelmilch and Diamantopoulos (1993) found a strong positive relationship between attitudes about the environment and purchasing behaviour. Environmental issues cover a wide range of topics and thus environmentally-focused consumers can be motivated based on a range of factors (Stone, Barnes and Montgomery 1995). However, someone who is active in one set of environmental behaviours may not necessarily be equally activated in others (Kahn 2007). As such we explore whether there are links between general knowledge and actions, as well as specific carbon knowledge and carbon actions using environmental attitude as a mediating variable. However, as was previously mentioned, behavioural intentions may not necessarily result in actual environmental behaviour (Davies, Foxall and Pallister 2002). Based on the TRA, we propose:

H2a  Attitude towards the environment is positively related to general pro-environment behaviours.
H2b  Attitude towards the environment is positively related to carbon offset related behaviours.

Method

An online survey was administered to a random sample of Australian grocery shoppers, using a for-profit panel. The target sample was 1,000 respondents; 195 responses were received of which 356 were deemed usable. Given that Structural Equation Modelling (SEM) was the methodology chosen for this study, the sample was cross sectional in nature. SEM is a method used to estimate causal relationships using a combination of statistical data and qualitative causal assumptions (see Pearl 2000). The sample consisted of 54% of males with a good representation from all age groups (including 23% in the over 65-age group to 18% from 45 to 54 years old). Sixty three percent were married or in a committed relationship and 32% had children living at home. The education level varied with 40% having completed high school, 18% trade school, 14% diploma, 17% bachelor's degree, and 8% postgraduate degree. The majority were not working full time (44%); as such 24% were retired, 9% homemakers and 5% were students.

Eight items measuring factual environmental knowledge drew on Maloney, Ward and Braucht’s (1978) scale, which has been used by others researchers in the environmental area (see for example, Fraj-Andres and Martinez-Salinas 2007, Ivy, Lee and Chuan 1998). Eight additional items were developed to explore consumers' knowledge of carbon offsets, as these have not been explored previously in regards to environmental knowledge, attitudes or behaviours. The questions were crafted taking into account issues raised by Ramseur (2007) and the ACCC (2008).

Past researchers have extensively explored a range of environmental behaviours, which have in many cases examined behavioural intentions rather than actual/self-report behaviour (Schlegelmilch et al 1996, Stone, Barnes and Montgomery 1995). Given our focus was on self report behaviour, we sought to explore the degree to which consumers undertook activities in regards to general environmental issues (Fraj-Andres and Martinez-Salinas 2007, GfK Roper Consulting 2007). As such, matching items on specific activities related to general environmental behaviour and carbon offsets were used to enable us to directly compare activities. Of course with any self reported data there is the potential of social responsibility
bias. The three behavioural items asked how often people undertook the following activities (scale: 1=Never to 7=Always). These included: 1) I investigate the specific details of firms' environmental claims or behaviour (or the carbon offset programs offered by firms); 2) I switch brands to ones that are less environmentally harmful (or offer carbon offsets); and 3) I choose to pay more for products because they are less environmentally harmful (or they offer carbon offsets). Attitude to the environment was measured using a scale developed by Diamantopoulos et al (2003).

Data Analysis

The first step of the analysis was to examine the reliability and internal consistency of the scales. The reliability test endorses that the items conceived to gauge a construct are satisfactorily associated to be reliable (e.g., low on measurement error) regarded as a set of items (Cronbach 1951). To test reliability we used Cronbach's alpha coefficient, as well as the inter-item correlations and corrected item-to-total correlations. The mean of the inter-item correlation was used as a guide of items homogeneity in a unidimensional scale while the corrected item-to-total correlation was used to determine whether any particular items had low correlations with all the items in the scale whereby the item being evaluated was correlated with all other scale items. Corrected item-to-total correlation of less than 0.5 were deemed candidate for deletion (Churchill 1979). The Cronbach's alpha values for the constructs were 0.858 for General Behaviour (3 items), 0.934 for Carbon Related Behaviour (3 items), 0.939 for Environmental Attitude (17 items), all of which were acceptable (Cronbach 1951). Carbon knowledge and general knowledge were each summations of eight item true-false scales and thus no alpha was calculated. We then ran Confirmatory Factor Analysis to examine the measurement model and to assess discriminant validity of constructs. In doing so the unconstrained and constrained correlations between pairs of latents were observed. All pairs of nested models differed significantly (p=0.000) on a $\chi^2$ difference test, suggesting that discriminant validity was achieved (Bagozzi et al., 1991). To test the overall fit of the structural model and the significance of the hypotheses we used path analysis.

Hypotheses testing

The hypotheses were tested for the five aggregated variables using path analysis with AMOS 17.0 (Arbuckle 2008). The model converged to a proper solution with an acceptable fit conforming to the guidelines suggested by Hu and Bentler – $\chi^2(5) = 5.611$, P = 0.230, RMSEA = 0.0343 (90 percent confidence interval 0.000 – 0.092, PCLOSE= 0.597) CFI = 0.995, TLI = 0.989, SRMR = 0.0380. The endogenous structural residuals were correlated as the behavioural measures were deemed to theoretically overlap (see Palmer et al. 2002) and in so doing the model would gain greatly in efficiency (Zellner and Theil 1962). Table I reports the standardised parameter estimates.

<table>
<thead>
<tr>
<th>Path Coefficients</th>
<th>N = 356</th>
<th>Estimate</th>
<th>S.E.</th>
<th>t-value</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental Attitude ← General Knowledge</td>
<td>.162</td>
<td>.327</td>
<td>3.090</td>
<td>.002</td>
<td></td>
</tr>
<tr>
<td>Environmental Attitude ← Carbon Knowledge</td>
<td>-.044</td>
<td>.252</td>
<td>-.840</td>
<td>.401</td>
<td></td>
</tr>
<tr>
<td>General Behaviour ← Environmental Attitude</td>
<td>.482</td>
<td>.058</td>
<td>10.355</td>
<td>.000</td>
<td></td>
</tr>
<tr>
<td>Carbon Behaviour ← Environmental Attitude</td>
<td>.297</td>
<td>.075</td>
<td>5.865</td>
<td>.000</td>
<td></td>
</tr>
<tr>
<td>e36 ← e37</td>
<td>.677</td>
<td>.092</td>
<td>10.564</td>
<td>.000</td>
<td></td>
</tr>
</tbody>
</table>

The results of the path analysis suggest that having a general understanding of environmental
knowledge is positively related to one’s general attitude towards the environment. H1a is supported. However, having higher level of carbon offset knowledge is not positively related to one’s general attitudes towards the environment and H1b is not support. As such general environmental knowledge appears to be related to attitudes but specific knowledge about offsets is unrelated. The reason for this may be that consumers have not yet fully understood or integrated carbon offset knowledge into their thinking.

By examining how attitudes relate to behaviour, we found that attitude affects both general behaviour (i.e. H2a is accepted) and carbon related knowledge (i.e. H2b is accepted). This suggests that both general and specific behaviours are driven by consumers overall attitudes towards the environment. While not an explicit hypotheses in our study we also examined whether attitudes mediated the relationships between knowledge and behaviour and found no significant moderated effect.

Conclusions and Future Research

The aim of the paper was to examine the relationship between general environmental and carbon offset knowledge with their respective behaviours. The SEM model confirms the relationships between general environmental knowledge, attitudes and behaviour. However, only the link between attitudes and carbon related behaviour is confirmed by the model. This may suggest that alternative models of the relationship are more applicable, as consumer behaviour in regards to specific environmental issues seems to be less driven by consumers’ specific knowledge on these issues, but rather more affected by their general knowledge and attitudes. Given the newness associated with carbon related issues, it may be that this is a special case and that consumers have yet to develop their specific knowledge on this issue, which in turn would be a stronger driver of behaviour in the future.

Future research needs to be undertaken to see if alternative models shaping behaviour exits or whether these relationships exist between other more specific types of knowledge and behaviours. There is of course the opportunity to look at a range of mediating factors, as other research suggest that these may also influence the relationship between knowledge, attitudes and behaviour (Cialdini, Petty and Cacioppo 1981, Hines et al 1986). Within this study we looked at actual behaviour rather than behavioural intentions and thus explorations in regards to differences, such as those undertaken by Davies, Foxell and Pallister (2002), could be undertaken. The fact that we looked at purported behaviour rather than an objective measure of behaviour, especially as there may be some socially responsibility bias when exploring issues about the environment, is also a potential issue that needs to be explored in future research. There are also opportunities to examine whether there are national differences in regards to these relationships, which could be based on the salience of environmental issues to different countries or how different cultures view the natural environment.
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