Received 13 March 2017
Revised 22 June 2017
Accepted 24 June 2017

Predicting consumer pro-environmental behavioral intention

The moderating role of religiosity

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Abstract

Purpose – The purpose of this paper is to study the role of religiosity in consumer pro-environmental behavioral intention (CPEBI). Consumer pro-environmental value, knowledge, concern and attitude predict CPEBI; however, previous findings are neither consistent about their predictabilities nor clear about the order of importance of these predictors. Further, while religiosity has the potential to affect values, beliefs, attitudes and behaviors, its role in CPEBI research has been neglected.

Design/methodology/approach – Data are collected from a sample of 306 respondents from Oman, an Islamic country with mostly Muslim consumers, and analyzed using a neural network model.

Findings – This study finds that the most important predictors of CPEBI, in order of importance, are attitude, concern, knowledge, religiosity and value. Further, results indicate that religiosity moderates the impacts of, in order of importance, attitude, value, concern and knowledge on CPEBI.

Research limitations/implications – Both businesses and policy makers can prioritize intervention strategies according to the importance of the predictors and can leverage faith-based messages and programs for promoting CPEBI toward creating a better environment for all.

Originality/value – Determining the predictabilities of psychological factors and their interactions with religiosity to predict CPEBI in Islamic countries is necessary for promoting environmentally friendly products in Islamic countries and for reducing the ecological damage to the environment.

Keywords Religiosity, Environmental concern, Oman, Environmental knowledge, Environmental behavioural intention, Environmental value

Paper type Research paper

Introduction

Consumer pro-environmental behavioral intention (CPEBI), a consumer's perceived likelihood of engaging in consumption behaviors that are friendly to the environment, continues to draw research attention because of its importance in reducing the deterioration of the natural environment and creating a sustainable future for all living beings as well as ecosystems (Han, 2015; Swaim *et al.*, 2014; Chan *et al.*, 2008; Newton *et al.*, 2015; Rice, 2006). Businesses also have stakes at CPEBI because of its importance in creating higher demands for environmentally safe products, increasing employee commitment and enhancing customer satisfaction (Menguc and Ozanne, 2005; Swaim *et al.*, 2014). According to theories of reasoned action and planned behavior, intention incorporates all the motivational determinants of a behavior and is the most immediate and important predictor of the behavior (Ajzen, 1991). Prior research has examined the effects of numerous causal factors on

Review of International Business and Strategy
Vol. 27 No. 3, 2017
pp. 352-368

2059-6014
DOI 10.1108/RIBS-03-2017-0022

CPEBI. For example, Joshi and Rahman (2015) identified 77 studies that have attempted to explain CPEBI by 35 different determinants that can be grouped into two categories, namely, internal or intra-personal factors and external or contextual factors (Ertz *et al.*, 2016; Miao and Wei, 2013). The oft-repeated causal factors of CPEBI include consumers' underlying pro-environmental values, knowledge, concerns and attitudes (Han, 2015; Mostafa, 2007). While these studies have advanced our understanding of the driving forces of CPEBI, a number of observations can readily be made.

First, scholars argue that religiosity, a specific cultural value, plays a significant role in shaping a variety of values, concerns, attitudes and behaviors in societies with strong religious orientations (Schneider *et al.*, 2011; Soyez, 2012), yet studies examining religiosity's role in models of CPEBI are scarce (Joshi and Rahman, 2015; Vitell *et al.*, 2006). A few studies have attempted to examine the effect of religiosity on consumer environmental behavior. Felix and Braunsberger (2016), for example, report that religiosity influences environmental behavior and moderates the attitude-behavior linkage among Catholic consumers in Mexico. Further, Rice (2006) finds that religiosity is a predictor of environmental behavior of Muslim consumers in Egypt. Several other studies demonstrate the impact of consumers' religiosity on their intra-psychological dispositions and physical behaviors (Essoo and Dibb, 2004; Schneider *et al.*, 2011; Weaver and Agle, 2002). A contrary view has also been expressed that by attributing environmental conditions to God's will for the planet and humans, religiosity will lead to consumers' inactions regarding environmental behaviors (Kalamas *et al.*, 2014). Overall, scholars contend that religiosity plays a role in business, consumer and ecological ethics, and thus, a better understanding of the relationship between religiosity and consumer environmental behavioral intention could benefit all major stakeholders such as, businesses, policy makers and consumers (Culliton, 1949; Vitell, 2009). Based on the calls in the literature, this study examines the moderating role of religiosity on the influences of environmental value, knowledge, concern and attitude on CPEBI in Oman, a Gulf Cooperation Council (GCC) state with a predominantly Islamic orientation (Ismail, 2015). Second, current research linking religiosity with environmental psychological dispositions and behaviors has mostly been undertaken in contexts with Catholic (Felix and Braunsberger, 2016) and Judeo-Christian orientations (Kalamas *et al.*, 2014; Schneider *et al.*, 2011). Very little research has been undertaken in Muslim countries such as in Egypt (Rice, 2006) and Turkey (Schneider *et al.*, 2011). Unfortunately, there is no study on religiosity and environmentalism in the GCC region, as per our search, which is not only Islamic in its orientation but also very religious compared to all other Muslim countries around the world (Bhuian *et al.*, 2014). The religion of Islam permeates all aspects of lives both in the public and private spheres in all six GCC states including Oman. This study will not only be helpful for businesses in effectively marketing environmentally friendly products in the GCC region and other Muslim countries but also for policy makers to formulate effective intervention strategies in effectuating behavioral changes in consumers. Finally, a considerable number of studies have examined the impacts of environmental value, knowledge, concern and attitude on CPEBI in different contexts primarily based on explanatory statistical techniques (Han, 2015; Joshi and Rahman, 2015; Newton *et al.*, 2015). The predictabilities of these antecedents are not only inconsistent but also the order of importance of these predictors is not well established. For instance, environmental value, knowledge and concern have been found to be both related and unrelated to CPEBI (Joshi and Rahman, 2015; Nittala, 2014; Ramayah *et al.*, 2010). Even though the neural network approach is useful in better understanding the predictabilities and the order of importance of these predictors, no study has yet integrated and examined these predictors using a predictive analytical model. The neural network captures non-linear relationships among decision variables and is not bounded by the linear compensatory

assumption (Chong *et al.*, 2015; Sharma *et al.*, 2016, 2017). In this study, we use the neural network approach to establish the predictabilities of environmental value, knowledge, concern and attitude, their interactions with religiosity and their orders of importance in predicting CPEBI in a noble context. The findings will be useful for businesses and policy makers in prioritizing environmental intervention strategies for influencing CPEBI more effectively and efficiently. Next, we offer the literature review, methodology and discussion.

Theoretical background

Along with economic and social sustainability, environmental sustainability is an important dimension of sustainable development (United Nations, 1987). To a great extent, environmental sustainability rests on consumption, business and marketing activities. Accordingly, environmental marketing literature seeks to understand the driving forces of consumer pro-environmental intentions and behaviors, such as purchase of environmentally friendly products, conservation, recycling and so on to formulate and implement effective environmental market strategies for marketing products that are considered environmentally more sustainable, such as hybrid cars, energy-efficient devices, organic products, eco-friendly appliances, etc. Reviewing 24 major empirical studies covering two and half decades until 1999, Tilikidou and Zotos (1999) identify four categories of drivers of consumer pro-environmental intentions and behaviors, namely, demographics, environmental knowledge, environmental attitudes and environmental values/traits. While demographics have appeared to be mostly insignificant predictors, knowledge, attitudes and values/traits have produced mixed results. In a subsequent review article covering the period from 2000 to 2014, Joshi and Rahman (2015) identify 35 predictors of CPEBI and 57 determinants of consumer pro-environmental behavior. These predictors have been classified into individual factors (such as values, knowledge, concern, attitude, intention and behavior) and situational factors (such as regulations, product availability and culture). A vast majority of these articles suggest that consumer intra-personal or psychographic variables are better predictors of environmental intentions and behaviors because psychographics not only represent deeper and internal information but are also helpful to understand consumer motivations behind environmental behaviors (Joshi and Rahman, 2015). However, the critical questions are which specific psychographics are important and how these psychographics influence consumer environmental intentions and behaviors. The findings so far are not conclusive about the preceding questions. Consequently, a stream of research is exploring the interaction effects of various contextual/situational factors with psychographics as better predictors of consumer environmental intentions and behaviors (Ertz *et al.*, 2016; Grimmer *et al.*, 2016).

Religiosity

Although sociology and psychology literature have long acknowledged religiosity as a significant contextual/situation factor, its role in consumer behavior research has not been adequately explored (Joshi and Rahman, 2015). Scholars posit that as the most universal and influential element of the culture, religion provides a value system that not only provides a social identity to groups and nations but also has considerable influence on people's intra-personal traits such as values, knowledge, concern, attitudes and behaviors (Rice, 2006). Linking Schwartz's (1992) value model and religiosity, research shows that by favoring the value of conservation, religiosity meaningfully relates to prosocial, environmental and consumer behaviors (Saroglou *et al.*, 2004). Further, drawing from Lewin's (1939) theory and attitude-behavior-context thesis (Stern, 2000), scholars claim that the interactions between intra-personal factors and contextual factors are more effective in predicting environmental behaviors. Thus, as a key contextual factor, religiosity is likely to

interact with intra-psychic factors in producing CPEBI and behaviors, particularly in societies that are more religious in nature. It is only recently that a few empirical studies linking religiosity and environmental issues have been undertaken (Felix and Braunsberger, 2016; Rice, 2006). This is unfortunate because most consumers identify with any one of the several major world religions and individuals' religions have considerable influence on their psychographics and behaviors (Rice, 2006). Kalamas *et al.* (2014) contend that two common traits of world's major religions are linked with environmentalism: subordination of self-interest for the sake of benefiting others and de-emphasizing materialism. These authors also posit that religiosity can also produce a fatalistic perspective about environmentalism by considering the environmental condition as God's will for the planet and humanity. Notwithstanding, scholars suggest that it is important to examine the role of religiosity in models explaining pro-environmental behavioral intention and behaviors. In the following, we discuss the study variables (environmental value, knowledge, concern, attitude, intention and religiosity) and their interrelationships.

Environmental value, consumer pro-environmental behavioral intention and religiosity

Environmental value represents altruism, biospheric, universalism and benevolence values. Altruism focuses on helping others, biospheric value emphasizes the welfare of the biosphere, universalism concerns with the welfare of all people and nature and benevolence focuses on the welfare of one's own in-group (Rice, 2006). CPEBI is the willingness of consumers to purchase products that are considered friendly or less harmful to the environment (Joshi and Rahman, 2015). The link between environmental value and CPEBI can be expected based on several moral motivation theories such as norm-activation theory (Schwartz, 1977), which purports that as personally held moral norms, environmental value can give rise to the feelings of a moral obligation to intent to behave in a pro-environmental manner. However, the preceding link is not clearly established because scholars have found environmental value to be influencing CPEBI both directly (Zhu *et al.*, 2013) and indirectly (Han, 2015). We argue that by augmenting the dimensions of the environmental value, religiosity can moderate the impact of environmental value on CPEBI. Religiosity's trait of subordinating one's self-interest for the betterment of others is likely to amplify the altruism, universalism and benevolence dimensions of the environmental value, while religiosity's trait of de-emphasizing materialism can enhance the biospheric value dimension of the environmental value. Thus, we contend that environmental value, religiosity and the interactions between environmental value and religiosity are all predictors of CPEBI. Thus,

H1. Environmental value, religiosity and environmental value*religiosity are predictors of CPEBI.

Environmental knowledge, consumer pro-environmental behavioral intention and religiosity

Environmental knowledge is general understanding of the facts, concepts and relationships about the natural environment including the major ecosystems (Fryxell and Lo, 2003). It is one of the most-studied predictors of CPEBI (Gleim *et al.*, 2013; Joshi and Rahman, 2015; Kanchanapibul *et al.*, 2014). A number of theories of moral motivation, such as norm-activation (Schwartz, 1977), value-belief-norms (Stern *et al.*, 1999) and planned behavior (Ajzen, 1991), have been used in support of the relationship between environmental knowledge and CPEBI. The argument is that by helping the process by which individuals develop personal norms involving the feeling of the moral obligation to intent to act pro-socially and pro-biospherically, environmental knowledge can directly influence CPEBI. However, empirical findings are mixed. A number of studies have found that environmental knowledge positively influences CPEBI (Gleim *et al.*, 2013; Kanchanapibul *et al.*, 2014), while some other studies have found no relationship (Chan and Lau,

2000; Eze and Ndubisi, 2013). These inconsistent findings have led scholars to suggest that further research is needed to concretely establish the environmental knowledge–CPEBI linkage. In this study, we contend that religiosity moderates the influence of environmental knowledge on CPEBI. Scholars argue that knowledge is intertwined with the rationality of the action that stems from expected utility and subjective credence (Hawthorne and Stanley, 2008). This subjective credence plays a crucial role in generating the intent to act and actions. Religiosity has the potential to provide the necessary subjective credence about the importance of the pro-environmental behavioral intent and/or behaviors and can augment the rationality of the action that arises from the environmental knowledge. Scholars claim that the subjective beliefs of most major religions about the environment are generally pro-environmental, such as man is entrusted with the stewardship of the earth, preservation and protection of all creations, respect for all species and to use only what is necessary (Felix and Braunsberger, 2016; Schultz *et al.*, 2000). Hence, we will use environmental knowledge and the interaction of environmental knowledge and religiosity as predictors of PECB. Therefore:

H2. Environmental knowledge and environmental knowledge*religiosity are predictors of consumer pro-environmental behavioral intention.

Environmental concern, consumer pro-environmental behavioral intention and religiosity

Fransson and Garling (1999) define environmental concern as the evaluation of or attitude towards the consequences on the environment of one's and/or others' behaviors. Literature has linked four value orientations to the environmental concern (Stern, 1992). One value orientation refers to a new environmental paradigm (NEP) (Dunlap and Van Liere, 1978), which stresses on having a concern about the ecosystem for its own sake. The second value represents a concern for the environmental quality because of the well-being of people, which is known as the anthropocentric altruism. The third value orientation of environmental concern relates to self-interest, that is, concerned about personal threats due to the environmental degradation. The fourth value orientation stems from some deeper cause such as religious beliefs or post-materialistic values. Empirical studies linking environmental concern to CPEBI have produced mixed results (Joshi and Rahman, 2015). For instance, Bang *et al.* (2000) have found a positive association, while Nittala (2014) reports environmental concern to be not related to CPEBI. Elsewhere, Bamberg (2003) argues that the behavioral predictive power of environmental concern is low. We argue that religiosity can moderate the environmental concern – CPEBI linkage based on the multiple motive thesis, which purports that a specific behavioral intent or behavior is a result of multiple motives, namely, normative, hedonic and gain motives (Lindenberg and Steg, 2007; White and Simpson, 2013). Normative motive refers to the motivation to act as per the expectation of the culture and the society. Thus, environmental concern's value orientations of the new environmental paradigm and anthropocentric altruism closely relate to the normative motive. Further, the hedonic motive (seeking personal comfort and better feeling right now) and gain motive (seeing an improvement of one's own resources) closely relate to the self-interest value orientation of the environmental concern (White and Peloza, 2009). Gardner and Stern (1996) note that people are gradually shifting from self-interest and anthropocentric altruism values to the ecological value. The pro-environmental beliefs, inherent in religiosity (Rice, 2006), can augment the normative motive (representing the ecological value) and make the latter a dominant driver of CPEBI. Therefore, environmental concern and an interaction between environmental concern and religiosity will be predictors of CPEBI. Hence:

H3. Environmental concern and environmental concern*religiosity are predictors of CPEBI.

Environmental attitudes, consumer pro-environmental behavioral intention and religiosity

Environmental attitude is the psychological tendency of evaluating the natural environment favorably or unfavorably (Joshi and Rahman, 2015). A considerable number of studies have examined the potential impact of environmental attitude on CPEBI based on several moral motivation theories such as the norm-activation theory and the theory of planned behavior (Ertz *et al.*, 2016). While Tilikidou and Zotos's (1999) review article produces an equivocal finding regarding the environmental attitude – CPEBI linkage, Joshi and Rahman's (2015) review paper reports an overall positive relationship between the environmental attitude and CPEBI (Arvola, 2008). Overall, there is a call to further investigate the attitude – behavioral intent/behavior gap in studies of environmentalism. In this study, we explore the potential moderating role of religiosity on the predictability of environmental attitude in predicting CPEBI. Previously, Felix and Braunsberger (2016) have found religiosity to be moderating the environmental attitude – behavior linkage. Both the consistency and attitude-behavior-context (Lewin, 1939) theories can be used to theorize the moderating effect of religiosity on the environmental attitude – CPEBI relationship. Religiosity's focuses on the subordination of self-interest for the betterment of others, de-emphasizing of materialism and stewardship of the earth are protection and respect for all species and are all by and large consistent with the favorable environmental attitude and thus are likely to amplify the impact of the environmental attitude on CPEBI based on the consistency theory. Also, by representing an important contextual factor, religiosity is likely to interact with the attitude in producing the behavioral intent or behavior from the point of view of the attitude-behavior-context theory. Hence, in this study, the environmental attitude and an interaction between the environmental attitude and religiosity predicts CPEBI. Figure 1 shows the conceptual research model of this study. Consequently:

H4. Environmental attitudes and environmental attitudes * religiosity are predictors of CPEBI.

Methodology

Data collection and measures

The survey was undertaken in the city of Muscat, the capital of Oman, a GCC state. Culturally (in terms of the language, Arabic, and the religion, Islam) and economically (primarily driven by oil and gas), GCC states are by and large homogeneous. The combined population of GCC states is over 51 million with an average per capita GDP of US$33,005. The population of Muscat is 838,000, which is 25 per cent of the total population of the country. The pre-dominant religion is Islam: 86 per cent Muslims, 7 per cent Christians, 6 per cent Hindus and 1 per cent other religions. Although Oman is a developing country, it enjoys an impressive per capita GDP, which is in the range of that of developed countries. The influences of Western consumption habits are very widespread as are evident from the presence of a large number of Western retailers, restaurants and other businesses and the wide-scale use of disposable gadgets and cars for transportations (Carrete *et al.*, 2012). Oman is faced with its share of environmental challenges such as the scarcity/pollution of water, air pollution, desertification, irresponsible waste disposals and a very little share of environmentally safe products.

A group of 55 fourth-year BBA students from Sultan Qaboos University, the premiere university in the country, collected the data. Each student distributed six questionnaires among respondents representing the university community, households and business establishments in Muscat and later on picked them up. This drop-off and pick-up method of data collection is common in the GCC region because of difficulties in getting random samples and contacting respondents (Rice, 2006). The survey was distributed to 330 respondents who completed and returned 290 usable questionnaires. Out of the 290

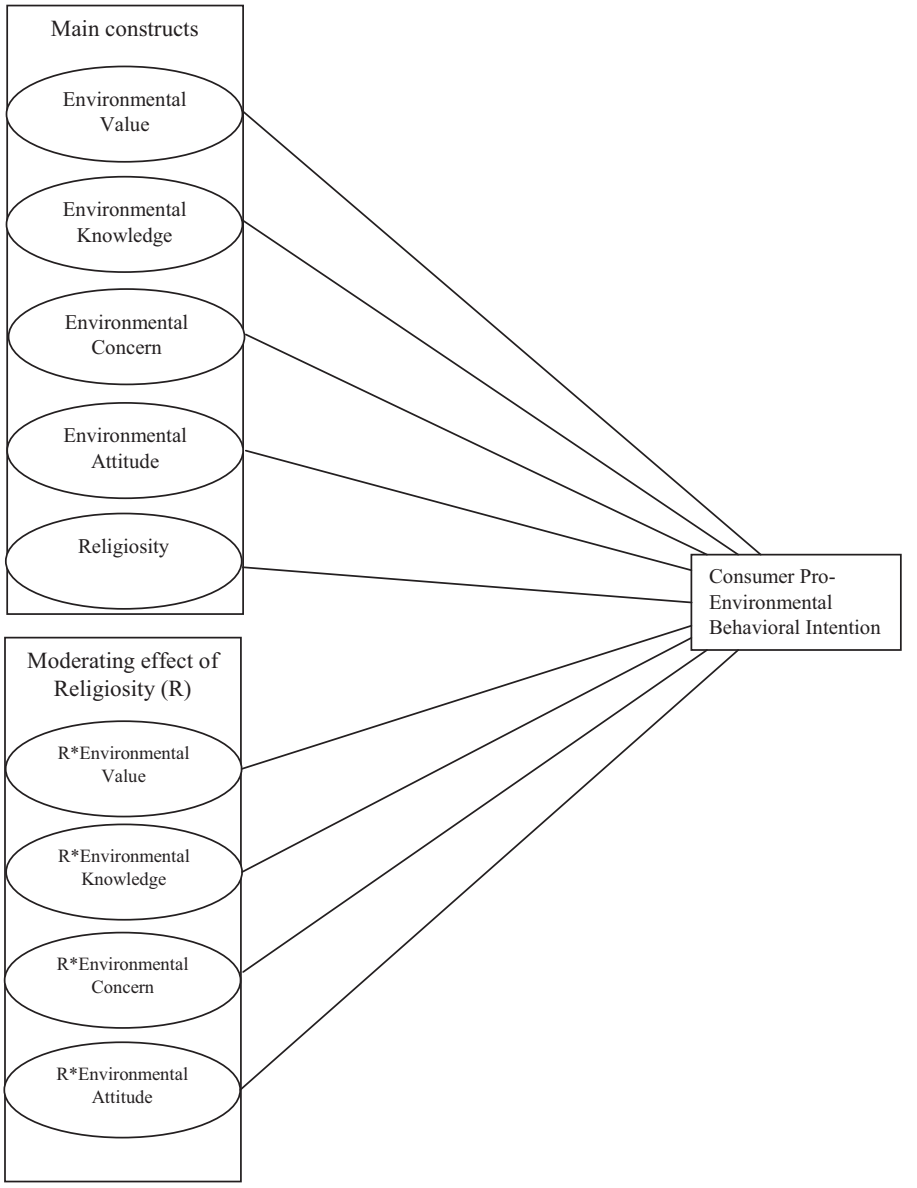


Figure 1.
Conceptual research model

respondents, 158 were males and 132 were females. The majority, 76.6 per cent, was in the age group of 25 to 35 years and had a graduate level of education, 73.5 per cent. In terms of income, the majority, 55.5 per cent, had a monthly income of about US$2,600. Also, the vast majority, 75.9 per cent, were Omanis. The respondent profiles indicated that they were likely to have the information asked for in the survey. The respondent profiles are given in Table I.

Demographic variables	Category	Frequency	(%)
Gender	Female	132	45.5
	Male	158	54.5
Age	Below 25 years	19	6.6
	Between 25 and 35 years	222	76.6
	Above 35 years	549	16.8
Education	Diploma	32	11
	Graduate	212	73.5
	Post Graduate	45	15.5
Income	Below 1,000 OMR	161	55.5
	Between 1,000 and 1,500 OMR	83	28.6
	Between 1,500 and 2,000 OMR	31	10.7
	Above 2,000 OMR	15	5.2
Nationality	Omani	220	75.9
	Non-Omani	70	24.1

Table I. Demographic statistics ($N = 290$)

The six constructs were measured by 31 items on a seven-point Likert format (1: strongly disagree and 7: strongly agree). The demographics of gender, age, education, income and nationality were assessed by single item scales. The constructs of environmental value (five items), knowledge (five items), concern (five items), attitude (three items) and intention (three items) were adapted from Mostafa (2007), while the religiosity (ten items) construct was adopted from Koenig and Bussing (2010). All these scales have been used in several past studies (Bhuian *et al.*, 2014; Do Paco and Raposo, 2009, and Pietrzak and Cook, 2013). Sample scale items are as follows: "humans are only part of nature"; "I know that I buy products and packages that are environmentally safe"; "we are approaching the limit of the number of people the earth can support"; "I like the idea of purchasing green"; "over the next month, I will consider buying products because they are less polluting"; and "my faith involves all of my life".

Reliability, validity and method of analysis

Data were analyzed using Statistical Package for Social Sciences (SPSS). A confirmatory factor analysis (CFA) was performed to assess the scale properties (Tarhini *et al.*, 2016). Composite reliability (CR) and average variance extracted (AVE) were computed to assess the reliabilities and validities of the constructs. The CR values of all constructs were greater than 0.843, i.e. they all exceeded the recommended threshold of 0.70 (Hair, 2010), indicating that the scales were reliable. The convergent validity was examined using AVE and CR. The CR values (ranged from 0.844 to 0.905) were greater than the AVE values (ranged from 0.520 to 0.626), which ensured the convergent validities of all constructs. In addition, discriminant validity (DV) was also examined to understand the extent to which constructs were distinct and uncorrelated. The DV values suggested that constructs should relate more strongly to their own factor than to another factor. The values of maximum shared variance (MSV) and average shared variance (ASV) were lower than the AVE values and the square root of AVEs were greater than inter-construct correlations. The values of CR, AVE, MSV and ASV are reported in Table II. The results of the CFA were indicative of a good fit: $\chi^2/df = 3.64$, NFI = 0.908, GFI = 0.919, IFI = 0.952, AGFI = 0.916, CFI = 0.939, TLI = 0.941 and RMSEA = 0.037.

The conceptual research model consisted of nine predictors (environmental value, knowledge, concern, attitude, religiosity, value * religiosity, knowledge * religiosity, concern * religiosity and attitude * religiosity) and CPEBI was analyzed using an artificial neural network, which will be discussed next.

Analysis and results

Neural network modeling

An artificial neural network (ANN) model is a flexible data-driven model, which is being used for prediction purposes in recent information system studies (Chong *et al.*, 2013, 2015; Sharma *et al.*, 2015, 2017). ANN is based on a biological model similar to the human brain, where neurons are interconnected for learning from the behavior of the data. Haykin (2001) has defined a neural network as a massively parallel distributed processor that is made up of simple processing units and has a natural propensity to store the experimental knowledge and to make them available for use. The acquired learning is stored by synaptic weights for predictive modeling (Haykin, 2001).

The main purpose of using ANN in this study was its superior predictive performance in comparison with other statistical models, namely, the multiple linear regression (MLR) and structural equation modeling (SEM). The shortcomings of multivariate statistical models are their multivariate assumptions, namely, linearity, normality, homoscedasticity and multi-collinearity, which need to be satisfied. ANN models are robust against all these multivariate assumptions. ANN models are considered more powerful than MLR and SEM that are frequently used in business research (Hew and Syed Abdul Karim, 2016; Sharma *et al.*, 2016). Furthermore, statistical models such as MLR and SEM detect linear relationships among independent and dependent variables, whereas neural network models are capable of detecting linear as well as non-linear complex relationships among decision variables. In this study, the back propagation neural network model was developed using the statistical software SPSS 21.0. There are three layers in the back propagation neural network model, namely, input layers, hidden layers and an output layer. Data and synaptic weights are assigned to input layers that are processed and passed on to hidden layers. The following nonlinear activation function, which is a *hyperbolic tangent function*, assigns value to the output layer.

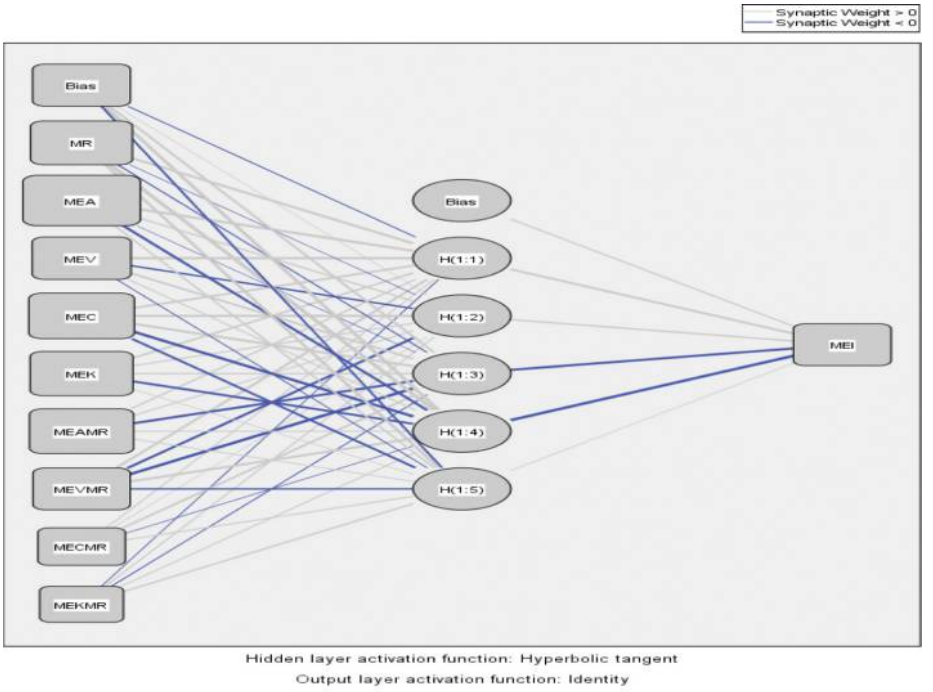
$$y_k = \varphi\left(\sum w_{kn} v_k\right) = \varphi(v)$$

where w_{kn} is the synaptic weight between output of neuron k and input of neuron n. (Sharma *et al.*, 2015). In this research, the predictors assigned to the input layer of the neural network model were environmental attitude, environmental knowledge, environmental value, religiosity, environmental concern, environmental value*religiosity, environmental concern*religiosity, environmental knowledge * religiosity and environmental attitude * religiosity. The output layer of the neural network model was CPEBI (Figure 2).

Constructs	CR	AVE	MSV	ASV	R	ENV	ENC	ENK	EEA
R	0.905	0.590	0.249	0.127	0.700				
ENV	0.844	0.520	0.229	0.125	0.499	0.721			
ENC	0.864	0.560	0.124	0.111	0.167	0.110	0.748		
ENK	0.846	0.525	0.346	0.109	0.173	0.187	0.156	0.724	
EEA	0.832	0.626	0.342	0.194	0.474	0.450	0.161	0.588	0.791

Table II.
Validity and convergent of constructs

Notes: CR: composite reliability; AVE: average variance extracted; MSV: maximum shared variance; ASV: average shared variance; R: religiosity; ENV: environmental values; ENC: environmental concerns, ENA: environmental attitude; ENK: environmental knowledge



Notes: MEI: Mean of consumer pro-environmental behavioral intention; MR: Mean of religiosity; MEA: Mean of environmental attitude; MEV: Mean of environmental value; MEC: Mean of environmental concern; MEK: Mean of environmental knowledge; MEAMR: Mean of environmental attitude × mean of religiosity; MEVMR: Mean of environmental value × mean of religiosity; MECMR: Mean of environmental concern × mean of religiosity; MEKMR: Mean of environmental knowledge × mean of religiosity; H(1:1), H(1:2), H(1:3), H(1:4) and H(1:5) are hidden nodes; Bias: Error

Figure 2.
Neural network model

Validation of neural networks

The multilayer perceptron training algorithm was used to train and validate the neural network (Chong *et al.*, 2015). Cross validations of the neural network model were performed to avoid over-fitting of the model. There is no algorithm available in the literature to determine the number of hidden nodes in the neural network model (Sexton *et al.*, 2002). Therefore, Wang and Elhag (2007) and Sexton *et al.* (2002) proposed to examine a range of 1-10 hidden nodes. Our neural network includes 9 predictors and 1 output variable, which should be complex enough to map the data set with no added errors to the neural network model.

Root mean squared error (RMSE) is a commonly used accuracy measure of statistical models. A 10-fold cross validation process was employed wherein 90 per cent of the data (i.e. 261) was used to train the neural network model, while the rest 10 per cent (i.e. 29) data was used to measure the accuracy of the neural network model. The RMSE of 10-fold validations are summarized in Table III. The average RMSE for the training model was 0.4346 and for the testing model was 0.5034. These results obtained from the neural network were benchmarked with multiple regression analysis. The RMSE of the multiple linear regression

Network	Testing	Training
1	0.527	0.484
2	0.494	0.423
3	0.503	0.435
4	0.506	0.429
5	0.489	0.418
6	0.487	0.422
7	0.523	0.447
8	0.483	0.412
9	0.514	0.439
10	0.508	0.437
Mean	0.5034	0.4346
SD	0.015138	0.020359

Table III.
NN model results validations

model was 0.779. Therefore, we can conclude that the performance of our neural network model was better than the regression model.

Figure 3 shows the predicted-by-observed chart that depicts the scatter plot between observed values and predicted values of intentions of users. This plot justifies the use of neural network model to predict CPEBI because the values are approximately plotted along the 45° line from the origin.

Sensitivity analysis

The sensitivity analysis was performed by calculating the average of the importance of predictors to predict CPEBI using ten networks (Chong *et al.*, 2015; Sharma *et al.*, 2016). Table IV

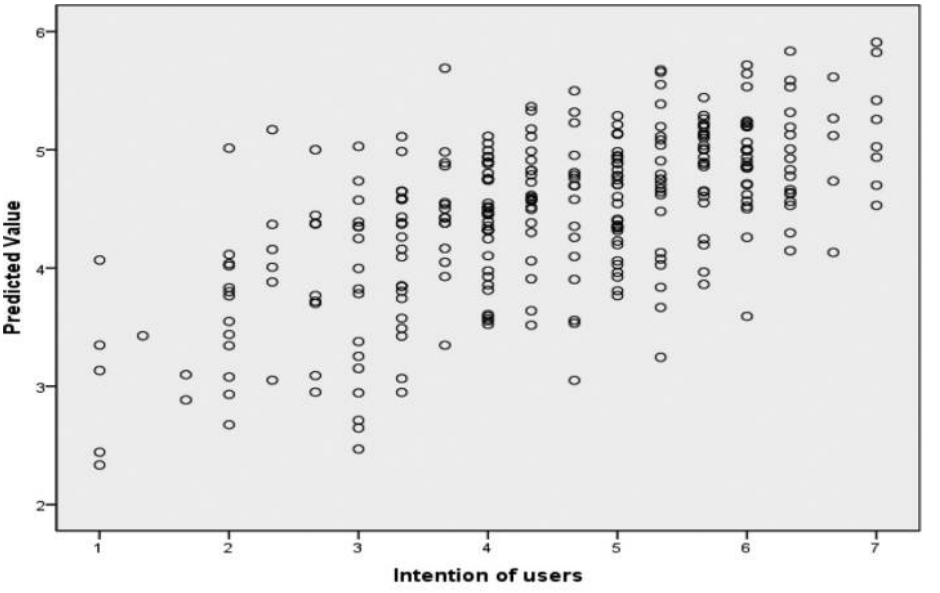


Figure 3.
Predicted-by-observed chart

Note: Intention of users: consumer pro-environmental behavioral intention (CPEBI)

Constructs	Importance	Normalized importance (%)
Environmental attitude	0.202	100.0
Environmental concerns	0.140	69.7
Environmental attitude × Religiosity	0.133	65.9
Environmental knowledge	0.127	63.2
Religiosity	0.121	60.1
Environmental values	0.105	52.1
Environmental values × Religiosity	0.098	48.5
Environmental concerns × Religiosity	0.047	23.1
Environmental knowledge × Religiosity	0.027	13.6

Table IV.
Predictor importance

shows that all nine predictors are important for the ten networks. The results revealed that the most important predictors of CPEBI, in order of importance, are environmental attitude, environmental concern, environmental attitude*religiosity, environmental knowledge, religiosity, environmental value, environmental value * religiosity, environmental concern * religiosity and environmental knowledge * religiosity. The results clearly indicated that all the hypotheses (*H1*, *H2*, *H3* and *H4*) were supported.

Discussion and conclusion

This study explores the roles of four intra-psychic factors, religiosity and the interactions between intra-psychic factors and religiosity in predicting CPEBI in an Islamic country using a predictive analytical approach. Our study contributes to our understanding of the relationship of religiosity with consumer environmental psychographics and environmental behavioral intention, a specific set of psychographics that might better explain CPEBI and the order of importance of specific psychographics in predicting CPEBI. The most important predictor of CPEBI appears to be the environmental attitude, which is consistent with Joshi and Rahman's (2015) finding based on a review of 53 articles covering a period from 2000 to 2014. However, the uniqueness of our finding is that we establish environmental attitude as the most important predictor of CPEBI using a neural network, whereas previous research, mostly based on explanatory statistical techniques, could not determine environmental attitude's order of importance as a predictor. The second-most important predictor of CPEBI is environmental concern. This finding challenges the results of previous studies that have reported a low behavioral predictive power of environmental concern (Bamberg, 2003), which might be because of the use of traditional statistical techniques. The interaction between environmental attitude and religiosity emerges as the third-most important predictor of CPEBI. This finding is somewhat consistent with Felix and Braunsberger's (2016) finding that religiosity moderates the environmental attitude–behavior linkage among Catholic respondents. The generalization of the moderating role of religiosity has not only been extended to a Muslim context but also the level of importance of the preceding interactive term as a predictor of CPEBI has been specified, which was not clear in previous studies. Our findings also indicate that the fourth-most important predictor of CPEBI is environmental knowledge, which challenges the discrepant findings that have been reported in past studies based on linear statistical approaches (Chan and Lau, 2000; Joshi and Rahman, 2015). The fifth-most important predictor of CPEBI is religiosity. This finding not only echoes the results of Rice (2006) and Felix and Braunsberger (2016) but also establishes religiosity as an important predictor to be considered in future models of consumer environmental behavioral intent or behaviors. Environmental value emerges as the sixth-most important predictor of CPEBI. This finding also challenges the indecisive findings related to the linkage between environmental value and CPEBI in previous studies (Joshi and Rahman, 2015).

Because our predictive approach takes into account of non-linear effects and is free from restrictive assumptions, the predictability of environmental value is more clearly specified compared to the previous results that stemmed primarily from traditional statistical techniques. Value*religiosity, concern*religiosity and knowledge*religiosity have emerged as the seventh-, eighth- and ninth-most important predictors of CPEBI, respectively. As per our search, this is the first study that examines the moderating role of religiosity on the effects of environmental value, concern and knowledge on CPEBI. These findings provide support for the view that religiosity needs to be considered as an important contextual factor in studies of environmental psychographics and behavioral intent or behavior.

Theoretical implications

Our study offers a number of theoretical implications. First, this study establishes a specific set of consumer environmental psychographics (attitude, concern, knowledge and value) as clear predictors of CPEBI and shows the order of importance of these predictors, which adds to the extant literature and provides guidelines for improving the predictive power of consumer environmental behavioral models. Second, this study ascertains the moderating role of religiosity in the effects of environmental psychographics on environmental behavioral intent or behavior, which gives religiosity the legitimacy that is required for its inclusion in models of environmental behaviors as an important contextual/situational factor. Third, this study extends the generalizability of environmental behavioral intent or behavior models from predominantly Catholic- and Judeo-Christian-oriented contexts to an Islamic context in the Middle East, a region where religion plays a significant role in all aspects of people's lives. Finally, this is the first study that applies a predictive analytic approach, i.e. neural network, to examine the predictabilities of psychographics, religiosity and their interactions in predicting CPEBI and thus paves the way for the use of predictive analytic approaches instead of or in addition to the use of traditional statistical techniques.

Practical implications

This study also offers several practical implications for managers. First, managers should realize that information on specific consumer environmental psychographics (such as attitude, concern, knowledge and value) and religiosity are important for developing marketing strategies aimed at enhancing consumers' willingness to act in a pro-environmental manner, e.g. intent to patronize environmentally friendly goods and services. Second, as the orders of importance of the predictors are attitude, concern, knowledge, religiosity and value, managers should target intervention strategies in this order of importance. In other words, the highest priority should be given to strategies that are meant to entice pro-environmental attitude among consumers, the second highest priority should be assigned to programs that can enhance consumers' environmental concern, the third highest priority should be attributed to interventions that can enhance consumers' environmental knowledge and so on. Third, our study shows that religiosity is an important moderator that can enhance the impacts of environmental psychographics on CPEBI. Thus, managers should leverage ecological values inherent in religions in promoting environmental messages and environmentally friendly products. Finally, other stakeholders such as government agencies and non-governmental groups can also take lessons from the findings of this study. They can target specific consumer psychographics, prioritize their intervention strategies and use faith-based messages to enhance consumers' willingness to behave in a pro-environmental manner.

Limitations, future studies and concluding remarks

Our results are subject to several limitations. First, Oman is one of the 60 Islamic countries in the world. Even though Islamic codes of conduct are strictly adhered to in Oman, future studies should be conducted in other Muslim countries located in different geographical areas to enhance the generalizability of the findings. Second, our study context is Islamic and respondents are Muslims. Thus, how our conceptual research model will fare in other religious contexts is not known. This study needs to be replicated in the contexts of other major world religions such as Catholicism, Judeo-Christianity, Hinduism and Buddhism. Third, our sample size is small and sample technique is non-random, which weaken the generalization of our findings. Future efforts should use larger samples and random sample techniques for data collection. Fourth, this is the first study that has used neural network to predict CPEBI with environmental psychographics, religiosity and their interactions. To ensure the robustness of the findings, other statistical techniques may be used and results of different statistical procedures can be compared and cross-validated. Fifth, no control variables, such as demographics, were used in the study, which should be used in future studies. Finally, our sample consists of mostly young subjects that can limit the generalization of the study. Thus, we suggest that future research uses a more balanced sample.

In conclusion, both specific psychographics and religiosity can be leveraged by managers and other environmental stakeholders to enhance consumers' pro-environmental behavioral intent towards ensuring a sustainable future for the environment and the humanity. We hope our research will stimulate new research on religiosity's role in consumer environmental behavioral models using predictive analytical approaches.

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