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Artificial neural networks: a tool for understanding green consumer behavior

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Abstract

Purpose – The purpose of this paper is to study the usefulness of neural network to explain the gap between behavior intention and actual behavior in the consumption of green products. The paper draws the base from theory of planned behavior (TPB) and social dilemma theory.

Design/methodology/approach – Artificial neural networks were used to analyze the data. A survey instrument was developed to understand the behavior pattern of customers while purchasing energy-efficient products. The outputs and input variables were identified and the input variables were divided into binary and discrete inputs.

Findings – The research attempts to identify the factors that drive as well as avoid green consumerism. It also details the measures that can be adapted to address the social dilemma of green consumerism. In general the paper identifies with the literature in eliciting that environmental consciousness does not drive green consumerism.

Research limitations/implications – The results of the study have important implications for practitioners as well as researchers. It is observed that neural network also provides inconclusive evidence for the intention behavior gap. This can be further explored by identifying different elements of environment consciousness and further testing.

Practical implications – Marketers need to have strategies interwoven with traditional influencers to promote their green offerings. The consumers expect a clear and measurable benefit to the green offerings that the marketers are marketing.

Originality/value – The research has its conceptual base in the TPB and social dilemma theory to understand the drivers of purchase behavior while evaluating an electronic product available in both energy efficient non-energy efficient rating scenario.

Keywords Consumer behaviour, Artificial neural networks, Green marketing strategy

Paper type Research paper

1. Introduction

Environment has attained a lot of significance in our lives in the recent past. It had been an area of concern since a long time with the only difference that now people are getting more familiar with its conservation and maintenance. This has even pressurized market places to take this aspect into consideration in their operations both upstream and downstream. In the downstream market it is basically about products and services that are being offered for consumer use. The concept of green marketing has then found its relevance and companies are trying to go green in their own ways. Today, green marketing has become a major trend in modern business. This has happened due to a sharp increase in customer awareness about environmental issues and strict regulations introduced by national governments, especially in industrially developed countries that brought the demand for ecological products into sharp focus (Bramah and Tweneboah-Koduah, 2011).

As far as the definition of green products is concerned it is not clear. The definition is unclear, the concept boundaries are poorly defined, and the literature still lacks a



commonly accepted definition (Hartmann and Ibanez, 2006). According to Ottoman (1998) a well-known author in the field of green marketing: green products are typically durable, non-toxic, made of recycled materials or minimally packaged. Of course, there are no completely green products, for they all use up energy and resources and create by-products and emissions during their manufacture, transport to warehouses and stores, usage and eventual disposal. So we can argue that green is relative, describing products with less impact on the environment than their alternatives.

Since the consumers have developed an understanding of environment consciousness, it would be interesting to study the change in their behavior pattern. Several prior studies have, however, found that environmentally conscious people do not show a consistent preference for purchasing environmentally friendly products and in other cases they are as well not interested in paying a premium for such products (Ohtomo and Hirose, 2007). It is also observed that on one hand the consumers are concerned about environment but at the same time they are not ready to compromise on certain attributes like price of the product (Jay, 1990). This has relevance in the social dilemma theory. On the above gap the paper attempts to identify the environmental consciousness of consumers in a developing economy like India using the case of energy-efficient products. This requires understanding the driving forces that influences a consumer's purchase intention for energy-efficient products as the income dynamics in a developing economy is different.

Researches in this area have produced inconclusive results with reference to the attitude toward the environment and actual behavior (Kellgren and Wood, 1986). Mintel (2006) also found that only few consumers are actually carrying forward the attitude to behavior and action. Thus these results make it very challenging for the marketers to position the energy-efficient products in the first place. This paper focusses on using neural networks as a tool of neuromarketing in classifying the consumers' and coming up with target strategies for promotion of green products. Neuromarketing is a new field of marketing research that studies consumers' sensorimotor, cognitive and affective response to marketing stimuli. Researchers use technologies such as functional magnetic resonance imaging to measure changes in activity in parts of the brain, electroencephalography and steady-state topography to measure activity in specific regional spectra of the brain response, and/or sensors to measure changes in one's physiological state, also to learn why consumers make the decisions they do, and what part of the brain is telling them to do it (Karmarkar, 2011).

While we suppose a consumer buys a product for its features, functions or its price, the consumer's brain tells us something different from the usual perspective. The neuroscience shows that this developed organ develops preferences on the basis of the intuitional relation with the product's brand and not on the basis of the advertising message. The brain cannot make the distinction between the messages of the marketing department and the rest of the messages. Neuroscience proposes to understand the motivation from the sub consciousness (positive or negative), motivation which impules the individual to act or which stops the action, determining a preference, a purchase or a behavior (Ciprian-Marcel *et al.*, 2009). The point for neuromarketing is the interconnection of frames of interpretation in order to achieve a fuller understanding of consumer behavior. Unfortunately, there is more of a research-practice gap than an interconnection in neuromarketing. There is, though, a biological turn and a focus on understanding underlying processes concerning markets and marketing exchanges (Butler, 2008).

2. Literature review

2.1 Consumer psychology toward environment and green products

Green marketing has not lived up to the hopes and dreams of many managers and activists. According to Ginsberg and Bloom (2004), although public opinion polls consistently show that consumers would prefer to choose a green product over one that is less friendly to the environment when all other things are equal, those “other things” are rarely equal in the minds of consumers. Despite expressing concern toward the environment the consumers were unwilling to purchase or pay a higher price for environmentally friendly products (Jay, 1990; Ottman, 1992; Schlossberg, 1991). A more recent report by the RoperASW (2002) produced somewhat disappointing results with overall environmental concern among the general population on a decline with 59 percent of the general population not even thinking of participating in environmentally friendly activities. Contrary to the belief of many economists, consumers very rarely weigh-up the full costs and benefits of their purchasing decisions. Instead, they are strongly influenced by emotional factors, the behavior of other people, by habits, and by the use of mental short-cuts, which all help to speed up decision making. Consumer preferences have also been shown to be inconsistent, changing over time and according to the situation and the way in which information is presented (Policy Studies Institute, 2006).

In order to get a deeper insight into consumers’ psychology, it is important to investigate how environmental attitudes of consumers are formed. Extant research also indicates that consumer attitudes are one of the most relevant predictors of green purchasing decisions (Grob, 1995; Schlegelmilch *et al.*, 1996). Consumers who are generally concerned about the environment may still not be proactive in a behavioral sense unless he/she feels that individuals can play an active role in positively affecting the environment (Straughan and Roberts, 1999). The consumers also feel that their individual contribution would be miniscule in terms of impact on the environment factors that have been shown to exert influence on the ecological behavior of individuals have been generally classified as external (e.g. education, media, family or culture), internal (e.g. knowledge, attitudes, awareness or involvement) and situational (economic rewards and legislation) (Carrete *et al.*, 2012).

However, most consumers, despite holding a positive attitude toward environmental conservation make purchase decisions to maximize self-interest because in their view, the costs of cooperation outweigh the uncertain utility obtained from it. Therefore, the decision to buy (collective social gain) or not buy (self-interest) the green product despite positive attitude toward environmental conservation may be conceptualized as a social dilemma (Gupta and Ogden, 2009). Consumers who plan to purchase durable products such as refrigerators or washing machines may have little objective experience with a specific brand of the product (compared to the situation of purchasing a frequently replaced item). Thus, their perceptions and beliefs about energy-efficient products as well as the environment will be shaped positively by objective factual information (Farhar, 1996). The decision to purchase green products presents itself as a social dilemma influenced by reference group effects and is driven by the motivation to maximize collective rather than individual gain (Gupta and Ogden, 2009).

Therefore, based on the above discussion, the following can be proposed:

- P1.* Environment consciousness is not an influencing factor in choosing an energy-efficient product.

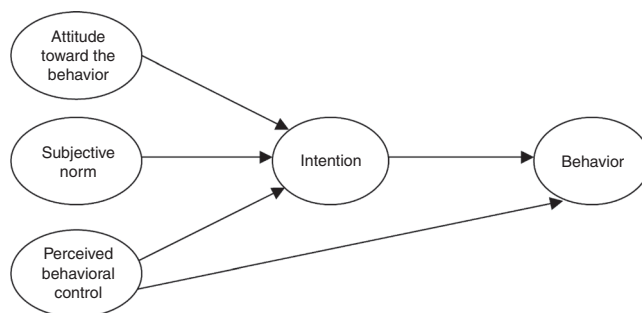
Emerging evidence (Wong *et al.*, 1996; Aspinall, 1993) suggests a curious paradox. Despite evidence to suggest that society is increasingly sympathetic toward the environment many eco-friendly products have not achieved the level of market success that would have been expected. In many consumer product categories, eco-friendly producers have achieved disappointingly low levels of market share. This is supported by the findings of recent UK surveys which indicate that, although consumers' concern with the environment continues to increase (albeit at a decreasing rate) their willingness to buy eco-friendly products has declined (Mintel, 1991, 1995). Thus the above are believed to support the claim that UK consumers are reluctant to change their purchasing patterns despite their expressed concern about the environment. We use Ajzen's (Ajzen, 1991) "The theory of planned behavior" to provide an insight into the determinants of intention within the green marketing domain (Figure 1).

How, then, should companies handle the dilemmas associated with green marketing? These firms must always keep in mind that consumers are unlikely to compromise on traditional product attributes, such as price, quality and performance (Ginsberg and Bloom, 2004).

2.2 Scope of neural networks

This study explores the use of neural networks for understanding the decision making process of consumers while buying energy-efficient products. Its aim is to capture the complex relationships between various factors that lead them to decide to buy a certain energy-efficient product. Standard econometric techniques which deal with such a problem have limited explanatory capabilities because they are based on linear models. Neural network technology has seen many application areas in business especially when the problem domain involves classification, recognition and predictions. With the capabilities of neural networks, hidden trends and relations among data which are previously unseen can be deduced (Poh *et al.*, 1998).

Considering the multi-faceted demands of the marketing domain and the myriad sets of available marketing data, it can be very difficult to draw anything relevant from the available data because of the unrelatedness and non-linearity of marketing data. With the capabilities of neural network, hidden trends and relations among data which are previously unseen can be deduced, in other words, obtaining information from information (White, 1990).



Source: From Ajzen (1991)

Figure 1.
Theory of planned
behavior

Hence, we can suggest that:

- P2. Neural network model is successful in identifying or verify existing patterns of data.

The concept of using artificial neural networks in the field of marketing has been mostly applied in the context of predicting sales and helping in taking decisions related to marketing. In this paper, we attempt to apply this field of neuromarketing on the other side of the market, that is, understanding the consumer psychology toward energy-efficient products and predicting the driving factors influencing the purchase behavior of energy-efficient products.

3. Research methodology

3.1 Data collection

The population of interest was consumers of energy-efficient products like air conditioners and refrigerators. A sample of 110 respondents was selected majorly from Ahmedabad. A questionnaire was designed to extract the information about the consumers' awareness about green products, their preferences, aspects on pricing, choice, views on various environmental issues, etc.

An artificial neural network is a form of computer program modeled on the brain and nervous system of humans. Neural networks are composed of a series of interconnected processing neurons functioning in unison to achieve certain outcomes. Neural networks detect patterns existing within a data by extracting the useful information and discarding the ineffective data.

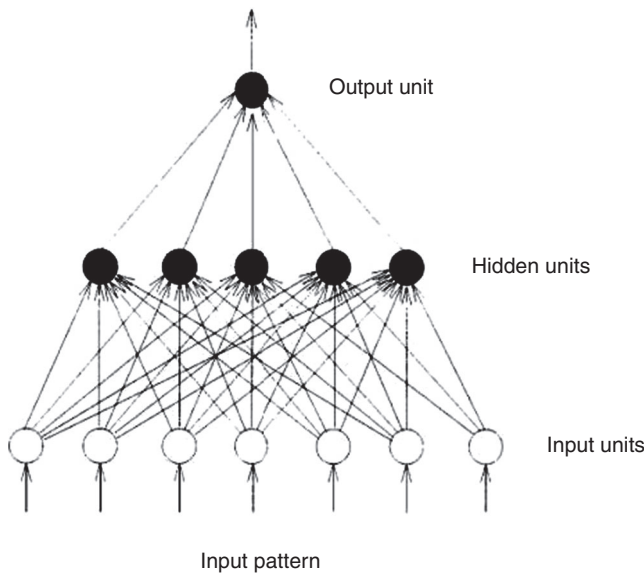
From a marketing perspective, neural networks are a form of software tool used to assist in decision making. Neural networks help fulfill the role of marketing companies through effectively aiding in market segmentation and measurement of performance while reducing costs and improving accuracy. Due to their learning ability, flexibility, adaption and knowledge discovery, neural networks offer many advantages over traditional models (Bloom, 2005). Neural networks can be used to assist in areas of marketing analysis, forecasting and pattern recognition and classification.

Figure 2 shows simple neural network architecture, with one output unit and one hidden layer, which can be trained using an algorithm called back propagation. The shaded nodes in figure are processing units. The arrows connecting input and hidden units and connecting hidden units and the output unit represent weights (Poh *et al.*, 1998). This algorithm was used for training and testing the data sets used in this research. The neural network analysis utilizes MATLAB for training and testing.

For performing the analysis the input and output is fed into the software. In total, 80 percent of the data are used for training the network to create a pattern that closely matches the input to the output. Once the network is trained the pattern is verified using the remaining 20 percent of the data. The pattern creates new set of results for the 20 percent of the data and it is compared to the already existing respective output. The difference between the two results is the mean square error (MSE). Lower the MSE higher the consistency of the network given any input.

3.2 Input and target outputs in this study

Followed by the data collection process, 26 variables were selected as inputs that would lead the individual in preferring a certain attribute of the product. The attributes were divided into eight categories and each of them was given as a target/output set to the



Source: Poh *et al.* (1998)

Figure 2.
Input pattern

neural network. The inputs are classified as binary and discrete. Binary inputs are those whose responses are either Yes or No. Discrete inputs are those whose values were falling in a certain range (Likert scale). Table I explains the discrete inputs, binary inputs and the output attributes.

Each output takes a value in the range of 0-12, as we tested for 12 different electronic appliances. For instance, if someone preferred brand in seven out of 12 appliances, then the total score assigned to brand for that particular individual is 7. Scores for other seven attributes will be calculated in the similar way. To get a more refined form of the output, it was normalized as 0 or 1 using the following formula:

$$Norm(Attribute) = 0 \text{ if } \frac{Score(Attribute)}{Maximum \text{ of all scores in the particular set}} < 0.5 \quad (1)$$

$$Norm(Attribute) = 1 \text{ if } \frac{Score(Attribute)}{Maximum \text{ of all scores in the particular set}} \geq 0.5 \quad (2)$$

This normalized score indicates whether this particular attribute is given importance or not while buying the product. For each of the 110 people who took the survey, we obtained 110 such sets of normalized scores. For example, let us take one of the outputs set as shown in Table II.

The role of ANN here is to map the input to the given set of output by assigning different weights from the each input variables to the hidden neurons and then from hidden neurons to the output. Once the weights are assigned, we analyze which input variables are having maximum influence on the output. Those input variables that are not having much influence on the output are discarded. Sensitivity analysis was used to detect the most influential inputs which are described as follows.

Table I.
Inputs to the artificial
neural network

Age of the individual	Monthly salary of individual	Monthly electric bill	How often does the individual check rating
<i>Discrete inputs</i>			
Duration the individual is using certain product	Level of satisfaction	Individual's opinion whether energy-efficient products are often overpriced	Individual's opinion whether energy efficiency is real concern and not a marketing gimmick of the company
<i>Binary inputs</i>			
Gender of the individual	Whether the individual considers his/her contribution to be important or not while buying certain electronic product	Whether the individual feels overburdened with the electric bill	Is the person going to recommend the product to others or not?
Individuals opinion whether they feel companies are trying to cheat in the name of energy efficiency	Whether the customer feels that only energy-efficient products should be marketed	Whether the individual has any apprehensions regarding the energy-efficient products	Whether the individual thinks that buying energy-efficient products will certainly help in reducing or controlling global warming
Whether the individual buy energy-efficient products if his/her income doubles	Whether the individual is willing to use energy-efficient products only in future	Whether the individual is willing to pay more to buy energy-efficient products	Whether high cost is the inhibiting factor for the individual
Whether little knowledge of energy-efficient products is the inhibiting factor for the individual	Whether unavailability of energy-efficient products is the inhibiting factor for the individual	Whether lack of awareness among the retailers is the inhibiting factor for the individual	Whether the individual will prefer energy-efficient products if available at subsidized rates
Whether the individual will prefer energy-efficient products if cost prices are reduced	If generating awareness can increase use of energy-efficient products		
<i>Outputs</i>			
Brand	Model	Price	Aesthetics
Energy efficiency	Marketing/promotional Offers	Warranty	Maintenance

Table II.
Example of
normalization score

	Brand	Model	Price	Marketing/ promotional offers	Energy efficiency	Aesthetics	Warranty	Maintenance
Scores	12	12	12	5	12	1	11	12
Value after dividing with the maximum value the attribute set obtained (its 12 here)	1	1	1	0.41667	1	0.0833	0.91667	1
Normalized value	1	1	1	0	1	1	1	1

3.3 Sensitivity analysis

A good and understandable data model can be provided by reducing the number of variables through weight sensitivity analysis (Poh *et al.*, 1998). The analysis of weights can be accomplished using two methods proposed in this study. The idea of type of variables aids us to choose the method for analysis. This is because a variable might not be meaningful when it is analyzed based on a certain method used for analysis.

The first method is the weight magnitude analysis method. The connecting weights between the input and the hidden nodes are observed. The variables with higher connecting weights between the input and output nodes will have greater influence on the output node results. The relative influence of each input node on output is the sum of its output weight magnitudes to each of the hidden layer nodes. The sum of the weight magnitudes from each input node is calculated by dividing the weight magnitude of each input node by the largest connecting weight magnitude between the input and the hidden layer. This is a necessary process called normalization whereby the weights are adjusted in terms of the largest weight magnitude. The weight magnitudes from each input node to the nodes in the hidden layer are subsequently summed and ranked in a descending manner (Yao *et al.*, 1998). Lower the rank of the node, higher is the effect on the output variable; thus deciding the most important and effective discrete variables. The rank formula is as follows:

$$I_i = \sum_k \frac{w_{ik}^1}{\max_{All\ i,k} (w_{ik}^1)}, \quad (3)$$

The second method is the variable perturbation method. It is used to adjust the input values of one variable while keeping all the other variables untouched. In this method, the value of one input is perturbed/changed (keeping rest of inputs unchanged) and the corresponding responses of the output against each change in the input variable are noted. The node whose changes affect the output most is the one that is most influential relative to the rest. Under the variable perturbation method, the binary variable gender will have values of 1.1 or 0.9 when it is 10 percent perturbed, but the values are not meaningful for this variable. Usage duration of the EEP, a discrete variable on the other hand, has values of 1, 2, 3 or 4. It will not be meaningful if it has values of 1.1, 2.2 or 3.3 under a 10 percent perturbation (Yao *et al.*, 1998).

The sensitivity analysis was thus used to observe the influence of the 18 binary and eight discrete input variables. The influence of each variable on the outcome was then ranked within the respective categories. Thereafter, the best few ranking variables within each category were selected and combined.

First, the 18 binary variables were examined one at a time using the variable perturbation method. The values of the variables to be tested were inverted and tested for each of the eight outputs while the other input variables were kept untouched. Thus, for each of the output, two or three best binary inputs were selected that affected the output greatly. Following the binary variables, the influence of discrete variables was tested using weight magnitude analysis method. For each of the output, the eight discrete variables were ranked according to their relative weight and the best one or two input variables were selected as the dominant variables.

4. Results and analysis

4.1 Results of variable perturbation method

The table represents those input variables which have a substantial influence on the output attributes. Brand becomes a driving force when energy-efficient products are not easily available in the market and consumers have apprehensions regarding the products. Similarly, for energy-efficient products, awareness, availability and willingness to pay are the driving forces (Table III).

In case of aesthetics and warranty, there was no considerable change in output when the inputs were inverted one at a time. So we assume that none of the inputs have major influence in purchasing of energy-efficient product based on aesthetics or warranty. Therefore, it can be implied that companies need to focus less on aesthetic design of the energy-efficient product and thus save large amount of cost that goes in developing fancy and funky design, garnering least attention of the consumers.

4.2 Results of weight magnitude analysis to check the influence of discrete inputs on each of the output

Among the discrete inputs, income acted as a major driving force for purchasing energy-efficient products. But at the same time, other discrete inputs like energy rating of appliances, does not feature to be a driving force in deciding the purchase behavior (Table IV).

The following table shows the final combination of the most influential inputs on the respective outputs (Table V).

4.3 Correlation of various attributes with energy efficiency (Table VI)

The above analysis does not represent environment consciousness (binary input) as a driving force at all toward buying behavior. The same is reflected by the literature review. Hence, P2 is validated that neural networks have the capability of recognizing

Table III.
Most influential
binary inputs

Rank	Brand	Marketing/ promotional offers	Model	Energy efficiency	Price	Maintenance
1.	EEP not easily available (binary)	Discounts in EEP (binary)	Generate awareness (binary)	Generate awareness (binary)	High cost (binary)	Recommend (binary)
2.	Apprehensions regarding the product (binary)	—	Reduction in cost prices (binary)	Market only EEP (binary) Willing to pay more (Rank 3)	Subsidy in energy- efficient product (binary)	Reduction in global warming (binary)

Table IV.
Most influential
discrete inputs

Rank	Brand	Marketing/ promotional offers	Model	Energy efficiency	Price	Maintenance
1.	Income	Age	Usage duration	Income	Satisfaction	Age
2.	Monthly electricity bill	Real and not gimmick	Monthly electricity bill	—	—	—

existing patterns of data. Moreover a correlation analysis of the outputs revealed that maintenance and price has a high level of correlation with energy efficiency. Hence it can be implied that higher the energy efficiency in the product higher would be the price and maintenance. This is a major hindrance in popularizing energy-efficient products among the masses. If a technological innovation which can aid in manufacturing low-priced energy-efficient products with low maintenance can increase the concern and saleability. Also, it can be seen that marketing is having very low correlation with energy efficiency, hence this calls for redefining the marketing and branding activities so that consumers start affiliating with the energy-efficient products more comfortably. This addresses the first proposition that environment consciousness is not a driving factor for purchasing energy-efficient product in a developing economy like India.

5. Implications and conclusions

In order to successfully market the energy-efficient products and convince consumer to purchase them, the firms manufacturing and selling energy-efficient products first have to determine their strengths: Are they a powerful brand? Does their product require least amount of maintenance? Are their models most innovative and cost efficient? Depending on their strengths and cashing on them, the firms can segment the target audience according to the results of this research and attract them to buy the energy-efficient products. For researchers it can be implied that the results are still inconclusive as far as identifying the drivers for energy-efficient products. The traditional drivers of brands, price and income still emerge out as influencers in purchasing energy-efficient products. Environment consciousness is not considered as the determining variable for energy-efficient products. Further study can be carried out to determine the elements of environment consciousness that can be studied for identifying the influencers. Marketers have substantial implications from the study. It was identified that customers are aware of the environmental issue at heart but are

No.	Output	Influential inputs (binary)
1.	Brand	Problem is energy-efficient product not available in market, apprehensions, salary, monthly electric bill
2.	Model	Generate awareness, reduction in cost price, monthly electricity bill, usage duration
3.	Price	High cost, subsidy in energy efficient product, satisfaction
4.	Marketing/ promotional offers	Age, subsidy, real and not gimmick
5.	Energy efficiency	Generate awareness, market only energy efficient-product, ready to pay more, salary
6.	Maintenance	Age, recommend, reduction in global warming

Table V.
Most influential binary and discrete input variables combined

Attribute	Correlation with energy efficiency	Rank
Maintenance	0.573819	1
Price	0.498779	2
Model	0.21464	3
Brand	0.155258	4
Marketing	0.117657	5

Table VI.
Correlation results

not practicing it. To make green marketing work they need to follow drivers different from the traditional ones to differentiate the green offerings otherwise the competitive advantage of “green” will be lost. Community-based campaigns could result in positively adapting green products. Moreover it was also observed that aesthetics and design do not impress the consumers of energy-efficient products. The companies spending a lot on adding that design and glamor quotient to their products can now focus more on the functional attribute of the product and make it technological advanced in terms of function while at the same time working a bit less on the design and aesthetics. As far as the traditional drivers are concerned the following are the implications for them.

5.1 Brand

It can be implied that a person will go for brand name while purchasing an EEP in a scenario where he is not aware about the availability of EEP product of same category. Brand is most likely to be the deciding factor when the individual has apprehensions regarding the quality of the product.

5.2 Model

Proper awareness has to be created to publicize the EEP models as awareness is a major hurdle in adopting such products. Once awareness motivates the individual to purchase, the consumers would be ready to share their experiences with others in the community. The positioning plan for going for high rated EEP should be the electricity bill. Electricity bill sensitive people can be the initial target audience. To achieve this, widespread marketing is required. Price is also an inhibiting factor for purchases which compels people to go for low-rated low-price energy-efficient products. Usage duration where the product is in continuous use like a refrigerator needs to be marketed heavily focussing more on the reliability for continuous use.

5.3 Price

As described above, price acts as a major inhibiting factor when it comes to buy high-rated energy-efficient products. This can be overcome by sharing satisfaction experiences of customers who bought these products. Affordability should be put in consideration because if prices are high, EEP products will be bought only by high-salaried people.

5.4 Marketing/promotional offers

Age is an influencing factor in the acceptance of promotional/marketing offers. Generally, old age individuals do not get excited by those offers. So, products targeted for young home makers can be exposed to EEP using exciting promos. They will be interested in availing in these kinds of benefits, namely, the older people may like to go which are renowned for low maintenance. Also, marketing/promotional offers tend to be more successful with those who feel that the brand associated with the product is honest and is not using energy efficiency factor as a gimmick. Therefore, a strong impression of a company and its involvement with energy efficiency should be marketed effectively.

The environmental consciousness has to be interwoven in the traditional drivers in a manner so as to create a winning proposition for the customer, seller as well as the environment. Researchers can further explore through extensive emphasis on

consumer behavior and by including many other variables that drives purchasing decisions of consumer. Also, this study has focussed heavily on the application of neural networks, therefore, students as well as academicians who are working on artificial neural networks can refer this work to understand and learn how neural networks have applications in the field of marketing.

The application of neural networks not only focusses on the factors that drive consumers to make a purchase, but it also throws light on those factors which are actually irrelevant for the consumers in this context, but somehow the marketers do not take this into consideration. For example, as in the case of aesthetic design and energy ratings, an average consumer is not bothered by any of these variables because their only concern is the cost they are incurring in long as well as short term. This observation was further strengthened when retailers' viewpoints were taken. The general and common view of people is that five star equipment are much more energy efficient than three-star equipment. However, the concept of energy efficiency and cost saving is relative according to the size of the room of where it is going to be used. According to the retailers, three-star equipment are often recommended by them to customers for medium sized rooms because it is more cost efficient. Another aspect of such equipment is their recyclability. iPhones are recyclable as these are made of metal and glass; however, the highly popular CFL bulbs are not recyclable because they are made of plastic. Thus, the whole longevity of the equipment from manufacturing till its disposal needs to be taken under consideration. Therefore, it is very important to "re-define" the meaning of "energy efficiency" at the very first place, with respect to the capacity of the rooms where these energy-efficient products are to be used and recyclability of the material and the cost as well.

This leads to the conclusion that to sell any such heavy electrical equipment to a consumer, they have to be shown what benefit they can get from the energy efficiency; the sentiment of energy efficiency does not work in making the sell.

Communication strategy will play an important role in effective marketing of energy-efficient products using above mentioned results. Since while selection of choosing an electronic appliance, lots of attributes are kept in mind, the firms can decide on one of these attributes and tap the target audience who prefer a certain attribute.

When a company wants to cash in on its brand, it can launch energy efficient version of those products in which no other company has done before, for example, mobile phones, laptop, etc. In this way, these firms can create new market space and attract more customers. Since a lot of innovation is involved in this strategy, the consumer may have apprehensions initially. Therefore, the firms have to market their products in such a manner that it clarifies all the doubts from the minds of the customer and get their loyalty. Communication strategies should involve high focus on energy efficiency inclination of the brand and thus promote the green nature of the product.

It is important to generate more awareness of certain models of a particular product category. Communication about the models which are energy efficient should be done at a higher level so as to create awareness about the new energy-efficient models being introduced by the company. Moreover it should be targeted to people who are at the initial stages of family building with promotional offers because the research says that promotions work out best with younger profile customers.

People are not buying energy-efficient products to actually contribute to the environment conservation. They are conscious toward the environment but they do not consider this as an attribute influencing their electronic purchases.

6. Future scope of work

- (1) Considering the complexity of the human mind and the fact that thousands of emotions and thoughts are active when the consumer is deciding to buy an energy-efficient product, the set of inputs, i.e. the dominant thoughts can be huge in number. In this study, 26 of them were considered. However, to explore more and to get a more refined insight into the consumer behavior, more number of inputs can be used.
- (2) The power of ANN lies in its capability to recognize non-linear relations, various patterns and clusters in the given data set. The clusters and patterns found in this study can be explored more for various experimentation and can be achieved through proper interpretation. The interpretations need more time and a deeper insight into the domain of neural networks. These patterns and interpretations can identify hidden relations among various inputs and thus help the marketers in segmenting the target audience.
- (3) The research methodology used for this particular study can be implemented for forming communication strategies of products and services of other industries as well.

References

- Ajzen, I. (1991), "The theory of planned behaviour", *Organizational Behavior and the Human Decision Process*, Vol. 50 No. 2, pp. 179-211.
- Aspinall, D. (1993), *Greener Cleaning*, Home Economics and Technology, Chicago.
- Bloom, J.Z. (2005), "Market segmentation: a neural network application", *Annals of Tourism Research*, Vol. 32 No. 1, pp. 93-111.
- Braimah, M. and Tweneboah-Koduah, E.Y. (2011), "An exploratory study of the impact of green brand awareness on consumer purchase decisions in Ghana", *Journal of Marketing Development and Competitiveness*, Vol. 5 No. 7, pp. 11-18.
- Butler, M.J. (2008), "Neuromarketing and the perception of knowledge", *Journal of Consumer Behaviour*, Vol. 7 Nos 4-5, pp. 415-419.
- Carrete, L., Castano, R., Felix, R., Centeno, E. and Gonzalez, E. (2012), "Green consumer behavior in an emerging economy: confusion, credibility, and compatibility", *Journal of Consumer Marketing*, Vol. 29 No. 7, pp. 470-481.
- Ciprian-Marcel, P., Lăcrămioara, R., Andreea Ioana, M. and Monica Maria, Z. (2009), "Neuromarketing – getting inside the customer's mind", *Annals of Faculty of Economics*, Vol. 4 No. 1, pp. 804-807.
- Farhar, B.C. (1996), "Energy and the environment: the public view", *REPP Issue Brief*, Renewable Energy Policy Project, University of Maryland at College Park, College Park, MD, 20pp.
- Ginsberg, J.M. and Bloom, P.N. (2004), "Choosing the right green marketing strategy", *MIT Sloan Management Review*.
- Grob, A. (1995), "A structural model of environmental attitudes and behavior", *Journal of Environmental Psychology*, Vol. 15 No. 3, pp. 209-220.
- Gupta, S. and Ogden, D.T. (2009), "To buy or not to buy? A social dilemma perspective on green buying", *Journal of Consumer Marketing*, Vol. 26 No. 6, pp. 376-391.

- Hartmann, P. and Ibanez, V.A. (2006), "Green value added", *Marketing Intelligence and Planning*, Vol. 24 No. 7, pp. 673-680.
- Jay, L. (1990), "Green about the tills: markets discover the eco-consumer", *Management Review*, Vol. 79 No. 6, p. 24.
- Karmarkar, U.R. (2011), *Note on Neuromarketing (9-512-031)*, Harvard Business School, Boston, MA.
- Kellgren, C.A. and Wood, W. (1986), "Access to attitude relevant information in memory as a determinant of attitude-behavior consistency", *Journal of Experimental Social Psychology*, Vol. 22, July, pp. 328-338.
- Mintel (1991), *The Green Consumer Report*, Mintel International Group Ltd, London.
- Mintel (1995), *The Second Green Consumer Report*, Mintel International Group Ltd, London.
- Mintel (2006), *Green Living, US Marketing Research Report*, London.
- Ohtomo, S. and Hirose, Y. (2007), "The dual-process of reactive and intentional decision-making involved in eco-friendly behavior", *Journal of Environmental Psychology*, Vol. 27 No. 2, pp. 117-125.
- Ottman, J. (1992), "Sometimes, consumers will pay more to go green", *Marketing News*, Vol. 26 No. 14, p. 16.
- Ottoman, J. (1998), *Green Marketing: Opportunity for Innovation*, 2nd ed.
- Poh, H.-L., Yao, J. and Jasic, T. (1998), "Neural networks for the analysis and forecasting of advertising and promotion impact", *International Journal of Intelligent Systems in Accounting, Finance and Management*, Vol. 7, pp. 253-268.
- Policy Studies Institute (2006), *Designing Policy to Influence Customers: Consumer Behaviour Relating to the Purchasing of Environmentally Preferable Goods*, Policy Studies Institute, London.
- RoperASW (2002), *Green Gauge Report 2002*, Roper Organization, New York, NY.
- Schlegelmilch, B.B., Bohlen, G.M. and Diamantopoulos, A. (1996), "The link between green purchasing decisions and measures of environmental consciousness", *European Journal of Marketing*, Vol. 30 No. 5, pp. 35-55.
- Schlossberg, H. (1991), "Americans passionate about the environment? Critics say that", *Marketing News*, Vol. 25, pp. 8-10.
- Straughan, R.D. and Roberts, J.A. (1999), "Environmental segmentation alternatives: a look at green consumer behaviour in the new millennium", *Journal of Consumer Marketing*, Vol. 16 No. 6, pp. 558-575.
- White, H. (1990), "Connectionist nonparametric regression: multilayer feedforward neural networks can learn arbitrary mappings", *Neural Networks*, Vol. 3 No. 5, pp. 535-549.
- Wong, V., Turner, W. and Stoneman, P. (1996), "Marketing strategies and market prospects for environmentally-friendly consumer products", *British Journal of Management*, Vol. 7 No. 3, pp. 263-281.
- Yao, J.T., Teng, N., Poh, H.L. and Tan, C.L. (1998), "Forecasting and analysis of marketing data using neural networks", *Journal of Information Science and Engineering*, Vol. 14 No. 4, pp. 843-862.

Further reading

- Cannons, K. and Cheung, V. (2002), *An Introduction to Neural Networks*, Iowa State University, Ames.
- Kim, J. and Ahn, H. (2009), "A new perspective for neural networks: application to a marketing management problem", *Journal of Information Science and Engineering*, Vol. 25 No. 5, pp. 1605-1616.

Lee, W.-I., Shih, B.-Y. and Chung, Y.-S. (2008), "The exploration of consumers' behavior in choosing hospital by the application of neural network", *Expert Systems with Applications*, Vol. 34 No. 2, pp. 806-816.

Rivera-Camino, J. (2006), "Re-evaluating green marketing strategy: a stakeholder perspective", *European Journal of Marketing*, Vol. 41, pp. 1328-1358.

Tedesco, B.G. (1992), *Neural Marketing: Artificial Intelligence Neural Networks in Measuring Consumer Expectations*, Grey Associates, Chicago, IL.

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