Consumers' preferences for eco-friendly appliances in an emerging market context

Nadine C. Sonnenberg
Department of Consumer Science, University of Pretoria, Pretoria, South Africa, 0002
Tel: +27 (0)12 420 3775
Mobile: 083 407 2934
Fax: +27 (0)12 420 2855
E-mail: nadine.sonnenberg@up.ac.za

Alet C. Erasmus
Department of Consumer Science, University of Pretoria, Pretoria, South Africa, 0002
Tel: +27 (0)12 420 2575
Mobile: 082 784 2467
Fax: +27 (0)12 420 2855
E-mail: alet.erasmus@up.ac.za

Adré Schreuder
Consulta, Central Park, Building 1, Highveld Techno Park, Centurion, South Africa, 0046
Tel: +27 (0)12 665 6226
Mobile:
Fax: +27 (0)86 582 2858
E-mail: adre@consulta.co.za

Correspondence concerning this article should be addressed to Nadine Sonnenberg, Department of Consumer Science, University of Pretoria, Pretoria, 0002
Tel: +27 (0)12 420 3775
Mobile: 083 407 2934
Fax: +27 (0)12 420 2855
E-mail: nadine.sonnenberg@up.ac.za

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ABSTRACT

At present, the South African (SA) energy supply per person surpasses that of several other developing countries in the world notwithstanding the energy crisis in the country and evidence that SA produces among the highest greenhouse gas emissions per unit of GDP in the world. The problem is partly due to an increased demand for major household appliances in recent years, which have resulted in an over extension of existing capacity and perpetual power failures. Increasing consumption patterns in the rapidly expanding economy of South Africa requires intentional efforts to promote more sustainable product choices for example an understanding of the relevance of environmental attributes in consumers' evaluation of product alternatives to ensure lasting environmental implications. Using Sawtooth conjoint software, trade-off tasks were compiled and included in a cross-sectional survey involving 648 households in Tshwane, South Africa to assess the relative importance of various environmental attributes (e.g. energy efficiency) in relation to other product features (e.g. brand and price) of washing machines. Aggregate results reveal that consumers across various age, income and educational levels prioritise brand and price, despite the long-term financial and environmental repurcussions of product features that impact on the use of natural resources.Based on a cluster analysis, four consumer segments were identified that differ in terms of preference structures, which offer valuable insight for the development of intervention strategies and marketing campaigns. In summary, the findings underline current literature,namely that in order to facilitate pro-environmental product choices "green" product offerings must also perform competitively in terms of non-environmental attributes. Future studies should focus on a broader scope of factors, including consumers' knowledge and awareness of the environmental impact of their product choices, to better inform marketing campaigns and intervention initiatives.

Keywords: Green products, environmental attributes, conjoint analyses, emerging economies, pro-environmental choices, sustainable consumption, household appliances

INTRODUCTION

Continued poverty eradication efforts within the emerging economy of South Africa, which serves as an example for neighbouring developing African countries, have resulted in a migration of many previously disadvantaged citizens to middle and high-income groups who possess buying power similar to consumers in more developed economies (Nieftagodien and Van der Berg, 2007; Pricewaterhouse Coopers (PwC) and Economist Intelligence Unit, 2012). According to the 2012 Living Planet Report (World Wilde Fund for Nature (WWF), 2012, p. 50), South Africa's consumption patterns increasingly reflect those of high-income countries, which has important

benefits for the local economy, but also requires further consideration of the resultingenvironmental impact. Although South Africa's ecological footprint of 2.59 global hectares per person is slightly lower than the world average of 2.7 (WWF, 2012), averages do not negate the fact that 10% of South African households consume almost 50% of the available products and services, whereas the poorest segments consume a mere 1% (Rosenberg, 2006, p. 57). Over-consumption by consumer classes inevitably depletes natural resources upon which poorer communities often directly depend (Rogers and Ryan, 2001; Chokor, 2004). Intentional efforts are thus required to promote more sustainable product choices among middle to high-income groups who have the financial means to make alternative product choices, but that would require an understanding of the relevance of environmental attributes in their evaluation of product alternatives.

During the last decade progress was made in more developed economies to ascertain the significance of various aspects that may impact on consumers' pro-environmental product choices and -consumption. These aspects include, amongst other, socio demographic variables (Zelezny *et al*., 2000; Diamantopoulos *et al.*, 2003), lifestyle profiles (Papaoikonomou, 2013), cognition (Wagner-Tsukamoto and Tadajewski, 2006), motivational constructs such as values, attitudes, and beliefs (Nordlund and Garvill, 2002; Oregand Katz-Gerro, 2006) as well as situational/ contextual factors (Tanner *et al*., 2004). However, most research is based on conditions in high income industrialized countries and can therefore not reflect the status quo in emerging countries (Bodur and Sarigöllü, 2005), especially those with unique cultural complexities and contextual circumstances such as South Africa (Rousseau and Venter, 2001). Also, prior research has mostly focused on the factors that precede consumers' pro-environmental product choices, whereas few studies have explored the actual purchasing context in which consumers are confronted with the reality of assessing various environmental product features in relation to non-environmental attributes, which may be particularly relevant in complex and expensive acts such as purchasing major household appliances.

Some actions may have far greater environmental impact than others (Stern, 2000). As an example, infrequent decisions to purchase major appliances have long-term implications due to the expected service life of at least ten years and the repetitive use of such durables (Erasmus *et al*., 2005). Viewed from a "cradle-to-grave" perspective, appliances such as washing machines impact on the environment as a result of the initial energy and raw materials used in the production, transportation and the distribution of the appliance, the subsequent water, chemicals and energy consumption of the product throughout its life cycle as well as the eventual disposal of the appliance that contributes to waste and pollution (McCollough, 2009; Laitala *et al*., 2011; Sonnenberg, *et al*., 2011; Berkholz *et al*., 2013). Energy usage, in particular, is a major concern in the South African (SA) context since the country is at present experiencing an energy supply crisis (Niez, 2010; U.S. Energy Information Administration (EIA), 2013**),** while the situation is not much different in the neighbouring Botswana,

Swaziland or Mozambique (Lorenzoni and Pidgeon, 2006). Locally, the energy supply per person surpasses that of several other developing countries (Winkler, 2006) and the country has among the highest greenhouse gas emissions per unit of GDP in the world (OECD, 2013). In recent years millions of households have gained access to electricity through intentional drives to uplift previously disadvantaged communitiesin SA (Niez, 2010; EIA), 2013). The demand for major household appliances has thus soared in recent years and an overextension of existing capacity is manifested in perpetual power failures in key urban sectors (Inglesi and Pouris, 2010; EIA, 2013). These trends are expected to continue in the near future, which necessitates endorsing energy efficiency and environmental sensitivity in consumers' evaluation, selection and use of major household appliances.

With numerous SA households joining the ranks of an aspiring middle-class consumer segment, many of whom are acquiring appliances for the first time (Nieftagodien and Van der Berg, 2007; PwC and Economist Intelligence Unit, 2012), this study was focused on gaining an understanding of the relative importance of environmental attributes in relation to other product features such as brand and price in consumers' preference structures for major household appliances.

CONSUMER CHOICE DECISIONS IN THE SA WHITE GOODS INDUSTRY

Growth in the SA white goods industry has in part stemmed from the SA government's continued service delivery efforts and public housing schemes, which account for over three million homes that were built between 1994 and 2010, transferring an estimated 11 million people from informal settlements into formal housing (PwC and Economist Intelligence Unit, 2012; Department of Human Settlements, 2013). Efforts are ongoing and with an estimated backlog of 2.1million houses to be completed in the foreseeable future (PwC and Economist Intelligence Unit, 2012) the white goods industry has substantial grounds for future expansion. Currently the industryis dominated by appliances which are imported from Germany, China, the United States, the United Kingdom, Japan and Korea (Finlay and Liechti, 2008) and approximately 25 different brands are sold in the local retail sector (Covary, 2013). LG and Samsung, which are more affordable brands,are considered key role players in this sector (PwC and Economist Intelligence Unit, 2012; Euromonitor International, 2013a)with marketing campaigns that are strongly focused on good value for money, aesthetically pleasing, feature-rich andeco-friendly appliances (Euromonitor International, 2013a).

Consumers' evaluation and selection of major household appliances can comprise of various attributes, which may have a direct or indirect impact on the environment. Washing machines, as an example, may be assessed in terms of wash load capacity, which determines the number of wash loads, water and energy consumption (Sammer and Wüstenhagen, 2006), all of which have significant environmental implications throughout the life span of the product (Otto *et* al., 2006; Laitala *et al*.,

2011). Over the past few years, appliance manufacturers have endeavored to incorporate life cycle assessment (LCA) into their product design strategies with, amongst other, state-of-the-art sensor technology to achieve optimized consumption of energy and resources (Otto *et al*., 2006). These initiatives have contributed to an increased availability of energy-efficient, eco-friendly product alternatives in the SA medium-to high-end white goods sector. Furthermore, in an effort to eliminate inefficient appliances on the market, and to empower consumers to make informed choices when purchasing appliances (e.g. dishwashers, washing machines, dryers, ovens, hobs, stoves, refrigerators and freezers), the SA government has recently approved a five-year project with a US$13-million budget to implement standards and labeling for appliances that are sold locally (Lazenby, 2012; Covary, 2013). Energy labels are well known among European consumers (Sammer and Wüstenhagen, 2006) and the measures suggested for the SA market are modeled after the European Union standards (Covalry, 2013).

In addition to availability and the provision of relevant information, affordability is a key issue in consumers' acceptance of eco-friendly alternatives (Lorenzoni and Pidgeon, 2006; Aertsens *et al*., 2009; Gam *et al*., 2010; Ritch and Schröder, 2012). Eco-friendly options are generally associated with higher costs that often inhibit pro-environmental decision-making (Wagner, 2003; Van Doorn and Verhoef, 2011). Yet, some evidence suggests that other product features e.g. functionality may supersede price as the primary choice criterion in consumers' evaluation and selection of major appliances (Sonnenberg *et al*., 2011). Concurrently, whereas some may perceive the higher cost of an eco-friendly alternative as a constraint, others may regard it as an indication of superior quality (Stern, 2000). Price is known to have diverse meanings for individuals with different demographic and socio-psychological profiles, which may be of particular interest in terms of the spending and consumption patterns of an aspiring middle class consumer segment in the SA context (Nieftagodien and Van der Berg, 2007; PwC and Economist Intelligence Unit, 2012).

In summary, opportunities exist within the SA appliance retail sector that would allow consumers to act on their pro-environmental intentions. However, empirical findings about emerging consumers' choice of appliances, especially consumers with increased spending power and access to a wide variety of products in densely populated urban areasremain limited. These consumers' prioritization of eco-friendly product features may be of particular interest in the quest for the preservation of natural resources and ecosystems in the emerging economy of SA. Assessing the long term environmental consequences of purchasing a washing machine with eco-friendly features against more immediate gains(e.g. saving money by acquiring a cheaper conventional alternative) fit the basic assumptions that underlie the process of mental accounting (Thaler, 1985; Erasmus and Mathunjwa, 2011), i.e. consumers might regard immediate advantages more important than the longterm consequences that they might not necessarily feel or experience first hand, when they are confronted

with a product purchase. Apart from environmental implications, attributes such as optimized energy- and water consumption also involve financial consequences, which may add further justification in consumers' deliberation of the immediate and future outcomes of their purchase decisions. This study was therefore focused on assessing the relative importance of environmental attributes in relation to other product features such as price and brand in middle- to high-income consumers' evaluation and selection of washing machines, a commodity that almost all households own and use (Nieftagodien and Van der Berg, 2007). The study intentionally excluded low income consumers assuming that even if they were conscious about the relevance of environmental attributes, they would have limited opportunity to choose products other than those that are cheaper and more affordable. Conjoint analysis seemed an appropriate data collection framework for the study as it is based on the premise that any object/ concept is assessed in terms of a bundle of attributes (Hair *et al*., 2006) e.g. in an actual purchase situation, consumers jointly compare several attributes such as price, brand and performance of the available alternatives in order to select the best possible option (Alriksson and Öberg, 2008).

CONJOINT ANALYSIS METHODOLOGY

Several variants of conjoint analysis have emergedover the past few years (Hair *et al*.,2006), which differ in terms of design and data analysis. However, all of them afford the researcher insight into a respondent's preference structure across multi-attribute alternatives (Farber and Griner, 2000; Hair *et al*., 2006; Alriksson and Öberg, 2008). The alternatives included in a conjoint study are hypothetical since the researcher specifies the attributes and the levels for each attribute beforehand (Hair *et al*., 2006; Alriksson and Öberg, 2008). Based on the respondent's choice, rating or ranking of the hypothetical alternatives, the value (i.e. utility and part-worths) assigned to attribute levels (e.g. different prices, features or brands) can be estimated as a measure of an individual's overall preference (Hair *et al*., 2006). Conjoint analysis is therefore classified as a decompositional method as it decomposes utility from respondents' assessments of predetermined product alternatives (Green *et al*., 2001; Alriksson and Öberg, 2008;Mazzocchi, 2008) in contrast to compositional multivariate models (e.g. regression and discriminant analyses) that "compose"predictive models based on respondents'autonomous rating of the importance of product attributes (Hair *et al*., 2006; Alriksson and Öberg, 2008).

Although it has been argued that decompositional techniques are more adept in predicting choice behaviour (Alriksson and Öberg, 2008), it has not been exempt from critique. Since conjoint analysis relies on hypothetical situations/ products, the design phase entails several consequences if poorly executed e.g. the attributes and levels included in the conjoint task is based on the researcher's judgment and couldpotentially not includethe respondents' true preferences (Alriksson and Öberg, 2008). Respondent fatigue and information overload are also issues frequently highlighted, since

conjoint tasks can be difficult and time consuming (Sawtooth Software Inc., 2002). It is thus essential to carefully consider the number of attributes that are included in the study (in terms of complexity and length of the questionnaire) and to pretest the question format to ensure that the conjoint task iscomprehendable and easy to completewithin an acceptable time frame (Sawtooth Software Inc., 2002; Alriksson and Öberg, 2008).

Despite certain drawbacks, conjoint analysis offers several benefits if it is meticoulisly planned and executed. In the marketing field, conjoint analysis methodologies have been extensively applied to define products with the optimum combination of features for specific customer segments and to explore the potential of products with attribute combinations that are not yet available(Green *et al.*, 2001; Hair *et al*., 2006; Mazzocchi, 2008). Since the mid-1990s, conjoint analyses have also gained momentum in environmental studies with applications focused on issues such as ecosystem management, environmental evaluation, environmental policy development, public preferences regarding industrial projects, energy, recreation and consumer preferences for environmentally certified products (Faber and Griner, 2000; Alriksson and Öberg, 2008). Eco-friendly product evaluation and green consumer behaviour is recognized as particularly relevant in the future application of conjoint analyses, especially in terms of the development of new products with eco-friendly features (Alriksson and Öberg, 2008).

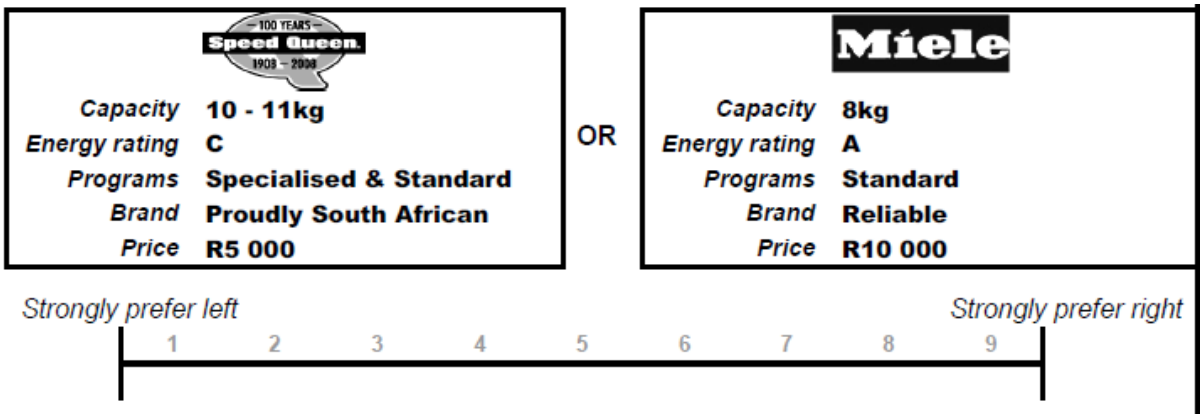
In recent years, several software packages have been developed to facilitate the application of the various conjoint methodologies (Green *et al.*, 2001; Hair *et al*., 2006; Alriksson and Öberg, 2008;Mazzocchi, 2008). For the purpose of this study, the Conjoint Value Analyses (CVA) Sawtooth software package was used to conduct a paired-profile conjoint analysis (Sawtooth Software Inc., 2002). This method incorporates the classic principles of conjoint analysis in the conjoint task and employs an additive model of consumer preference (Hair *et al*, 2006, p. 464).The method was suited to this study as the number of attributes included in the investigation was less than ten(Hair *et al*., 2006, p. 475) and a basic model in terms of estimation procedures was considered appropriate (Hair *et al*., 2006, p. 461). The method also allowed for the transferal of computer generated conjoint tasks/ profiles to paper based questionnaires, which was essential for data collection purposes in this study. In general, conjoint analysis represents a useful approach for environmentally related studies, since it reduces socially desired answers by revealing consumer preferences in a more indirect manner (Sammer and Wüstenhagen, 2006) while maintaining a high degree of realism (Hair *et al*., 2006). Surveys tend to overestimate consumers' willingness to engage in environmentally responsible behaviour because of social response bias (Mohr*et al*., 2001). Studies often rely on self-reported behaviour, which do not always reflect actual, observed behaviour (Steg and Vlek, 2009). Since the measurement of actual behaviour is at times problematic, valid and reliable measures that are more

adept in predicting pro-environmental choice behaviour is needed (Alriksson and Öberg, 2008; Steg and Vlek, 2009).

Questionnaire development and the CVA design

A structured questionnairewas developed and pre-tested for this study. The questionnaire included, amongst other, a section consisting of demographic questions pertaining to gender, age, education level, household size, income, population group and area of residence as well as a section involvingcarefully designed conjoint tasks. The design phase is critical to the success of any conjoint project (Sawtooth Software Inc., 2002; Alriksson and Öberg, 2008) and therefore the initial step in creating a CVA design is the compilation of an appropriate choice set. The choice set for this study included specific factors/ attributes (e.g. price and washing programmes as presented in Figure 1) and the levels for each factor (e.g. different price levels and different washing programmes) that were considered relevant in consumers' evaluation and selection of automatic washing machines. Due to the complexity of their design, washing machines require more resources for production compared to other appliances such as refrigerators (Otto *et al.*, 2006), but it is also a category in which significant progress has been made to ensure optimum eco-efficiency (Otto *et al.*, 2006; Euromonitor International, 2013b). Decisions pertaining to the inclusion of specific attributes and levels were guided by an extensive review of catalogues, brochures and websites of appliance manufacturers and retailers as well as prior empirical evidence regarding consumers' evaluation and selection of appliances (Sammer and Wüstenhagen, 2006; Erasmus *et al*., 2011; Sonnenberg *et al*., 2011).

Figure 1 Example of the pair wise task



Environmentally related attributes that were included in the choice set were energy efficiency ratings, wash load capacities and washing programmes/ cycles. To reduce the complexity and length of the questionnaire, a parsimonious approach was adopted in the specification of levels for each factor with careful consideration of the relevance of each level in consumers' assessment of alternatives. As an example, energy efficiency ratings were included rather than actual energy consumption, because

consumers tend to interpret A+, A, B or C energy efficiency ratings in a more meaningful manner than kWh/ wash cycle (Sammer and Wüstenhagen, 2006).Since most washing machines sold within the middle to high-end sector have high energy efficiency ratings, only four levels were specified for this attribute. Similarly, a basic classification and description of washing machine programmes was included in the questionnairerather than the broad range of available wash cycles that differ substantially in terms of energy- and water consumption. However, to avoid misinterpretation a list of definitions was attached to the conjoint task (Alriksson and Öberg, 2008), which explained what energy efficiency ratings meant and how wash cycles differed in terms of functionality, water- and energy consumption. Wash load capacity levels were specified according to the available range of models in appliance retail outlets. Price, brand and brand perception were also recognized as important selection criteria in consumers' choice of products (Sammer and Wüstenhagen, 2006; Erasmus *et al*., 2011; Sonnenberg *et al*., 2011) and levels were specified based on relevant market information.

During the design of the combinations of factors and attribute levels, it inevitably happened that some of the combinations were somewhat extraordinary, for example presenting a brand which is generally quite expensive at a very affordable price and vice versa. This was necessary to determine consumers' price sensitivity and their determination to purchase a specific brand. Having specified the different factors/ attributes and levels, CVA Sawtooth software was employed to create the conjoint tasks. Washing machines were described in terms of all six attributes, with each conjoint task presenting the attributes at different levels. CVA software applies D-efficiency measures(Sawtooth Software Inc., 2002; Kuhfeld and Tobias, 2005) to assess the goodness of a conjoint design in terms of orthogonality (i.e. zero correlation between pairs of attributes) and balance, which is achieved when each level within an attribute is shown an equal number of times (Hair *et al*., 2006, p. 498; Sawtooth Software Inc., 2002). Based on 10 random versions, each consisting of 40 conjoint tasks, a final set of 40 questions was computed for the study with a D-efficiency of 0.88 which is considered satisfactory.Another useful CVA diagnostic for conjoint questionnaire design is the attribute efficiency coefficients of which the best possible value is 1.00 (Sawtooth Software Inc., 2002). Four attributes (brand, price, washing programmes and brand perception) achieved efficiency coefficients of 0.98, with capacity and energy rating achieving efficiency coefficients of 0.99. A pair wise comparison technique was used to present the conjoint tasks i.e. respondents were asked to compare two profiles at a time indicating their preference for one profile over the other on a nine-point rating scale that allowed them to make their selection on any point on the nine-increment line. The exact points were later measured meticulously. Although pair wise presentation can fairly difficult for a respondent as it requires a comparison of two sets of information where each set may combine items that are acceptable with some that are not, it produces finer distinctions between products with different features than single concept presentations (Sawtooth Software Inc., 2002).To reduce

respondent fatigue and information overload, conjoint tasks were alternated with other scale items in the questionnaire.

Data collection and demographic profile of respondents

To address the objectives of this study, a cross-sectional survey was conducted in the city of Tshwane, the administrative capitol of SA, which is located in the Gauteng province, the economic hub of the country. Tshwane is a densely populated urban area with numerous shopping centres and retail outlets that offer a wide range, including high-end consumer goods, which best reflects the progress that the country has made in terms of the avialability of goods and services in an emerging economy. An important pre-requisite for participation in the study involved experience in the purchasing of major household appliances. This resulted in a non-probability purposive sampling technique, whereby potential participants were identified by means of a store intercept approach, similar to the approach used by Sammer and Wüstenhagen (2006) in their choice-based conjoint study. Permission was obtained from stores that offer a variety of eco-friendly appliances, to approach consumers who were in the process of acquiring washing machines. Respondents who were willing and able to participate in the study were asked to complete a questionnaire on the spot in a structured face-to-face interview.

A total of 648 questionnaires were retrieved for analyses. Most respondents were female (69%), presumably due to females' leading role in acquiring major household appliances as observed in stores. Ages ranged between 19 and 77 years, with 25% categorized as young (≤ 29 years); 45% as middle aged (30 to <50 years) and 29% as older (≥50 years). Prior empirical evidence confirms that households spend more on appliances in the middle and later stages of the life cycle (Erasmus *et al*., 2002). The majority of respondents were Whites (81%) and possessed a higher level of education, i.e. post-secondary school diploma or degree (63%). In formulating the objectives of this study, focus was directed toward middle to high income consumers due to their proportionally higher share in the average ecological footprint. Consequently, 47% of the sample was of the upper middle- to high income- and 53% of the middle to lower middle income segments. In terms of area of residence, 89 geographic wards were recorded and grouped according to five municipal regions (City of Tshwane, 2008), i.e. North West region (n = 46/ 7%); North East region (n = 72/ 11%); Central-Western region (n = 152/ 23%); Southern region (n = 226/ 34%) and the Eastern region (n = 171/ 25%). The study hence aimed to include a proportional sample of the population in accordance with municipal survey data (City of Tshwane, 2008), which confirms a percentage distribution of households with a monthly household income of ≥ZAR6401 (1 USD = 10 ZAR) in the various regions.

RESULTS AND DISCUSSION

CVA software provides two options for part-worth utility estimation including ordinary least squares (OLS) and monotone regression (Sawtooth Software Inc., 2002). Since the dependent variable was interval scaled, an OLS estimation method was applied (Alriksson and Öberg, 2008; Sawtooth Software Inc., 2002). The results are summarised in Table 1. This estimation includes 25920 observations based on the responses of 648 individuals, each performing 40 paired comparison choice tasks. For conjoint analysis, the statistical assumptions associated with model estimation is generally limited (Hair *et al*., 2006, p. 501). The average R^2, which is a typical goodness-of-fit measure for conjoint analyses models (Baker and Burnham, 2001, p. 394) was 0.90 and the average Kendall's tau was 0.93, indicating a good fit.

Table 1 Aggregate results of the conjoint value analyses for washing machines

Attribute	Factor importance	Attribute levels	Utility
Price (10.5ZAR = 1USD)	28.5	3000 ZAR	42.44
		4000 ZAR	37.20
		5000 ZAR	24.07
		6000 ZAR	7.71
		7000 ZAR	10.12
		8000 ZAR	1.19
		10000 ZAR	-15.08
		14000 ZAR	-44.75
		18000 ZAR	-62.90
Brand	24.5	Defy	11.83
		Whirlpool	-9.71
		Samsung	10.00
		LG	12.85
		Miele	-21.38
		Bosch	-2.91
		AEG	-2.05
		Siemens	-1.45
		Speed Queen	2.82
Brand perception	14.9	Eco-friendly	14.26
		Reliable	-2.34
		Affordable	1.01
		Innovative	-0.42
		Respected	-7.22
		Prestigious	-7.03
		Proudly SA	1.73
Energy rating	14.5	A+	31.57
		A	12.05
		B	-12.58
		C	-31.04
Washing cycles	10.9	Standard[a]	-5.51
		Standard and eco-friendly[b]	12.85
		Standard and convenience[c]	-6.04

		Standard and hygiene[d]	-5.97
		Standard and specialized[e]	4.66
Load capacity	6.8	7 kg	-11.30
		8 kg	1.79
		10 kg	9.50

Washing programmes were described as follows:
[a]Standard programmes include conventional wash cycles for cottons, synthetics, delicate fabrics and woolens;
[b]Eco-friendly programmes use up to 50% less energy and/or water without compromising on results;
[c]Convenience programmes are less than 30 minute "quick wash" and "reduced ironing" cycles;
[d]Hygiene programmes use high temperatures and high water levels for high standard of cleanliness;
[e]Specialized programmes are for soft toys, pillow, sport shoes, sportswear and curtains.

Based on the results summarized in Table 1, respondents across various age, population, income and educational levels prioritised price, brand and brand perception, despite the long-term economic and environmental repurcussions of product features that impact on the use of natural resources, such as the machine's load capacity, energy efficiency ratings and choice of washing cycles.On an aggregate level, price was the most important attribute in respondents' choice of washing machines. Price levels ranged from 3000ZAR to 18000ZAR (1USD = 10 ZAR), with price levels higher than 8000ZAR obtaining negative utility values. Respondents are therefore reluctant to pay more than 8000ZAR for a washing machine, which excludes some of the more sophisticated brands such as Miele that focus strongly on environmentally friendly attributes. Brands and brand perceptions also featured prominently in respondents' preference structures. Brands that obtained the highest utility values namely LG (12.85),Defy (11.83) and Samsung (10.00), coincide with those reported to have the highest market share in the SA home laundry appliances sector (Euromonitor International, 2013b). According to Euromonitor International (2013b), LG electronics dominates this sector with a 27% overall share; Defy Appliances Ltd holds the second largest market share at approximately 23% and Samsung Electronics achieved the third highest market share at 13% in 2012. LG and Samsung, in particular, are supported by marketing campaigns that are strongly focused on "eco-efficiency" (Euromonitor International, 2013b), which may have contributed to the high utility value (14.26) assigned to eco-friendly brand perceptions. Interestingly, the Proudly SA brand perception also obtained a positive utility value (1.74). The Proudly SA campaign was originally launched in 2001 to encourage consumers to purchase locally produced products, predominantly in an effort to stimulate the local economy and to create sustainable job opportunities (Proudly South African, [s.a.]).Of all the brands listed, Defy was the only brand accredited in accordance with the Proudly SA criteria for membership. However, it is not clear whether the utility value assigned to the Proudly SA brand perception was linked to a sense of national pride or the environmental implications of acquiring a locally manufactured product.

Despite the high utility value of eco-friendly brand perceptions, attributes that have a more immediate environmental impact (i.e. energy ratings, washing programmes/ cycles and load capacity) were less

influential in respondents' choice of washing machines. This suggests that respondents do not necessarily realize the overall long-term implications of their product choices and hence rely on price and brand associations to guide their decision-making. Although energy ratings attained an average importance score (14.5%) almost equivalent to that of brand perception (14.9%), the importance of energy ratings may be attributed to escalating electricity prices in SA in recent years rather than concern for the environment. Since 2008, SA consumers have experienced substantial increases in the cost of electricity due to an energy crisis in the country (Inglesi and Pouris, 2010; EIA, 2013). Informed by several energy saving campaigns, SA consumers are now more conscious of energy consumption than ever before and sales of energy efficient A+ rated appliances have grown significantly (Euromonitor International, 2013a).As pointed out by Sammer and Wüstenhagen (2006), consumers may also associate an A+ energy rating with a high-quality product. All of the above, may account for the significant difference between the utility values of A+ (31.57) and C (-31.04) energy ratings.

Washing programmes (which impact on the environment in terms of detergent-, water- and energy usage) and load capacity were the least important criteria in respondents' product choices. Apart from their environmental impact, these features have financial implications that span over the entire life cycle of the appliance, which necessitates informed decision-making and deliberation of consequences that extend beyond the initial selection of a particular product option. Although these attributes achieved a lower ranking in respondents' preference structures, it was encouraging to note that wash cycles with a combination of standard and eco-friendly features were most preferred (utility value of12.85). In terms of load capacity, respondents preferred the largest capacity with a significant difference in the utility values of 10 kg capacities and 7 kg capacities, which may be attributed to the fact that 60% (n=390) of the respondents belonged to households consisting of three or more members, and that a larger capacity allows for fewer wash loads per week.

Although aggregate results provide useful background regarding the average importance of various attributes across the sample, promoting environmentally significant behaviour often requires identification of target segments of individuals in order to develop tailored intervention strategies (Steg and Vlek, 2009). Cluster analysis, which are algorithms that group observations into homogeneous categories according to similarity rules are often used for segmentation purposes (Mazzocchi, 2008, p. 263) and was considered appropriate for this study. As a first step, the Euclidean distance measure, which simply refers to geometric distance in multi-dimensional space(Mazzocchi, 2008, p. 265; Stat Soft Inc, 2013) was computed from the raw conjoint data and entered into a proximity matrix. The Euclidean distances were squared to progressively add more weight on observations that are further apart (Stat Soft Inc, 2013). During the initial exploratory phase, a hierarchical (joining/ tree) algorithm was applied whereby it is assumed that each of the (N =

648)observations represents a separate cluster, with each consecutive step involving the amalgamation of clusters until all observations are joined together in a single cluster (Mazzocchi, 2008, p. 269; StatSoftInc, 2013).Ward's amalgamation rule was applied, which reduces the sum of squares of clusters that are formed at each step (StatSoftInc, 2013).Close scrutiny of the resulting dendogram revealed four clusters, which was then used as the *a priori k* number of clusters in a non-hierarchical *k*–means clustering approach. Although three, five and six cluster solutions were also considered, the *k*-means method produced a four cluster solution with less variability within clusters and more variability between clusters. The Root Mean Square Standard Deviation (RMSSTD) which measures the homogeneity of the clusters were as follows: .07 (first cluster); .06 (second cluster); .05 (third cluster) and .07 (fourth cluster). Lower RMSSTD values are indicative of homogeneity of the clusters.

Based on respondents' prioritization of particular attributes in their choice of washing machines, the four clusters were labeled as brand buyers (n = 114), price punters (n = 178), energy investors (n = 104) and the indecisive shoppers (n = 252). Figure 2 illustrates the average importance of brands, prices, load capacities, energy ratings, wash cycles and brand perceptions for each of the clusters.

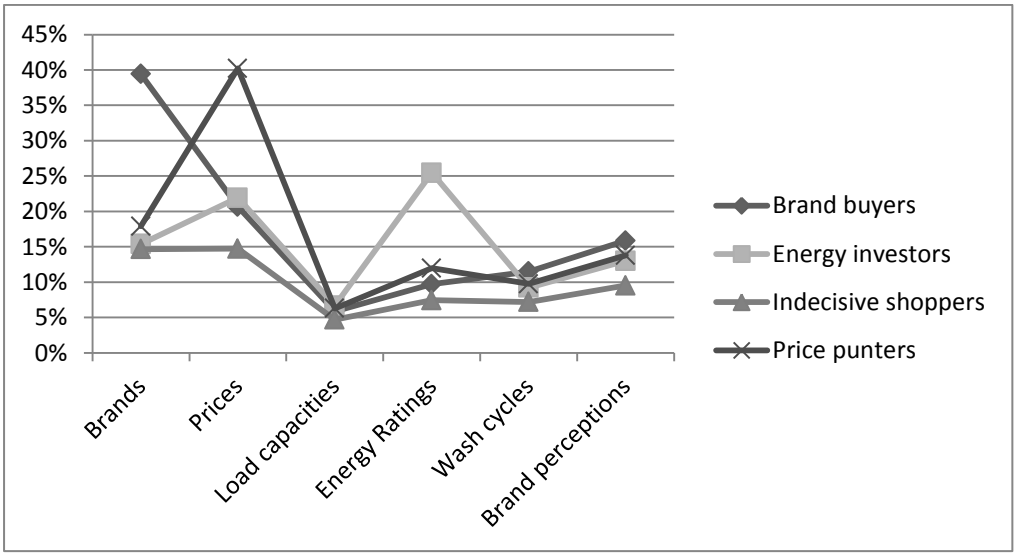


Figure 2 Relative importance of attributes for various clusters

Table 3 Comparison of the buying clusters in terms of the demographic characteristics

	Brand buyers N = 114/ 18%		Price punters N =178/ 27%		Energy investors N = 104/ 16%		Indecisive shoppers N = 252/ 39%	
	n	%	*n*	%	*n*	%	*n*	%
Gender								
Male	25	21.9	66	37.1	31	29.8	83	32.9
Female	89	78.1	112	62.9	73	70.2	169	67.1
Missing	0	0.0	0	0.0	0	0.0	0	0.0
Age								
19 - 29years	31	27.2	40	22.5	23	22.1	72	28.6

>29 - 49 years	50	43.9	85	47.8	45	43.3	110	43.7
>49 years	31	27.2	51	28.7	34	32.7	69	27.4
Missing	2	1.8	2	1.1	2	1.9	1	0.4
Education								
≤ Grade 12	42	36.8	60	33.7	36	34.6	97	38.5
Gr 12+degree/diploma	72	63.2	117	65.7	67	64.4	152	60.3
Missing	0	0.0	1	0.6	1	1.0	3	1.2
Income								
<15000 ZAR	53	46.5	63	35.4	32	30.8	108	42.9
≥15000–19999 ZAR	10	8.8	20	11.2	9	8.7	25	9.9
≥20000–44999 ZAR	27	23.7	52	29.2	31	29.8	58	23.0
≥45000 ZAR	18	15.8	37	20.8	23	22.1	44	17.5
Missing	6	5.3	6	3.4	9	8.7	17	6.7
Population group								
White	78	68.4	157	88.2	94	90.4	202	80.2
Black and other	36	31.6	20	11.2	10	9.6	50	19.8
Missing	0	0.0	1	0.6	0	0.0	0	0.0
Household size								
1 member	12	10.5	18	10.1	9	8.7	27	10.7
2 members	28	24.6	52	29.2	34	32.7	74	29.4
3-4 members	49	43.0	79	44.4	44	42.3	107	42.5
>4 members	23	20.2	29	16.3	17	16.3	42	16.7
Missing	0	0.0	0	0.0	0	0.0	2	0.8

A comparison of the four clusters (Figure 1) indicates that the brand of a product is the most important among the brand buyers (39%) and that they thereafter prioritized price (21%) more so than factors associated with environmentally related attributes such as energy rating, wash cycles and load capacities. Based on the demographic information summarized in Table 2, the brand buyer segment had a higher female to male ratio and a large representation (47%/ n=53) of lower income (<15000ZAR) groups. The majority were middle-aged, i.e. thirty to 49 years (44%/n=50) and belonged to households with three or more members (43%/n=49). Compared to the other clusters, this group also had a higher representation of Black, Coloured and Asian respondents (32%/ n=36).

For the price punters, price was notably more important (40%) than any of the other attributes including brand (18%), brand perception (14%), energy ratings (12%), wash cycles (10%) and load capacity (6%). This group was the second largest cluster (n=178), accounting for 27% of the respondents, with comparatively more males (37%/ n=66) than the other clusters. Most price punters belonged to the thirty to 49 age group (48%/ n=85) and had a higher level of education (66%/n=117). The middle and upper middle income levels (≥15000-44999ZAR) were also well represented in this cluster and most price punters belonged to large households consisting of three or more members.

From an environmental perspective, the energy investors were of particular interest due to their prioritization of energy ratings (25%). However, price was almost equally important (22%), which

suggests that cost implications are of primary importance in energy investors' decision-making. This cluster only accounted for 16% of the sample and were older (30-49 years: 43%/n=45 and ≥50 years: 33%/n=34), with the majority belonging to the upper middle to high income brackets (≥20000ZAR). They were predominantly White (90%/n=94), with higher levels of education (64%/n=67) and their households were mostly smaller, consisting of two to four members.

The fourth cluster, i.e. the "indecisive shoppers", was the largest of the four groups (n=252/ 39%) and seemed less confident in their prioritization of product attributes as none of the attributes seemed particularly important (<20% importance rating). Brand and price were judged equally important (15%), with the importance scores of other attributes ranging between 5% to 10%. Compared to the demographic profile of the other clusters, this group consisted of younger consumers (≤ 29 years: 27%/n=72; 30-49 years: 44%/n=110) of which 43% (n=108) were in the lower income bracket (<15000ZAR), possessing a basic secondary school qualification.

Researchers have argued that experience, knowledge and information contribute to consumers' confidence in their decision-making abilities (Aertsens *et al*., 2009). Informational strategies that are focused on increasing environmental knowledge/ awareness with emphasis directed toward pro-environmental alternatives (Steg and Vlek, 2009) may therefore benefit a cluster such as the indecisive shoppers. However, when pro-environmental options are expensive, structural strategies that are aimed at changing contextual factors such as the availability, cost and benefits of greener alternatives may be more effective than information campaigns (Steg and Vlek, 2009; Stern, 2000). As an example, pricing policies or incentive schemes for adopting energy-efficient, eco-friendly alternatives may appeal to a cluster such as the price punters. In particular, strategies that emphasize the benefits and long term cost implications of investing in energy efficient technology may further promote pro-environmental choice behaviour among a group such as the energy investors. On the other hand, marketing campaigns that build on eco-friendly brand appeal may be more successful among the brand buyer cluster. SA is characterized by an increasingly large segment of middle-class consumers with aspirational spending on high-end status goods (PwC and Economist Intelligence Unit, 2012; Nieftagodien and Van der Berg, 2007). Since household technology including major household appliances, is a product category that is visually consumed and therefore perceived as an indicator of progress (Erasmus *et al*., 2011), appliance retail and industry may benefit from brand building and image enhancement surrounding innovative green technology. Taken as a whole, a combination of strategies, both informational and contextual seems most appropriate, since expensive acts such as the purchasing of major household appliances, may be influenced by multiple factors that inhibit or promote environmentally significant choice behaviour (Steg andVlek, 2009; Stern, 2000).

CONCLUSION AND RECOMMENDATIONSFOR FUTURE RESEARCH

Due to globalization and the influx of leading multi-national appliance manufacturers, the availability and quality of products with eco-friendly features has substantially increased in the SA high-end appliance retail sector over the past few years. Although multi-national firms have improved their environmental impact due to increased pressure from environmentally conscious consumers in developed markets, there is very limited coercion from the SA consumer populations in this regard as decision-making is still exclusively driven by price sensitivity (PwC and Economist Intelligence Unit, 2012). Marketers can therefore not solely rely on consumers' willingness to compromise on non-environmental product attributes for the sake of the environment (Gam *et al*., 2010). In line with the above, the aggregate results of this study indicate that most consumers highly regard price in their preference structures, despite the relevance of product features with positive environmental consequences and that may even represent long term financial benefits.In this regard, Kahneman's () critique of the key role of rationality in the prevailing utility theory is justified. Alternative models may offer more insight and are thus worthy of further investigation e.g.Kahneman and Tversky's (1973) Prospect Theory, which acknowledges the irrational and insular outcomes of consumers' assessmentsas well as Thaler's (1985) mental accounting, whereby consumers discount future implications to benefit from the immediate gains of their choices (Erasmus and Mathunjwa, 2011).

Even though individuals may develop a sense of moral obligation and intent to take pro-environmental action, behaviour is strongly influenced by the actual purchasing context, which must be considered in efforts to promote pro-environmental product choices (Stern, 2000).In reality, eco-friendly options are assessed in terms of all features that apply to conventional alternatives. Moreover, as illustrated in the results of the cluster analysis procedure, different consumer groups may have different priorities in their evaluation and selection of particular products, which implies that marketing campaigns and intervention strategies are best tailored to the preference structures and profiles of specific target segments (Steg and Vlek, 2009).

Although information campaigns are needed to increase consumers' awareness and knowledge of the benefits of environmentally significant choice behaviour, structural intervention strategies that reduce the appeal of environmentally harmful options may be more effective (Steg and Vlek 2009). As an example, precipitous increases in the cost of electricity since the 2008 energy crisis has forced many SA households to become more energy conscious(PwC and Economist Intelligence Unit, 2012) and sales of energy efficient A+ rated appliances have soared (Euromonitor International, 2013a), which indicate some awareness of how energy efficient products can reduce energy consumption. In this regard, the budget allocated by the SA government toward the implementation of energy efficiency standards and labeling for appliances is justified. Results of this study indicate that respondents were

confident in their differentiation between A+ and C energy efficiency ratings. As concluded by Sammer and Wüstenhagen (2006) further delineation between A++ and A+ levels (as suggested in the European market)may not be equally meaningful and effective in reducing "information cost" for consumers.

In terms of policy, prior empirical evidence suggests that households prefer policies that promote the acceptance of new energy-efficient technology above strategies aimed at reducing current equipment usage (Poortinga*et al*., 2003; Steg and Vlek, 2009).Life-cycle assessments in fact demonstrate that economical and ecological benefits are to be gained by replacing appliances older than ten years (Otto*et al*., 2006). Thaler and Sunstein (2003) suggest that government and private institutions could "nudge" consumers toward behavior with positive consequences by means of "choice architecture" i.e. individuals' choices are influenced without restricting alternatives or amending financial incentives. As an example, the "Japanese Top Runner" approach which was implemented in 1998, endorsed the elimination of low efficiency appliances from the market by advancing the development ofnew energy efficientalternatives through standardsthat was based on the most efficient "Top Runner" product on the market (Kimura, 2010). Consumers are thus not restricted in their choice of alternatives, but the inefficient options are simply eliminated from their choice set.In similar vein, the EcoDesign directive is recognized as an important policy tool in the European Union, which obligates manufacturers to develop appliances with improved energy efficiency and reduced environmental impact throughout the product's lifespan (De Almeida et al., 2011). However, in South Africa the affordability of replacing older appliances may represent a significant constraint for lower income households and even though such barriers are surmounted, an energy-efficient, eco-friendly appliance still requires effective utilization to realize the long-term economic and financial benefits of green technology. Policy, regulation and strategies to encourage environmentally significant choice behaviour, therefore require careful consideration of the high levels of income inequality and heterogeneity of consumer populations in the SA context.

The empirical findings of this study contribute to theoretical insight that underline environmentally significant choice behaviour in an emerging market context with regard to a product category that has lasting environmental implications and where increased effort is needed to convince consumers of their potential to limit exploitation of the world's natural resources. This may be particularly difficult as consumers may not experience the benefits of pro-environmental behaviour immediately. It may also be difficult because developing countries are partially excused for lavish behaviour by international organisations due to their developmental status. The results of this study are based on a non-probable purposive sample and can therefore not be generalised. To better inform marketing campaigns and intervention initiatives, future studies should focus on a more representative sample including a broader scope of factors e.g. underlying motivational and situational factors, as well as

considering personal capabilities such as knowledge and experience. These factors may highlight further differentiation between various segments of consumers and their evaluation of product alternatives. In addition to segmenting various groups of potential customers, choice simulators can be applied to the conjoint results that enables the researcher to simulate competitive scenarios and estimate the share of preferences that particular attribute combinations are likely to capture (Hair *et al.*, 2006).

Future research may benefit from assessing the relevance of various conjoint methodologies (e.g. adaptive/ hybrid- and choice-based conjoint) in predicting pro-environmental choice behaviour and extending the application of these methods to other product categories.Causal factors may vary greatly across different target markets and types of pro-environmental behaviour (Stern, 2000; Nordlund and Garvill, 2002). A wide array of relevant phenomena thus offers fertile ground for the further exploration and application of various conjoint methodologies.

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