

# **FOOD TRACEABILITY IN THE CONTEXT OF KAROO LAMB: SUPPLY CHAIN AND CONSUMER PERSPECTIVES**

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## **Abstract**

As food markets have become more globalised, consumers have become more concerned about the origin of the foods they eat by accommodating the importance of establishing a link between the product, the producer and the place of production, and these are gaining momentum in the food industry.

This paper describes the product attributes that could influence the decision making process of consumers towards purchasing a specific type of meat, namely Karoo lamb. Karoo lamb is the product of specifically reared lambs in the Karoo region of South Africa and has a distinctive taste. The information used in this paper was obtained in the first phase of a research endeavour involving three focus groups. They were conducted to identify the product attributes that were critical in influencing the consumers' preferences and choices regarding Karoo lamb. In phase two conjoint analysis was used to measure the importance that individual consumers attach to the various product attributes and their denominations, and the utility they then attach to it based on their valuation of the product as a whole.

Price, as an extrinsic attribute, was identified as the most important factor in the decision making process of consumers when purchasing lamb. Safety and quality were also relatively important although, of the two, food safety was clearly the more important consideration. This is not surprising given the legacy of bovine spongiform encephalopathy (BSE), commonly known as mad-cow disease, and e-coli outbreaks that, in the past, received considerable publicity, especially in the press. The attribute "origin" was rated as of the lowest importance. Traceability can be meaningful to consumers although in an indirect manner. The importance of traceability to consumers is mostly in terms of its benefits such as providing information on safety and quality, in relation to aspects that they think are important regarding food in general. In terms of meat especially, there is a need for fast and reliable traceability. From origin to the user, the end consumer, provision of safe and high quality food is imperative.

**Keywords:** conjoint analysis, consumer decision making, traceability, Karoo lamb, place of origin

## **Introduction**

Globalised food markets resulted in consumers becoming more concerned about the origin of foods they eat and more enthusiastic about the quality of food with a clear regional identity. By nature, food products are land-based and therefore have a regional or geographic origin, but the link between food and territory has eroded over time (Kuznesof, Tregear and Moxey, 1997). Karoo lamb is a product with specific regional qualities that are based on the natural environment present in the region of origin, the Karoo, which is an outstretched inland area in the southern Northern Cape, eastern Free State and northern Western Cape, provinces of South Africa, characterised by semi-desert conditions. This identity creates a uniqueness that brings with it added value.

Consumers face various competitors' products in their purchase choice. Their purchasing decisions are generally based on several attributes such as price, functional characteristics (such as meat supply chain monitoring), external appearance, guarantee, brand and designation of origin. A heightened awareness of food-related safety issues among consumers is driving the demand for more information about the vertical food supply chain and the origin and handling of food products generated and consumed throughout the world (Smith, Tatum, Belk, Scanga, Grandin and Sofos, 2005). Although food traceability systems per se guarantee nothing except the ability to track the product throughout the food chain, they are considered to be indispensable in assuring product safety and implementing quality standards, delivering reliable information and feedback throughout the livestock production chain (Verbeke, 2001). In the case of Karoo lamb, traceability can be considered as a buying and confidence criterion especially as it provides information about the origin, the producer and the ingredient, namely, quality lamb meat.

With regard to the traceability of food, three questions therefore arise: whether traceability in itself is of value or valued by consumers; whether consumers associate additional attributes such as safety and quality with traceability; and whether consumers are willing to absorb the increased costs associated with traceability.

## **Background**

### ***The product – Karoo lamb***

The Karoo is a semi-arid area that covers almost 50% of the total area of South Africa. It can be argued that the particular taste of Karoo lamb is the result of the animals foraging on the fragrant Karoo scrub or that the distinctive taste results from the free-range conditions under which the animals roam (Kirsten, Troskie, Vermeulen, Schonfeldt and Bramley, 2008). A selection of six key plant species was identified that contribute the most to the specific taste and uniqueness of Karoo lamb. The specific plant species, vegetation and the veld type contribute to the unique characteristics of Karoo lamb (Kirsten, *et al.*, 2008). Karoo lamb has been part of African culture for centuries and, for more than a hundred years, typical of Afrikaner and the Cape cuisine. This can be seen in the traditional use of the name “Karoo lamb” on the facades of restaurants and guesthouses in South Africa, pointing to strong cultural and geographical ties. Where the place of origin is used as a product attribute, like the Karoo, resources of the area, such as production techniques, are used to enhance the value of the product.

Using geographical indications is a means of identifying goods originating from a particular geographical area. A strong geographical link exists in the Karoo lamb concept. The problem however arises that there is a lack of certification and guarantee that the product, which is marketed as Karoo Lamb, truly originates from the Karoo and consumers can easily be misled as to the true origin of the lamb being sold. This is due to the fact that, in South Africa, there is no specific public regulatory system for the protection of geographical indicators (GIs). The trademark law that is used for the protection of geographical indications only identifies the relationship between the proprietor of the mark and the goods and services provided (Bramley, Bienabe and Kirsten, 2009).

Bramley and Kirsten (2007) state that an increasing number of trademarks are being registered which incorporate regional names like the Karoo, in an attempt by firms to identify and link their products to names and regions of reputation, thereby enhancing the product’s image. In South Africa, the threat of misappropriation comes with this notion as producers not linked to the geography or values of the region could exploit regional names for their own profit. Increased protection of GIs will thus lead to increased consumer protection.

### ***Consumer decision making process***

Schiffman and Kanuk (2007) describe consumer behaviour as an interdisciplinary science that investigates the consumption-related activities of individuals, the when and why consumers buy and consume a product. Consumers make simple or complex buying and consumption decisions on a daily basis, which involves a selection of an option from two or more product alternatives. Within the consumer decision making perspective the actual purchase is considered as one particular point in the course of actions undertaken by a consumer. To understand that point, examination of preceding events, such as problem recognition, the search and processing of information and the evaluation of product alternatives, is needed (Verbeke, 2001). The decision making process is not a single activity but comprises a sequential and repetitive series of psychological and physical activities ranging from problem recognition to post-purchase behaviour (Brijball, 2003). Some stages of the decision making process can also occur simultaneously.

Without recognition of a problem, there is no need for a decision. If unsure about the quality and safety of the lamb, a need will arise to rectify the situation, and the consumer will start searching for information that has the potential to assist in fulfilling this need. Two pre-purchase search processes are distinguished, namely, internal and external. Past experience is considered an internal source of information. Availability and accessibility of product information (e.g. product name, attributes and benefits) are necessary conditions for this information to be retrieved from memory. Having consumed a certain type of lamb previously and recalling a pleasurable experience, the memory will facilitate in future decision making. If this information is perceived insufficient, an external search for information may follow. The information obtained then instigates a subsequent internal search for interpretation and/or elaboration.

The consumer has to decide which criteria will be used to evaluate product alternatives and has to integrate the perceptions of the alternatives in terms of those criteria, into an overall attitude about the attractiveness of each product alternative. The type of food product, for example meat, determines the criteria used by a consumer. The eventual consumer decision is the outcome of the evaluation of alternatives and involves the mental process of selecting the most desirable alternative from a set of alternatives that a consumer had identified.

### ***Food attributes as influencing factors***

Products are conceived as a set of attributes contributing to the formation of the consumer's impressions of the product itself. A consumer receives information as cues on product attributes in various ways, for example, during shopping and while consuming. The cues can be extrinsic and intrinsic in nature and are used by consumers to evaluate the performance of the product with respect to their needs.

**Traceability** with regard to meat is defined as the ability to maintain a credible custody of identification for animals through various steps within the food chain, from the farm to the retailer (Shackell, 2008). In the meat sector traceability holds that it is a system that offers the ability to identify an animal, trace its movement throughout its life and subsequently trace the meat products of the animal to the final consumer (Verbeke, 2001). As a result, specific food quality and safety levels can be guaranteed.

Coff, Korthals and Barling (2008) specify five objectives for traceability in food products. They are risk management and food safety; control and verification; supply chain management and efficiency; provenance and quality assurance of products; and information and communication to the consumer.

**Traceability.** Traceability can be an important tool to help to establish the authenticity of food and to check that claims made by producers are true (Van Rijswijk, Frewer, Menozzi and Faioli, 2008). It enables consumers to have access to targeted and accurate information. In the differentiation of a product of animal origin many of the desired attributes are introduced at the production level and cannot be added during processing. In the case of Karoo lamb consumers can therefore be misled as to the true origin of the lamb that is sold in outlets and the reputation and image of the product, Karoo lamb, can be jeopardized and influenced negatively.

**Quality.** The concept of product quality implies *determined* and *perceived* quality. Determined quality refers to the technical, measurable and verifiable quality of products, processes and quality controls. Perceived quality refers to the consumers' value judgments or perceptions of quality which involves *intrinsic* product attributes like colour and fat content as well as *extrinsic* product attributes such as the meat's cut. Consumers' quality perceptions of meat have traditionally been based on intrinsic cues because fresh meat is largely an unbranded product (Grunert, 2006). Traceability is an essential tool for ensuring both production and

product quality and represents an effective means for boosting consumers' perception of a food's safety and quality (Bertolini, Bevilacqua and Massini, 2006).

**Safety.** The meat industry faces public negativity, due to the association of meat consumption with certain risks to human health (heart disease in particular) and safety scares. The main risks, as perceived by consumers, are chemical residues of growth hormones and antibiotics, used during the meat production process, the fat content, microbial infections (salmonella, Escherichia coli), dioxins and the resulting danger of food poisoning, the use of genetic modification in the production of animal feed as well as Bovine spongiform encephalopathy (BSE) (Sofos, 2008). Consumers are thus starting to look for signs and certification that guarantee the safety of food and will reassure them that it is safe for consumption. Traceability is viewed as a potential risk management tool for public health purposes (Van Rijswijk, *et.al.*, 2008) as it provides consumers with targeted and accurate information.

**Origin.** Agricultural products have specific geographic origins. Consumers differentiate between products from different countries or areas, a phenomenon known as the country-of-origin effect. This effect is rooted in the image the consumer has of the quality of specific products, to the point where consumers may use origin as a cue for determining product quality, either alone or in conjunction with other product information. The grazing plants from the Karoo and Karoo-like regions impart herbal and musty attributes to meat from sheep breeds of these regions and distinguish the lamb/mutton as meat-of-origin. These provide the product with a distinctive taste that represents the flavour of the area and gives it certain unique characteristics.

## **Methodology**

### ***Participants***

Respondents for the electronically conducted conjoint analysis were recruited with the assistance of a marketing research firm, Consulta Research (Pty) Ltd based in Centurion, located in the province of Gauteng, South Africa. A total of n = 1011 questionnaires were distributed electronically during October and November 2009 to individual consumers who differed with regard to age, sex, nationality, wealth and social status. Of these n = 608 completed questionnaires were retrieved. The response rate was therefore 60,14%. Of these only n = 352 completed

questionnaires were useful (34,9%) because the only precondition for inclusion in this research project was that respondents had to be actual buyers and consumers of lamb as a meat product. This would ensure that participants would be in a position to provide valid answers to and opinions about the questions on the product under investigation.

**Procedure**

Three different data collection methods were used: semi-structured interviews, focus group discussions and conjoint analysis. The semi-structured interviews and focus group discussions were used to identify the product attributes and attribute levels relevant to consumers in their decision making about purchasing and consuming lamb. As several steps are necessary when conducting conjoint analysis, the first step was to select the relevant Karoo lamb attributes and the next to determine the attribute levels. Selecting the wrong attributes would result in an incorrect understanding of consumer decision making and an invalid measurement of the values which consumers attached to the decision factors. All the participants were presented with the same set of trade-off questions in a pair-wise comparison.

Example 1: Question format

When you have to choose between two options of lamb to buy, which of the following would you prefer?

- Lamb that has no traceability information
- and originated from a national region (e.g South Africa)
- where the quality is assured through certification
- knowing that the safety is not guaranteed
- and I am willing to pay 7.5% MORE than the current price/kg

or

- Lamb that is traceable to the processing plant
- and originated from a specific region in the country (e.g Karoo lamb)
- where the quality is assured through origin
- knowing that the safety is guaranteed through certification
- and I am willing to pay 10% LESS than the current price/kg

Strongly Prefer Left ————— Somewhat Prefer Left ————— Indifferent ————— Somewhat Prefer Right ————— Strongly Prefer Right

## Results and discussion

### *Product attributes and attribute levels*

**Table 1** Product attributes and attribute levels

<b>Attributes</b>	<b>Attribute levels</b>
Traceability	Trace to animal Trace to birth farm Trace to abattoir Trace to processing plant No trace
Origin	Origin: Local region Origin: National (SA) Origin: No region Origin: Specific region (Karoo)
Quality	Quality through certification Quality through labelling/branding Quality through origin Quality not assured
Safety	Safety through certification Safety through labelling/branding Safety through place of purchase Safety not guaranteed No safety knowledge
Price	10% more 7.5% more 5% more 2.5% more Same price 2.5% less 5% less 7.5% less 10% less



The attributes of Karoo lamb as a product had to be critical factors affecting consumers' purchasing decisions and were selected accordingly. The product attributes were identified during the focus group discussions.

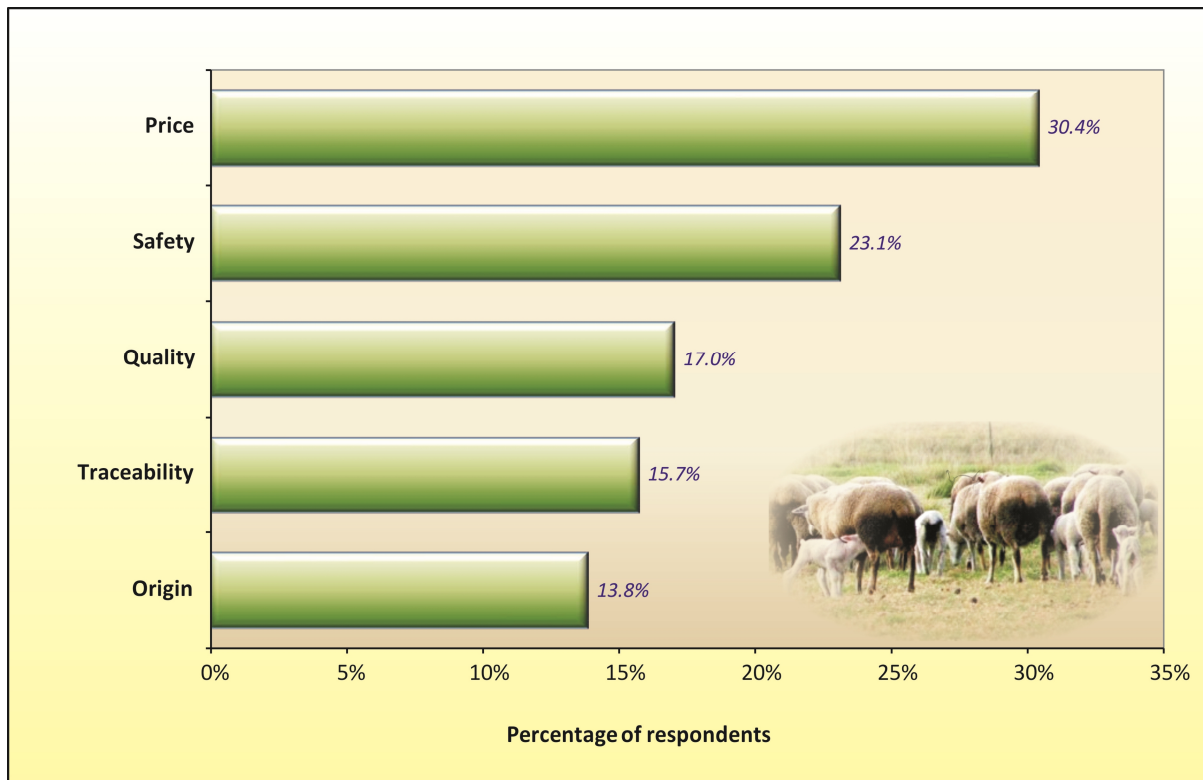
### ***Importance of product attributes***

Consumers generally do not consider each attribute of a food product singly or independently when making a purchasing decision. Through conjoint analysis it was possible to indicate what combinations of attribute levels were ranked the highest. Moreover, the relative importance of each attribute and attribute level could be identified, because in real life when asked to do so, consumers might find it difficult to indicate which attribute they consider of value or how they combine the attributes to form their overall opinion.

Data analysis revealed that the impact of price on the purchasing decision of consumers was 30.4%. Price was therefore the most important attribute in consumers' choice. Lichtenberg, Heidecke and Becker (2008) provided three possible reasons for the reluctance of consumers to pay higher prices for the attribute traceability. First, consumers increasingly have concerns about food products but not at the levels at which they would be willing to pay extra. Second, consumers do not necessarily think that traceability is sufficient to guarantee food safety or quality. Third, consumers regard food traceability as a basic obligation from producers and retailers and thus feel under no obligation to pay a premium price for it. Price is often known to be one of the most important and determining factors in the consumer's decision making process. According to Brijball (2003) a higher price is often associated with better quality or safety and therefore paying a higher price can be seen as paying for a meat product of better quality.

Safety was the second most important attribute and it was found effective in the purchasing decision at 23.1%. Credence attributes such as food safety have become increasingly important to consumers due to food scares and contaminated products (Donnelly, Karlsen and Olsen, 2009; Shackell, 2008). The third most influential attribute in terms of the purchasing decision was quality (17.0%). The fourth most influential attribute, namely traceability, affected the purchasing decision with a score of 15.7%. Traceability systems can facilitate the provision of quality signals to consumers (Hobbs, 2003). The results of this study have indicated that

perceived quality played a relatively important role in consumers' decision making. The next attribute, namely origin (13.8%), showed that origin had a negative influence on consumers' purchase decision. Figure 1 summarises the importance of each individual attribute.



**Figure 1** Importance of each product attribute

### ***Importance of product attribute levels***

In evaluating products, consumers will always make trade-offs. A consumer may like the quality and safety feature of a product like Karoo lamb, but may reject the price and thus refrain from purchasing it. In this case, cost has a high utility value. Utility can be defined as the value that consumers place on an attribute, that is, the relative “worth” of the attribute. A low utility indicates less value and a high utility indicates more value. The attribute level, which has the highest part-worth, is the most preferred alternative. In conjoint analysis, the difference between attribute levels, level, represents the impact the attributes have on consumer preferences. In this study the attribute importance and part-worth or weighted utility values of attribute levels were calculated per individual for each of the selected scenarios. A utility level

**Table 2** Attribute relative importance

<b>Attribute</b>	<b>Attribute levels</b>	<b>Attribute relative importance (%)</b>	<b>Attribute level utility value</b>
1. Traceability	Trace to animal	15.7	-0.001
	Trace to birth farm		0.075
	Trace to abattoir		0.031
	Trace to processing plant		0.001
	No trace		-0.106
2. Origin	Origin: Local region	13.8	0.003
	Origin: National (SA) region		-0.052
	Origin: No region		-0.070
	Origin: Specific region (Karoo)		0.118
3. Quality	Quality through certification	17	0.089
	Quality through labelling/branding		0.049
	Quality through origin		0.054
	Quality not assured		-0.193
4. Safety	Safety through certification	23.1	0.162
	Safety through labelling/branding		0.063
	Safety through place of purchase		0.144
	Safety not guaranteed		-0.181
	No safety knowledge		-0.188
5. Price	10% more	30.4	-0.118
	7.5% more		-0.103
	5% more		-0.084
	2.5% more		-0.036
	Same price		-0.033
	2.5% less		0.040
	5% less		0.135
	7.5% less		0.138
	10% less		0.061

from one attribute cannot be compared to the utility level associated with another attribute. Therefore, the negative utility values for price have no significant relation in comparison to the utility values of the other attributes. Each utility value should

therefore be compared only within its own attribute. The utility values for each attribute level are shown in Table 1.

Table 2 shows that the respondents' main preference was for lamb meat that could be traced back to the farm where the lamb was born. Second in importance was lamb meat traced back to the abattoir and the least preferred was lamb meat that could not be traced. Traceability to the birth farm, abattoir and processing plant had positive utility levels while traceability to the animal and no traceability had negative utility values. Furthermore, the respondents most preferred the lamb meat that originated from a specific region, in this case the Karoo. This was followed by the "local region", then "national region" and least preferred was the lamb meat from no specific region.

According to the utility values for quality, the respondents strongly preferred the lamb meat with "quality through certification". This is clearly shown by a utility value of 0,089. The second most preferred was "lamb meat with quality through origin", followed by "quality through labelling/branding" and least preferred was lamb meat with "quality that was not assured". The utility values for safety showed that the respondents preferred lamb meat with "safety through certification", followed by "safety through place of purchase" (utility value of 0,144) and then "safety through labelling/branding". The last two levels for safety, namely "safety not guaranteed" and "no safety knowledge", were both negative and did not vary much. The utility values for price indicated that the respondents preferred the price level to be 7.5% cheaper for the lamb meat, followed by the price level that was 5% lower. Least preferred was the price level that was 10% higher for the lamb meat.

### ***Simulation findings***

Conjoint analysis was done in the final stage which provided the opportunity to conduct computer choice simulations. Conjoint simulators are directional indicators, which can provide much information about the relative importance of features and consumers' preferences for products. Simulation analysis models are used to estimate choice or market share based on respondent preferences for different "simulated products" each of which is defined by specifying a set of selected attribute levels. Looking only at average preferences (part-worth utilities) can mask important market forces caused by patterns of preference at the segment comprising individuals.

The simulator is used to convert raw conjoint (part-worth utility) data into something much more useful: simulated market choices. Products can be introduced within a simulated market scenario and the simulator reports the per cent of respondents projected to choose each. Knowing how important or valuable each profile is, can be useful when wanting to know the best combination. The results of market simulators are easy to interpret because they are scaled from zero to one hundred. And, unlike part-worth utilities, simulation results (shares of preference) are assumed to have ratio scale properties – it is legitimate to claim that a 40% share of preference is twice as much as a 20% share. ‘What if’ simulations can thus be modelled and answers obtained. With the simulation tool the researcher was able to test alternative product scenarios as illustrated in Tables 1 and 2. Various simulations can be run by changing the levels to find the optimum importance and preference of each profile.

Table 3 illustrates two simulations based on assumptions made specifically for the product Karoo lamb.

**Table 3** Attribute simulation tool for Karoo lamb – example one

<b>Base Case</b>	<b>Simulation 1</b>	<b>Simulation 2</b>
No trace	Trace to birth farm	Trace to birth farm
Origin: No region	Origin specific region Karoo	Origin local region
Quality not assured	Quality through origin	Quality not assured
No safety knowledge	No safety knowledge	Safety through place of purchase
Same price	Same price	Same price
	<b>82.4%</b>	<b>81.8%</b>

The profile score obtained from simulation 1 was higher than that of simulation 2 in Table 3. Two attribute levels, namely ‘trace to birth farm’ and ‘same price’ were similar in both simulations. One could then change the levels for a

specific attribute category and see the potential impact of the change. The price attribute level was changed in simulation 3 from 'same price' to 'price 5% more'. Table 3 illustrates the effect of change on the simulation and indicates that consumers were extremely price sensitive.

**Table 4** Attribute simulation tool for Karoo lamb – example two

<b>Base Case</b>	<b>Simulation 3</b>	<b>Simulation 4</b>
No trace	Trace to birth farm	Trace to birth farm
Origin: No region	Origin specific region Karoo	Origin specific region Karoo
Quality not assured	Quality not assured	Quality not assured
No safety knowledge	Safety through place of purchase	Safety through place of purchase
Same price	Price 5% more	Same price
	<b>80.1%</b>	<b>86.1%</b>

In Table 4 the profile score obtained from simulation 3 was now lower than that of simulation 4. The tool therefore indicated that the product Karoo lamb as simulated in simulation 4 was valued higher (86.1%) as the product in simulation 3 had gained a higher preference among the respondents.

## **Conclusion**

Conclusions drawn were based on the quantitative approach and qualitative techniques that were employed in the study. A consumer perspective was used as the point of departure. For this research the electronic conjoint analysis was the principle method of data collection. The analysis of the data and interpretation of the results were done in accordance with the objectives set for the study. The analysis allowed the researcher to determine which product attributes created most value for the consumers and how consumers were likely to react to different product configurations. Value to a consumer is created by any product attribute which motivates the consumer to buy the product.

The outcomes of this conjoint analysis study provided not only useful information about the importance of traceability in general, but also provided additional information about the relative importance, that is, the utility of information about various product characteristics such as the region of origin, traceability, safety and quality that might be associated with this particular meat product, namely Karoo lamb. The focal attribute in the study was traceability. Price was identified as the most important attribute in determining consumers' choice of lamb meat regardless of gender, age, education, culture or product knowledge. The results showed that the impact of price on the purchasing decision was the highest, followed by safety and lastly place of origin.

The results showed that the respondents' strongest preference was for lamb meat that could be traced back to the farm where the lamb was born. Traceability to the birth farm, abattoir and processing plant had positive utility levels while traceability to the animal and the no traceability category had negative utility values. As the utility value can be defined as the relative "worth" of the attribute, a high utility indicated more value. Furthermore, the respondents had the greatest preference for lamb meat that originates from a specific region, in this case the Karoo. According to the utility values for quality, the respondents strongly preferred lamb meat of quality indicated through certification. The utility values for safety show that the respondents preferred lamb meat with safety through certification. The utility values for price indicated that the respondents clearly preferred the price level 7.5% less for the lamb meat, followed closely by the price level 5% less.

In addition to providing information on the importance of product features, conjoint analysis provided the opportunity to conduct computer choice simulations. The simulator was used to convert raw conjoint (part-worth utility) data into something much more manageable and useful for simulating market choices.

## **References**

BERTOLONI, M., BEVILACQUA, M. & MASSINI, R. (2006) FMECA approach to product traceability in the food industry. *Food Control*, **17**, 137-145.

BRAMLEY, C., BIENABE E. & KIRSTEN, J. (2009) The economics of geographical indications: Towards a conceptual framework for geographical indication research in developing countries. *The Economics of Intellectual Property*, January, 109-138.

BRAMLEY, C. & KIRSTEN, J.F. (2007) Exploring the economic rationale for protecting geographical indicators in agriculture. *Agrekon*, **46**, 69-93.

BRIJBALL, S. (2003) The level of importance attached to price and quality in purchasing behaviour. *South African Journal of Industrial Psychology*, **29**, 93-99.

COFF, C., KORTHALS, M. & BARLING, D. (2008) "Ethical traceability and informed food choice" in Coff, C., Barling, D., Korthals, M. & Nielsen, T. (Eds). *Ethical Traceability and Communicating Food: The International Library of Environmental. Agricultural and Food Ethics*, **15**, 1-22.

DONNELLY, K.A., KARLSEN, K.M. & OLSEN, P. (2009) The importance of transformations for traceability – A case study of lamb and lamb products. *Meat Science*, **83**, 68-73.

ESPEJEL, J., FANDOS, C. & FLAVIAN, C. (2007) The role of intrinsic and extrinsic quality attributes on consumer behavior for traditional products. *Managing Service Quality*, **17**, 681-160.

GRUNERT, K.G. 2006. Future trends and consumer lifestyles with regard to meat consumption. *Meat Science*, **74**, 149-160.

HOBBS, J.E. (2002) Consumer demand for traceability. *International Agricultural Trade Research Consortium*, December, 15-17.

KIRSTEN, J. (2006) For the good name of Karoo lamb. *Business Day*, 24 April 2006.

KIRSTEN, J., TROSKIE, D., VERMEULEN, H., SCHONFELDT, H. & BRAMLEY, C. (2008) The potential for Karoo Lamb as origin based meat and a Geographical



Indication. Research report. Department of Agricultural Economics and Rural Development. University of Pretoria. South Africa.

KUZNESOF, S., TREGGAR, A. & MOXEY, A. (1997) Regional foods: A consumer perspective. *British Food Journal*, **99**, 199-206.

LICHTENBERG, L., HEIDECKE, S.J. & BECKER, T. (2008) Traceability of meat: Consumers associations and their willingness-to-pay. 12<sup>th</sup> Congress of the European Association of Agricultural Economists – EAAE.

SHACKELL, G.H. (2008) Traceability in the meat industry – the farm to plate continuum. *International Journal of Food Science and Technology*, **43**, 2134-2142.

SCHIFFMAN, L.G. & KANUK, L. (2007) *Consumer Behaviour*. 9<sup>th</sup> Ed. Pearson Prentice Hall. New Jersey.

SMITH, G.C., TATUM, J.D., BELK, K.E., SCANGA, J.A., GRANDIN, T. & SOFOS, J.N. (2005) Traceability from a US perspective. *Meat science*, **71**, 174-193.

SOFOS, J.N. (2007) Challenges to meat safety in the 21<sup>st</sup> century. *Meat Science*, **78**, 3-13.

VAN RIJSWIJK, W., FREWER, L.J., MENOZZI, D. & FAIOLI, G. (2008) Consumer perceptions of traceability: A cross-national comparison of the associated benefits. *Food Quality & Preference*, **19**, 452-464.

VERBEKE, W. (2001) The emerging role of traceability and information in demand-oriented livestock production. *Outlook on Agriculture*, **30**, 249-255.