Trade-offs in the formation of consumer purchase intentions with regard to complex genetically modified products

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Abstract

Consumers' product choices are increasingly influenced not only by the attributes of the products themselves, but also by characteristics of the way in which the product have been produced, including factors like origin, working conditions, and production technology. Genetic modification (GM) is a production technology whose application to the food domain is highly controversial to consumers in many parts of the western world. The research investigates consumer reactions to applications of genetic modification to produce enzymes that result in improved performance of target products, both at consumer and producer level, by means of a conjoint study comprising 1,200 respondents in three European countries. Results show the nature of the enzymatic production method (GM or non-GM) to override both price advantages and product and process benefits. This indicates that at present the successful marketing of products manufactured by means of genetic modification is contingent on consumer acceptance of genetic modification as such, and only secondarily on the obtained benefits.

Keywords: consumer decision-making, genetic modification, conjoint analysis

Introduction

Consumers' product choices are increasingly influenced not only by the attributes of the products themselves, but also by characteristics of the way in which the products have been produced. Many consumers have developed a liking for some production methods, e.g. organic production (Magnusson *et al.*, 2003; Saba & Messina, 2003), and a dislike for others, the most notable example in western countries these years being the application of genetic modification to food production (Bredahl, 1999, 2001; Gaskell, Allum & Stares, 2003; Sparks, Shepherd & Frewer, 1994).

From a managerial perspective, this raises not only the issue of how to deal with those preferences for and against certain production methods, which consumers already have developed, but also the issue of how attitudes to production methods interact with perceptions of the benefits obtained to determine consumer purchase behaviour. It seems that consumers form attitudes with regard to the use of genetically modification in foods rather quickly in a combination of bottom-up and top-down processes once they have become aware of its application (Scholderer & Frewer, 2003). Marketers, however, need to go one step further also understanding how perceived benefits, costs and the applied production technology interact in determining consumers' purchase decisions.

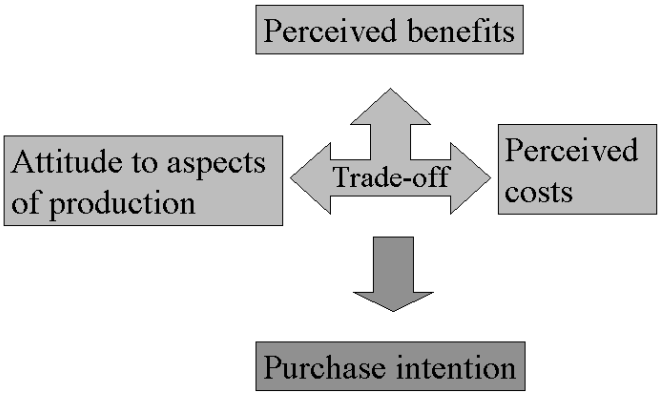
Understanding trade-offs in the formation of purchase intentions with regard to complex genetically modified products is the topic of this paper. The example used in the empirical study is how consumers form purchase intentions with regard to the use of genetic modification in the production of enzymes used as ingredients in food production. Previous research has shown consumers to generally hold rather negative attitudes towards the application of genetic modification in food production (Bredahl, 1999, 2001; Bredahl, Grunert & Frewer, 1998; Magnusson & Hursti, 2002; Saba & Vasallo, 2002). The application of GM enzymes is a highly complex issue, however, given that average consumers have only vague ideas about what enzymes are, how they are produced by traditional means and what they may be used for. At the same time GM enzymes are met with substantial interest among producers, and it is the type of issue that easily could become the focus of public debate, especially through adjusted, and stricter, labelling regulations.

Theoretical Approach

The theoretical basis is the cognitive paradigm in which consumer attitudes and consumer behaviour are explained by expectancy-value-type models such as Fishbein's multi-attribute attitude model (Fishbein, 1963) and The Theory of Reasoned Action (Ajzen & Fishbein, 1980). In this type of model consumer attitudes towards a product are expressed by the sum of attitudes towards individual attributes of the product, and behaviour is regarded as determined by behavioural intentions that are determined by these attitudes and perceived social pressure.

In a purchase situation consumers usually make *trade-offs* between different attributes associated with the product (Peter, Olson & Grunert, 1999). When purchasing a product produced by means of methods that have the high awareness among consumers, such as genetic modification, the attitude towards the production method applied is likely to influence purchase intentions together with factors such as perceived costs (monetary and other) and perceived benefits of the product. The relations are shown in figure 1.

Figure 1. Trade-Offs in Forming Purchase Intentions with Regard to Products Produced by Production Methods with High Consumer Awareness



In-depth insight into these trade-offs is not obtained by compositional approaches such as the traditional ways of measuring and estimating behavioural intentions in a Theory of Reasoned Action-type framework (see e.g. Ajzen & Fishbein, 1980). Instead, a de-compositional approach is called for.

Although resting on the expectancy-value approach, conjoint analysis represents such a de-compositional method. In conjoint analysis, respondents are shown a number of product profiles where attributes are combined according to a factorial design so that the factors become orthogonal and their effects on the dependent variable (e.g. preference or choice) can be separated (Green & Srinivasan, 1990; Louviere, 1994). In the analysis, dependant variables are explained by utility functions associated with the different levels of the factors forming the conjoint design (part-worths) and relative importance values of each factors. The utilities determine how influential each factor is for consumer evaluations. The higher the utility, the more important the factor level for determining the dependent variable. The relative importance values illustrate the significance of each factor, overall, to the dependent variable and add up to 100 per cent. Here, too, higher values indicate greater significance.

Consumer acceptance of genetic modification has previously been shown to depend significantly on the extent to which the application is associated with product or process benefits (Frewer *et al.*, 1997b). At the same time consumer attitudes towards genetic modification have been shown to differ significantly with the type of organism that is being genetically modified, with GM microbes generally being more acceptable than GM plants, not to speak of GM animals or genetically modified human material (Frewer *et al.*, 1997a; Heijs & Midden, 1995). Genetically modified foods, which are labelled as such, are, however, only rarely seen on the market.

Building on this knowledge, an empirical conjoint study was conducted to investigate the trade-offs which consumers make among different enzyme production methods (GM and non-GM), price and obtained product and process benefits in relation to the purchase of food products.

Design of the Study

The study comprised 1200 respondents from three countries (Finland, Germany and Italy), and included three product examples (bread, ice cream and pasta). Respondents were selected on a nationally representative basis with quotas for age and gender and from a number of sample points. All 1,200 respondents are responsible or co-responsible for shopping and cooking in their own household and consume bread, pasta and ice cream (during summer) at least once a month. Furthermore, all respondents have heard of gene technology.

The design comprised four attributes: production method (four levels; enzymes from plants, enzymes from micro-organisms, enzymes from GM plants, enzymes from GM micro-organisms), price (three levels; average market price –25%, average market price, average market price +25%; translated to real prices), product benefits (two levels; present, not present) and process benefits (two levels; present, not present). The +/- 25% price ranges were used to pave the way for significant price effects. Respondents were shown 16 profiles from an orthogonal design (within-subjects, reduced design) covering information about price, benefits and enzyme production method. The nature of enzymes and the four enzyme production methods were described in detail

immediately before the conjoint task (written information). Purchase intentions were measured on a seven-point scale anchored by 1 'I would definitely not buy this product' and 7 'I would definitely buy this product'.

Profiles of the target products were each constructed to display realistic process and product benefits obtained through the use of enzymes. For bread, product benefits were preservation of soft crumbling and longer shelf life, while the process benefit was greater tolerance of the dough to variations in mixing and rising time. For ice cream, product benefits were low fat along with a creamy and smooth texture and slower melting. Process benefits were higher quality and more stable quality of the raw materials used. For pasta, product benefits were a higher content of fibres and greater nutritional value along with improved cooking qualities, while the process benefit was a simpler production process because of a reduced need for additives.

Data were collected in the autumn of 2003 by means of personal in-home interviews.

Results

Analysis of the relative effects of the factors in the conjoint analysis show quite consistent results across products (adj. R^2s: bread: .99 (P<.0000); ice cream: .99 (P<.0000); pasta: .99 (.0000)). In all cases, the enzymatic production method is by far the most important factor. Price is less than half as important, while the two benefit types have practically no effects on purchase intentions.

Table 1. Relative Importance Values and Utility Coefficients of the Conjoint Factors

Factor	Level	Bread	Ice cream	Pasta
Enzyme production method	*Relative importance*	*59.1%*	*58.7%*	*62.8%*
	Plants	1.24	1.23	1.35
	Microbes	0.34	0.33	0.31
	GM plants	-0.79	-0.84	-0.86
	GM microbes	-0.79	-0.72	-0.81
Product benefit	*Relative importance*	*10.3%*	*9.7%*	*8.8%*
	Present	-0.01	0.03	0.04
	Not present	0.01	-0.03	-0.04
Process benefit	*Relative importance*	*7.7%*	*8.3%*	*7.5%*
	Present	-0.02	0.04	0.03
	Not present	0.02	-0.04	-0.03
Price	*Relative importance*	22.8%	23.3%	20.9%
	Low (-25%)	0.23	0.27	0.18
	Average	0.02	0.01	-0.04
	High (+25%)	-0.26	-0.28	-0.18

The partial utility coefficients show that within the enzyme production methods the (traditional) non-GM plant method is the most favoured method in all three countries, whereas the two GM methods are the least preferred, with no significant differences detectable among them. There are no significant differences between the utility coefficients of the enzyme production methods among the three products either, meaning that the production method has the same effect on purchase intentions across products and benefits. Price is, however, slightly more important for ice cream and bread, while the enzymatic production method is attached more weight for the pasta product. The results are shown in table 1.

Results from a hierarchical cluster analysis show that, for each product, a segment of consumers that is positive towards the attributed product and process benefits may be identified. For these consumers the positive utilities of the product and process benefits outweigh the application of GM enzymes. The segment of positive consumers is, however, rather small (at a three-cluster solutions the size of the segment ranges from 9% to 19% across products).

Concluding Remarks

The study strongly indicates that the nature of enzyme production methods applied (GM or non-GM) has an overruling, and in the case of GM applications, discounting effect on consumers' purchase intentions. Hence, in the study, negative attitudes towards the two GM methods clearly outweigh both as much as a 25% price reduction and any immediate product or process benefits.

Somewhat surprisingly, consumers did not distinguish between product and process benefits, but discounted applying genetic modification overall, regardless of whether the benefits obtained were directed towards improving the efficiency of production processes or targeted directly at consumer-oriented quality improvements. It its noteworthy that this does not mean that GM applications need not consider consumer benefits, but rather that consumer benefits are a precondition for consumer acceptance of a production technology that consumers in most European countries would generally rather avoid in food production at all.

Clearly, the issues treated warrant more research before substantial conclusions can be reached. In addition, one limitation of the present study seems to be the underlying assumption of homogenous respondents. Future research will probably benefit from taking different consumer segments more explicitly into account.

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