CONSUMER ATTITUDES AND DECISION-MAKING WITH REGARD TO GENETICALLY ENGINEERED FOOD PRODUCTS – A REVIEW OF THE LITERATURE AND A PRESENTATION OF MODELS FOR FUTURE RESEARCH

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CONSUMER ATTITUDES AND DECISION-MAKING WITH REGARD TO GENETICALLY ENGINEERED FOOD PRODUCTS – A REVIEW OF THE LITERATURE AND A PRESENTATION OF MODELS FOR FUTURE RESEARCH

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PREFACE

This report is a task of a project with the title *Consumer Attitudes and Decision-Making with regard to Genetically Engineered Food Products* The project is funded by the European Commission through contract number FAIR-PL96-1667. Coordinator of the project is professor Klaus G. Grunert, The MAPP Centre at The Aarhus School of Business. Participating organisations are the Technical Research Centre of Finland; Oy Panimolaboratorio-Bryggerilaboratorium, Finland; Chr. Hansen A/S, Denmark; Universität Potsdam, Germany; ISIDA, Italy and Institute of Food Research, Great Britain.

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EXECUTIVE SUMMARY

1. Few studies have to date explained consumer attitudes and purchase decisions with regard to genetically engineered food products. However, the increased marketing of genetically engineered food products and the considerable concern that consumers seem to express with regard to the technology call for the development of a theoretical basis for research into these issues.

2. The aim of the paper is to present three models which we have developed to explain consumer attitudes, buying behaviour and attitude change with regard to genetically engineered food products. All three models build on established consumer behaviour theory and on existing and comparable research in the field.

3. Consumer attitudes toward genetic engineering in food products are explained in an attitude model that builds on Fishbein's multiattribute attitude model. The model deviates from Fishbein's model in a number of ways: there is an explicit distinction between perceived benefits and risks and between attitude towards product and process, outcome beliefs are targeted at different outcome groups, more general attitudes are included as additional determinants of attitudes, and the traditional outcome evaluation measures are replaced by standardised regression coefficients obtained by regressing attitudes, measured by global measures, on beliefs.

4. Consumer buying behaviour with regard to specific genetically engineered food products is explained in a behavioural intention model which uses Ajzen's Theory of Planned Behavior as its point of departure. In the model, behavioural intention covers both intentions to purchase and intentions to avoid a genetically engineered food product, and the model suggests perceived moral obligation,perceived difficulty and, through the attitude to behaviour factor, the person's attitude towards genetic engineering in food production in general as additional determinants of behavioural intentions.

5. How consumers' attitudes towards genetically engineered food products are affected by various information strategies is explained in an attitude change model, which integrates aspects of the Elaboration Likelihood Model and Social Judgment Theory. The model specifically takes into account the impact of source credibility and various informational factors, such as persuasive content of the information provided, on attitudes.

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BACKGROUND AND INTRODUCTION

Genetic engineering has been used as a production aid in the manufacturing of consumer goods such as medicine and detergents for several years. While, to date, these applications of gene technology have not been the centre of much consumer attention, the application of genetic engineering to food production has been met with considerably more concern – and opposition – by the public. Despite this, and despite the huge impact that consumer attitudes have on the food industry's possibilities of using gene technology in food production in the future, only a very limited number of research projects have tried to explain consumer attitudes and consumer purchase decisions with regard to genetically engineered food products.

This working paper is the first in a series that will continuously report results obtained in the EU-funded project *Consumer Attitudes and Decision-Making with Regard to Genetically Engineered Food Products*. Over a three-year period the project is aimed at investigating and gaining an understanding of

1) how consumers form attitudes towards the application of genetic engineering in food production,

2) how these attitudes interact with other factors in determining consumers' purchase decisions, and

3) how consumer attitudes and purchase intentions are affected by various information strategies about the risks and benefits of gene technology and its application to food production.

There is reason to believe that in general genetic engineering brings along more complex considerations among consumers than among food technologists and producers, who tend to regard genetic engineering mostly as just another production method in a whole range of new production technologies that can be used to increase the quality of food products and to make food production more efficient, as well as providing other advantages such as increased environmental friendliness (eg, Smink & Hamstra, 1994). Because of the few opportunities that most consumers have had so far to actually buy and consume genetically engineered food products, experience is limited. Attitude formation and decision-making is therefore likely to be complex and closely related to personal values. This potential complexity combined with the limited research into these relationships calls for the development of a theoretical basis for the subsequent empirical research in the project.

The aim of this working paper is to present three models which we have developed from established consumer behaviour theory, in order to explain consumer attitudes, buying behaviour and attitude change with regard to genetically engineered food products. [1]

1 Throughout the project we use the wording 'genetically engineered food products' as a general designation of foods and food ingredients which contain or consist of genetically modified material or which are produced from, but do not contain,genetically modified material.Thus, both genetically engineered tomatoes as such and any product containing genetically engineered tomatoes (eg, pizzas or ketchup) are considered genetically engineered food products. Equally, bread, beer, wine etc. made with genetically engineered yeast are regarded as genetically engineered food products, regardless of whether the final product contains the genetically modified organisms or not. Products containing enzymes or chemical compounds such as sugar or lecithin made by the use of gene technology are not covered by our definition.

Consumer attitudes will be explained in an *attitude* model that builds on Fishbein's multi-attribute attitude model (Fishbein, 1963) and other main principles of modern cognitive psychology. Consumer buying behaviour will be explained in a *behavioural intention model* where Ajzen's Theory of Planned Behavior (Ajzen,1985; 1988) serves as the major frame of reference. Changes in consumer attitudes, finally, will be explained in an *attitude change model* that takes established attitude change/information processing theory into account. The attitude model will aim at explaining consumer attitudes towards genetic engineering in food production in general, whereas the two subsequent models will focus on specific food products produced by means of genetic engineering (in the project, genetically engineered yoghurt and beer).

The three models are outlined below, following short reviews of existing and comparable research in the field.

CONSUMER ATTITUDES TOWARDS GENETIC ENGINEERING IN FOOD PRODUCTION

Previous research

As follows from the review below, we have only come across a handful of studies which have looked specifically into the determinants of consumer attitudes towards genetic engineering in food production.

Sparks, Shepherd and Frewer (1994) investigated consumer attitudes towards the use of gene technology in food production in a mail survey among British consumers (n=1499). The research was exploratory and used a standardised questionnaire which listed a variety of possible determinants of consumer attitudes. By means of hierarchical regression analysis perceived benefits, perceived risks, perceived needs, perceived improvements in the quality of life and ethical considerations were identified as significant determinants of attitudes. Generally, knowledge about gene technology was found to be very limited, and consumers tended to associate high risks and low benefits with the application of the technology to food production. The external validity of these results may, however, be somewhat flawed by the low response rate in the study (about 25%). In addition, attitudes are likely to change as products reach the marketplace.

Hamstra investigated consumer acceptance of genetically engineered food products and other food products made with the aid of modern biotechnology in three related studies. The studies used a simple model suggested by Hamstra to explain consumer acceptance of food biotechnology. Two determinants of consumer acceptance are put forward: consumer characteristics and product characteristics. Consumer characteristics are understood as demographic characteristics together with knowledge of and attitudes towards modern food biotechnology, whereas the other construct concerns consumer perceptions of individual products and their characteristics. In the first study, Dutch consumers (n=870) were interviewed about their attitudes towards the application of genetic engineering to food production and about their willingness to buy and consume nine different genetically engineered food products (Hamstra, 1991). The second study used means-end chain theory to further investigate these aspects in a number of focus group discussions (Hamstra, 1993), during which 20 different

food products manufactured by means of modern biotechnology, including genetic engineering, were discussed. The third study used a sample of Dutch consumers (n=423) to empirically test the model (Hamstra, 1995). Generally, these studies indicated that consumer acceptance of modern biotechnology in food production was determined by the consumers' subjective perceptions of the actual product characteristics, whereas demographic variables had little explanatory power. Perceived benefits were found to have a greater impact than perceived risks on consumer attitudes and acceptance. The relationship between knowledge of the technology and attitudes was also analysed,but no clear link could be found.

Kutznesof and Ritson (1996) used focus group discussions to explore consumer attitudes towards genetically engineered food products, with farmed salmon as the point of departure. Seven focus group discussions were conducted with British and Irish consumers. The results pointed to the existence of three different consumer types in relation to the acceptability of genetically engineered food products: 'refusers', 'undecided' consumers and 'triers', with the large majority of the consumers classified into the middle group, and the rest equally split between refusing and accepting the products. The authors concluded from the research that the acceptability of genetically engineered food products is likely to increase with use of products, perceived consumer-related benefits (as opposed to producer-related benefits), price consciousness, perceived increased product quality (primarily taste and naturalness), perceived purity of products (reduced use of chemicals) and perceived wholesomeness of the products. The acceptability was also found to depend on the type of product (more favourable attitudes in connection with fruits, vegetables and dairy products than meat and eggs).

A considerably larger number of studies have investigated consumer attitudes towards genetic engineering at a more general level.Most opinion polls (reviewed in for example Lemkow, 1993 or Zechendorf, 1994), the Eurobarometer studies and a number of other studies (eg, Borre, 1990a; 1990b) are examples of studies that have focused on consumer attitudes towards genetic engineering in general. Another group of studies have looked specifically into attitude differences depending on the target or field of application, such as food versus medicine and genetic engineering in plants versus animals or micro-organisms (eg, Frewer, Howard & Shepherd, 1997; Heijs & Midden, 1995; Hoban & Kendall, 1992). The potential use of these more general studies in this project appears rather limited. However, given the lack of studies with a narrower focus, our attitude model will also draw on results of this research. Generally, the studies point to low levels of public knowledge about genetic engineering, and to a general rejection of different applications of the technology by consumers. The support of genetic engineering in food has been found to be lower than when genetic engineering is applied to, for example, detergents or medicine (eg, Frewer & Shepherd, 1995).A clear differentiation in attitudes depending on the target of the gene technology has also been identified and consumers have been shown to be significantly more positive towards applying the technology to plants and micro-organisms than to animals or human genetic material (eg, Frewer, Hedderley, Howard & Shepherd, 1997). Finally, the Eurobarometer surveys have looked specifically at cross-national differences and have continuously found Danish, German and Dutch consumers to be the ones least supportive of genetic engineering in Europe (INRA, 1993; Marlier, 1992).

General conclusions resulting from previous research is complicated by the fact that the studies vary in methodology and level of abstraction. However, it remains clear that a sound theoretical frame of reference will have to be established before future research can be successful in explaining consumer attitudes towards genetically engineered food products. Such theory will have to deal with the relationship between perceived risks and benefits, and do so at a high level of specificity. How attitudes towards genetic engineering in food production are related to other more general attitudinal domains also remains unclear, as does the impact of consumer concerns and perceptions related to the process of applying gene technology as as well as the perceptions of benefits and risks related to specific products.

The attitude model

The model which we suggest for explaining consumer attitudes towards genetic engineering in food production will adopt a cognitive approach. The model will specifically build on Fishbein's multi-attribute attitude model,which states that a person's attitude towards an object, abstract or concrete, is determined by the sum of beliefs that the person has about the consequences or attributes of the object weighted by how they are evaluated (Fishbein, 1963).The model has been widely applied in consumer research, but a revision is obviously required in the present context.

It has been shown that a distinction between different *outcome groups* may be of relevance for attitudes towards genetic engineering (Frewer & Shepherd, 1995; Frewer, Howard & Shepherd, 1996b). This indicates that consumer attitudes towards genetic engineering in food production are not only based on the consequences that the technology is perceived to have for the person him- or herself, as claimed by Fishbein, but also on considerations of consequences for other groups in society, such as one's family, future generations or the environment. It may even well be that the beliefs underlying attitudes vary in strength depending on which outcome group the person has in mind. Thus, in empirical research on consumer attitudes towards genetic engineering in food production, the beliefs underlying attitudes should be explicitly related to key outcome groups so that the influences of each group on overall attitudes can be assessed.

Likewise, it has been shown that beliefs about the *risks and benefits* of genetic engineering are important determinants of attitudes (eg, Frewer & Shepherd, 1995; Hamstra, 1991, 1995). Generally, perceived risks can be considered to influence attitudes negatively, while perceived benefits can be assumed to influence attitudes in a positive direction. Perceptions of greater benefits allow a certain amount of risk to be compensated for in the minds of the consumers. To allow the weights of these two kinds of beliefs to be empirically assessed, we suggest an explicit distinction between beliefs about risks and beliefs about benefits associated with the application of genetic engineering in food production.

It seems reasonable to expect that consumer attitudes towards genetic engineering in food production are determined both by beliefs concerning the production *process* and by beliefs that relate specifically to the perceived quality of the resulting *product (*Frewer, Howard, Hedderley & Shepherd, 1997). In fact, it is highly probable that a person's attitude towards genetic engineering in food

production is determined both by the attitude that the person holds towards the use of genetic engineering in the production process and by the attitude that the person has towards the resulting genetically engineered food products, regardless of whether the production technology is directly traceable in the final product or not (eg, yoghurt produced with a genetically engineered starter culture, which is still present in the final product, versus beer brewed on genetically engineered yeast, which is not present in the final product).

More *general attitudes* held by the consumers can also be expected to influence attitudes towards the application of genetic engineering to food production. Previous research has indicated at least seven major attitude domains as possible determinants of attitudes towards genetic engineering in food production and in general. These are *perceived knowledge* about genetic engineering (Frewer, Howard & Shepherd, 1997), *attitude towards the environment and nature* (Frewer et al., 1997; Hamstra, 1995), *attitude towards science and technology* (Borre, 1990a; Hamstra, 1991; Sparks, Shepherd & Frewer, 1994), *food neophobia* (Pliner & Hobden, 1992), *trust in regulators* (Frewer, Howard, Hedderley & Shepherd, 1996), *interest in food production* (Hamstra, 1991), and *price sensitivity* (Kuznesof & Ritson, 1996). We hypothesise that these more general attitudes will significantly influence attitudes towards process and/or product, and in this way also overall attitudes towards genetic engineering in food production.[2] In addition, we regard it as highly likely that the consumers' perceptions of *personal control* over what they buy and eat will influence their attitudes towards genetic engineering in food production.

Finally, the proposed model takes into account the general critique of the multiplication principle in Fishbein's model that has been put forward by among others Schmidt (1973) and Evans (1991). They point to the fact that the covariances of the multiplicative composites based on belief strengths and evaluations are heavily dependent on the scales used to measure the underlying items, which causes problems in interpreting correlation and regression coefficients. To avoid this statistical problem, we suggest that belief strengths be measured directly and the direct assessment of outcome evaluations be replaced by standardised regression coefficients resulting from a regression of beliefs on the global measures of attitude. Since the beliefs will be interrelated, and in order to allow an estimation of the model by structural equation modelling using latent constructs, single beliefs may be replaced by belief factors, identified by means of principal components analysis.

To summarise, the suggested model for explaining consumer attitudes towards genetic engineering in food production deviates from Fishbein's model in six ways: an explicit distinction between perceived benefits and risks is included, a distinction between attitude towards product and process is made, outcome beliefs are specified for different outcome groups, more general attitudes are included as determinants of attitudes towards product and process, and the belief-based measures of attitudes will be weighted by standardised regression coefficients rather than direct evaluation measures.

A graphical presentation of the model can be seen in figure 1. More formally, the postulated relationships can be listed as follows:

2 In this case, it probably makes sense to subdivide 'trust in regulators' into trust in regulators at the European level,trust in regulators in one's own country, and trust in regulators in other countries.

$$A = w_1 A_{prod} + w_2 A_{proc}$$

$$A_{prod} = v_1 B_{prod} + v_2 R_{prod} + \sum_i u_i GA_i$$

$$A_{proc} = y_1 B_{proc} + y_2 R_{proc} + \sum_i u_i GA_i$$

$$B_{prod} = \sum_j \sum_k \beta_{jk} pb_{jk}$$

$$B_{proc} = \sum_j \sum_k \beta_{jk} cb_{jk}$$

$$R_{prod} = \sum_j \sum_k \beta_{jk} pr_{jk}$$

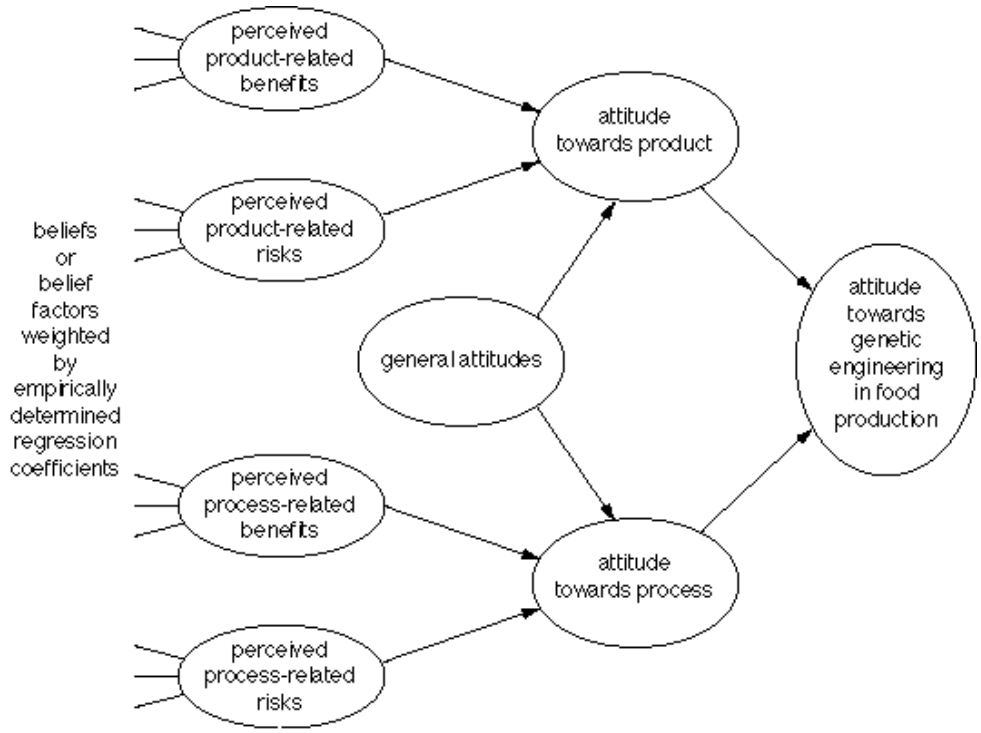
$$R_{proc} = \sum_j \sum_k \beta_{jk} cr_{jk}$$

where

A	= attitude towards the application of genetic engineering to food production
A_{prod}	= attitude towards product
A_{proc}	= attitude towards process
B_{prod}	= overall benefits of product
B_{proc}	= overall benefits of process
R_{prod}	= overall risks of product
R_{proc}	= overall risks of process
w,v,u,y,z,b	= empirically determined weights (standardised regression coefficients)
pb_{jk}	= strength of belief about product-related benefit *j* related to outcome group *k*
pr_{jk}	= strength of belief about product-related risk j related to outcome group *k*
cb_{jk}	= strength of belief about process-related benefit *j* related to outcome group *k*
cr_{jk}	= strength of belief about process-related risk *j* related to outcome group *k*
GA_i	= general attitude *i*

Demographic characteristics, lifestyle and other factors are assumed to influence attitudes only indirectly through the beliefs or through the more general attitudes held by the consumers.

Figure 1. Determinants of attitudes towards genetic engineering in food production



The model can be empirically tested by means of a survey. Multiple-item measures, possibly using semantic differential scales, should then be used to assess the global constructs A, A_{prod}, A_{proc}, B_{prod}, B_{proc}, R_{prod}, and R_{proc}. As far as possible measurement of the general attitudes GA should be based on established measurement instruments found in the literature. Strengths of the beliefs, pb, pr, cb, and cr, should be measured on Likert-type scales. The evaluation terms should not be measured directly, but inferred from standardised regression coefficients resulting from regressing beliefs, or belief factors, on the global measures of attitudes.

When analysing the data it may be relevant to distinguish between various groups of consumers. In the empirical estimation of the model, data on appropriate demographic characteristics and food-related lifestyle should be collected as well (Grunert, Brunsø & Bisp, 1997).

CONSUMERS' PURCHASE DECISIONS WITH REGARD TO GENETICALLY ENGINEERED FOOD PRODUCTS

Previous research

As with consumer attitudes towards genetic engineering in food production, only few studies seem to have investigated the determinants of consumers' decisions to purchase and eat, or not to purchase and eat, genetically engineered food products.

One such study is Sparks, Shepherd and Frewer's (1995) application of an extended version of the Theory of Planned Behavior to explain British consumers' behavioural intentions with regard to genetically engineered food products (n=334). Two intention measures were used: intention to "eat food produced by gene technology within the next 15 years" and intention to "support the use of gene technology in food production in the future". Multiple regression analysis showed attitudes to be an important determinant of both behavioural intentions, whereas perceived social pressure did not contribute to the explanation of either of the two. Perceived control and a measure of self-identity contributed marginally to the determination of intentions to eat genetically engineered food products but did not explain intentions to support the use of gene technology in food production in the future. Perceived moral obligation, finally, was a marginally significant antecedent of both intention measures, but was found to be so highly correlated with attitudes that the authors suggest perceived moral obligation as a direct determinant of attitudes and only indirectly of behavioural intentions with regard to genetically engineered food products. Taken together, the five hypothesised determinants of behavioural intentions explained 19% and 77% of the variance in the two intention measures. As the data were collected by means of a mail survey with a response rate of only 17%, some caution should probably be taken in more detailed interpretation of the results.

With both Tesser and Schafter's (1990) model of attitude-behaviour relationships and the Theory of Planned Behavior as starting points, Heijs and Midden (1995) investigated the impact of attitudes and perceived control on behavioural intentions in a sample of Dutch consumers (n=543), and did so with regard to ten different areas of application of modern biotechnology. Four of these examples dealt specifically with applications of genetic engineering in food production. Intention to buy each of the products was used as a measure of positive intentions, while intention to protest against each of the products was considered a measure of negative intentions. Intentions to purchase products made by the use of modern biotechnology were generally found to be low, as were intentions to actively protest against the products. From 25 to 50% of the variance in the positive intention measure was found to be explained by consumer attitudes, whereas this relationship was weaker for the negative intention measure with only from 5 to 25% of the variance explained.The contribution of perceived control to the determination of the two intention measures was generally found to be insignificant. This may, however, be due to the fact that the authors failed to ensure perfect accordance between the control and intention measures with regard to product and context such as is generally recommended (Ajzen, 1988).

A third study used conjoint analysis to investigate purchase decisions with regard to different kinds of novel cheese (Frewer, Howard, Hedderley & Shepherd, 1997). Product profiles for cheese produced by genetic engineering, protein engineering (a biotechnique that does not involve genetic engineering) and traditional breeding methods were developed and varied on a number of consumer and producer benefits, following a reduced factorial design. The experiment was carried out on a sample of British consumers (n=120) who were asked to state their purchase likelihood for each of the product profiles presented to them. Perceived consumer benefits turned out to be far the most important component of the consumers' purchase decisions, with some consumers attaching more importance to environmental benefits and some consumers emphasising nutritional and health-related benefits. Genetic engineering was generally regarded as the least favourable production technology of the three, but no independent influence of the production method on the purchase decisions was found, which indicates that, in the minds of the consumers, the perceived benefits generally compensated for the use of genetic engineering.

In a quantitative study on the influence of realistic product exposure on consumer attitudes towards genetic engineering in food, Frewer, Howard and Shepherd (1996b) investigated possible determinants of consumers' purchase likelihood (n=60). The study used 15 product examples (based on genetically engineered yoghurt,tomato, and chicken),each with different benefits attached. The results showed that in general the acceptability and stated purchase likelihood of the genetically engineered food products were significantly more influenced by the perceived benefits associated with the displayed products than by attitudes towards the technology overall. The perceived naturalness of the products also seemed to contribute to the purchase likelihood.

Again, the varying methodology and focus of the limited available research into the issue complicate the formation of general conclusions. A general characteristic of the studies is, however, that only moderate degrees of explained variance are obtained. It therefore makes sense to consider possible additional determinants of consumers' purchase behaviour with regard to genetically engineered food products.

The behavioural intention model

According to most behavioural scientists operating in the field of cognitive psychology, the best predictor of human behaviour is a person's conscious decision to perform the behaviour. Here, we apply The Theory of Planned Behavior to derive a model that can explain consumers' purchase intentions with regard to genetically engineered food products. The Theory of Planned Behavior states that a person's behavioural intention is basically determined by three factors: the *attitude* that the person holds towards the behaviour, the degree of *social pressure* felt by the person with regard to the behaviour, and the degree of *control* that the person feels he or she has over performing the behaviour (Ajzen, 1985; 1988). These three factors are, in turn, determined by a number of beliefs and how they are evaluated, following the principles of Fishbein's multi-attribute attitude model.

The Theory of Planned Behavior was originally developed to explain social behaviours, but has in recent years been successfully applied to explain aspects of consumer behaviour as well (eg, East, 1993; Taylor & Todd, 1995). It has also been demonstrated that the theory, or modified versions of the theory, is applicable to explain consumers' food choice (eg, Grunert, Sørensen, Bredahl & Nielsen, 1995; Thompson & Thompson, 1996, Connor, 1993). The low experience of consumers with genetically engineered food products to date together with the general complexity of the subject warrant a number of modifications to the Theory of Planned Behavior in its present application. These modifications are elaborated below.

Firstly the fact that consumers are not familiar with genetically engineered food products implies that they will find it difficult to imagine the types of products discussed and even more so to generalise in stating and explaining their purchase intentions. We believe that the predictive validity of studies on consumers' purchase decisions with regard to genetically engineered food products can be greatly strengthened by focusing on specific products rather than investigating purchase decisions with regard to genetically engineered food products in general.

Labelling of genetically engineered food products is the visible signal to consumers that a product is manufactured with the aid of genetic engineering. However, with the new EU standards for labelling, not all products manufactured with the help of genetic engineering will apparently have to be labelled. This means that with some products, consumers may not perceive an actual choice. We would therefore argue that The Theory of Planned Behavior should be used here not only to explain consumers' *conscious intentions to buy* genetically engineered food products, but also to explain consumers' *intentions to avoid* the products. Our suggestion is that the end points of the response scales for measuring behavioural intentions be labelled "would definitely avoid" and "would definitely buy". In this way the data would capture consumers who are not actively going to seek out genetically engineered food products, but who are not consciously going to try to avoid them either, and we would be able to distinguish between opponents and non-opinions in the analysis of the data.

The *attitude* that a person holds towards buying a genetically engineered food product is likely to be determined both by the perceived attributes and consequences of buying and consuming the product and by the attitude that the person has towards genetic engineering in food production in general. The relationship between the attributes and consequences of buying the actual product and the general attitudes held towards genetic engineering is hypothesised to be compensatory. This means that the model should allow a possibly negative attitude towards genetic engineering in food production to be offset by specific consequences of buying and consuming the product which the consumer regards as attractive.

Recent research by Sparks, Guthrie and Shepherd (1995, in press) dealing with applications of the Theory of Planned Behavior to consumer food choice has indicated that *perceived behavioural control* may actually be composed of two separate constructs, perceived difficulty and perceived control. Perceived difficulty would then cover factors embedded in the person such as skills and abilities, whereas perceived control would cover the effect of external factors, such as time and access, believed by the consumer to influence the degree of personal control over the behaviour in question. This distinction should be ex-

plicitly included in the model.The competence that a person feels he or she has in judging risks and benefits of a genetically engineered food product in a purchase situation is an important aspect of perceived behavioural control which can then be measured by the perceived difficulty construct along with other aspects of skills and abilities.

The component that measures social pressure, the *subjective norm*, will probably not have to be modified in the present context, and several normative groups will have to be considered as determinants of subjective norm.

Perceived moral obligation has also been shown to be a significant determinant of behavioural intentions in what has been termed 'moral situations' (eg, Gorsuch & Ortberg, 1983). Perceived moral obligation reflects personal norms, whereas subjective norm reflects the norms of others. The impact of perceived moral obligation on behavioural intentions has also been verified for food-related behaviours (Raats, Shepherd & Sparks, 1995) and specifically for behavioural intention with regard to genetically engineered food products (Sparks, Shepherd & Frewer, 1995). We suggest that perceived moral obligation be included as a fifth determinant of behavioural intention.

Finally, in the empirical estimation of the models, the problems of analysing multiplicative composites (Evans, 1991; Schmidt, 1973) will again be taken into consideration. As in the attitude model, all evaluation terms (evaluation of outcomes, motivations to comply, power of control factors etc) will be replaced by empirically assessed regression coefficients.

The suggested model is summarised in figure 2. Algebraically, the relationships can be listed as:

where

$$BI = w_1 AB + w_2 SN + w_3 PC + w_4 PD + w_5 PMO$$

$$AB = \sum_i \beta_i b_i + A$$

$$SN = \sum_i \beta_i n_i$$

$$PC = \sum_i \beta_i c_i$$

$$PD = \sum_i \beta_i d_i$$

$$PMO = \sum_i \beta_i m_i$$

BI = behavioural intention (purchase versus avoid)

AB = attitude to behaviour

SN = subjective norm

PC = perceived control

PD = perceived difficulty

PMO = perceived moral obligation

w_i = empirically determined weight (standardised regression coefficient)

A = attitude towards genetic engineering in food production (as determined by the attitude model

b_i = strength of outcome belief *i*

n_i = strength of social normative belief *i*

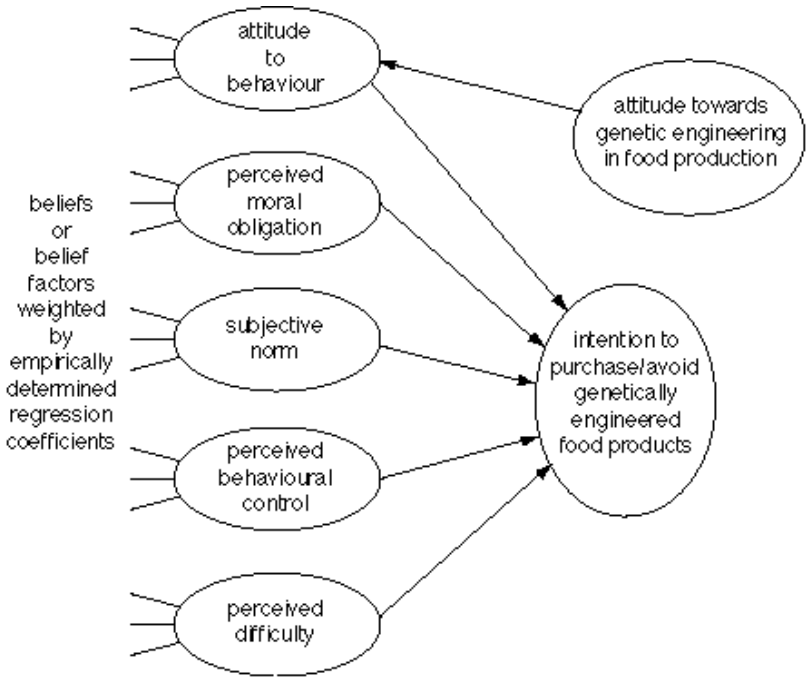
c_i = strength of control belief *i*

d_i = strength of difficulty belief *i*

m_i = strength of personal normative belief *i*

$ß_i$ = empirically determined weight of beliefs (standardised regression coefficient)

Figure 2. Determinants of consumers' purchase intentions with regard to a genetically engineered food product



Like the attitude model,the behavioural intention model can also be empirically tested by means of a survey. The global constructs BI,AB, SN, PC, PD and PMO should then be measured by multiple items, while the beliefs can all be assessed on single item measures and rated on Likert-type scales. One set of questionnaire items will have to be developed for each product example that is applied.

Again, information on demographic characteristics and food-related lifestyle should be included in the questionnaire so that group differences can be analysed.

CHANGES IN CONSUMER ATTITUDES TOWARDS GENETICALL Y ENGINEERED FOOD PRODUCTS

Previous research

How consumers' attitudes towards genetically engineered food products are affected by various information strategies about the risks and benefits of genetic engineering has previously been investigated both in an exploratory manner and in a few more systematic experiments.

The European Commission's initiative to conduct a number of focus group discussions with consumers in four European countries is among the more qualitative approaches. The general conclusion derived from this research is that consumers are generally interested in more information on genetic engineering, and that such information is more likely to lead to more positive attitudes when the information is objective and provided in clear language by sources that are regarded as reliable by the consumers (Lemkow, 1993).

This general result was reinforced and further elaborated in a study by Frewer, Howard and Shepherd (in press) on the impact of prior attitudes, source credibility and admission of risk uncertainty by the information source on British consumers' attitudes towards genetic engineering and its application to food production. The study used Social Judgment Theory as a point of departure. Through a mail survey (n=120), data were collected on initial attitudes and attitude changes provoked by the provision of mailed information attributed to different sources (consumer organisation, Government, government-collaborating consumer organisation) and with different levels of admission of uncertainty about the risks of the technology (high, low). Prior attitudes were identified as the most important determinant of subsequent attitudes, whereas the trust in the information source was found only to have a significant impact on the attitudes of consumers who had initially been negative towards genetic engineering. Admission of a certain amount of risk uncertainty by the information source appeared to increase trust in the attributed source among consumers with prior negative attitudes only.

Frewer and Shepherd (1994) adopted an experimental approach when they investigated how consumer attitudes towards genetically engineered food products were influenced by various informational material. 149 British consumers completed questionnaires on the perceived quality of various kinds of information provided to them, on perceived bias and attitude of the information sources (Government, consumer organisation, quality newspaper, no source attribution), and on attitudes towards genetic engineering in food products (after provision of the information). The results of the study showed no significant impact of either perceived attitude of the information source nor trust in the information source on consumer attitudes. Overall,the relationship between the information activities and consumer attitudes did not reveal a clear pattern. Some of the reasons for this may be the rather small sample size and the fact that no attempt was made to measure attitudes prior to the information provision, which reduces the possibilities of investigating attitude *changes* as such.

The impact of the credibility of information sources on consumer attitudes towards genetic engineering applied to food and agriculture in general was also

investigated in a third study by Frewer and her colleagues (Frewer, Howard, Hedderley & Shepherd, submitted). The study used the Elaboration Likelihood Model to collect data from 260 British consumers after the provision of information of varying persuasive content (high, low) and attributed to different information sources (Government, consumer organisation). Again, prior attitudes were not assessed. This study also demonstrated a significant impact of the credibility of the information source on consumer attitudes.

A number of projects, finally, have used an opinion survey-like methodology to explore consumers' use of and trust in selected information sources and information channels in connection with communication of information about the risks and benefits of biotechnology and genetic engineering. This research points to television, radio and newspapers as the information channels that are most often used by consumers, followed by discussions with other people and available informational brochures (INRA, 1993; Borre, 1990a; Heijs & Midden, 1995). Consumer organisations, environmental groups and (biological) researchers are generally seen as the most reliable information sources, whereas the industry typically scores very low on this dimension (eg, Borre, 1990a).

Despite these attempts to investigate the determinants of attitude change in relation to genetic engineering, the cognitive processes that may eventually lead to attitude change are complex, and more research into the issue is required. Such research should adopt a fully systematic and theoretically sound approach, and should also make sure to take prior attitudes into account.

The attitude change model

The attitudes that consumers currently hold towards genetically engineered food products can be assumed to change over time partly because of increased availability of genetically engineered food products, which results in increased experience, and partly as a result of increased knowledge about the technology.

Our attitude change model will consider possible ways of changing consumers' attitudes towards genetically engineered food products through providing information about the benefits and risks of genetic engineering. The model which we propose is based on existing attitude change/information processing theory and will be related to the two previous models by also adopting a cognitive approach, and will in addition concentrate on processes by which consumers react to messages under varying conditions.

We believe that the impact of information from various sources on consumer attitudes and acceptance is likely to be heavily influenced both by factors relating to the information itself (contents, style etc.) and by factors relating to the sender of the information (eg, industry, consumer organisation or Government). In the model presented here, particular emphasis will be put on the impact of the *credibility* of the message sender, the *substantial content* of the message/ information and the *execution*. The Elaboration Likelihood Model and Social Judgment Theory have provided the major input for the model.Both approaches have previously been applied in the context of consumer attitudes towards genetically engineered food products (Frewer, Howard, Hedderley & Shepherd, submitted; Frewer, Howard & Shepherd, in press).

The *Elaboration Likelihood Model* (Petty & Cacioppo, 1981, 1986a) deals explicitly with the impact of information on attitude change and basically posits that there are two routes to persuasion, the *central* route and the *peripheral* route. The central route involves in-depth processing of the incoming information, whereas the peripheral route utilises external cues surrounding the information to permit simple inferences about the merits of the content without recourse to complex cognitive processing. Use of the central or the peripheral route is assumed to depend on the recipient's motivation and ability to process the information. It is a model which acknowledges the importance of individual differences and the importance of such potential differences when messages are structured.

Key findings from the application of the Elaboration Likelihood Model are described as follows:

- Greater involvement in effortful information processing, ie use of the central route, is likely to occur when the recipient of the information deems it necessary (Eagly & Chaiken, 1993) – the effect is, however, prone to both individual and situational factors (Petty, Cacioppo & Schumann, 1983).

- One of the most important variables affecting the motivation to process a persuasive message is whether people expect the issue to have significant consequences for their own lives. When personal relevance of a message is increased, people become more motivated to process the issue-relevant arguments presented. Strong arguments are accepted more often when the motivation to process is high, and weak arguments are rejected more often (Petty & Cacioppo, 1986a).

- Attitude change is related to the extent to which the communicator is perceived to be stating the truth (Priester & Petty, 1995). Thus, a communicator perceived to be high in credibility will be regarded as being more truthful than one who is low in credibility. Persuasion or attitude change in the direction proposed by the information will be less likely to occur if the information is not seen as being truthful. A message communicated by someone promoting a particular vested interest, for example, is likely to be less persuasive than a message by someone who is perceived to be disinterested.

- High credibility is likely to facilitate central processing, whereas low credibility will act as an external cue resulting in peripheral processing. This is also known as communicator bias, linked to either "knowledge" (perception that the source is ill-informed about the "facts" and cannot provide accurate information) or "reporting" (perception that information is systematically distorted to promote a particular view) (Eagly, Wood & Chaiken, 1978). Source characeteristics can predict whether central or peripheral processing will occur (King, 1976; Liska, 1978).

- Frewer, Howard and Shepherd (1996a) have shown an interaction between source credibility and persuasive content in response to information about genetic engineering – there was a greater response to information low in persuasive content if it was attributed to a high credibility source, than to persuasive information if it were from a low credibility source. However, under these circumstances, respondents tended to express concern about the technology rather than agree with the positive messages included in the information.

In the case of genetically engineered food products, it is clearly important to facilitate in-depth or elaborative processing of information in order to try to get people to think about the issues under consideration, rather than to discount the information as irrelevant or untrustworthy. The issue is not about persuading people to accept the technology, but rather to allow them to make informed choices about acceptance and future development. The Elaboration Likelihood Model will be used here to systematically investigate the impact of source factors (credibility) and informational factors (substantial content and execution, eg, degree of persuasiveness).

Social Judgment Theory is an attributional approach describing mechanisms of attitude formation and change which can occur in the absence of argument-based processing (Sherif & Hovland, 1961). Attribution approaches emphasise how people's inferences about the cause of communicators' attitudinal statements affect their agreement with these statements. Social Judgment Theory emphasises how people's prior attitudinal statements affect their perceptions of the attitude positions that people express, and how these perceptions, in turn, influence agreement with persuasive communicators.

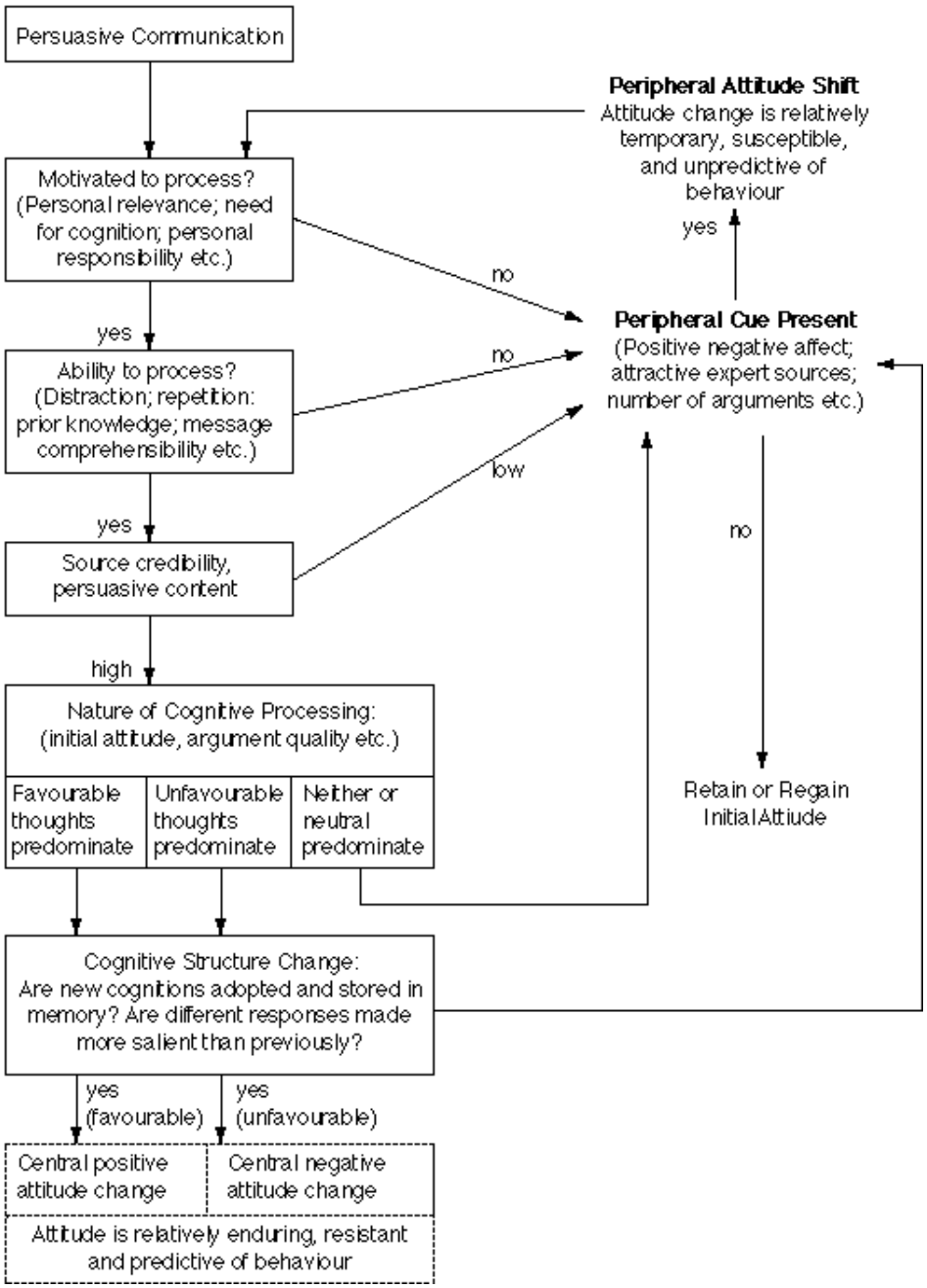
Source credibility and admission of uncertainty (found to increase information credibility and source credibility) have been identified as salient to this process.

Social Judgment Theory is primarily used to investigate the interactions between prior attitude and source credibility in terms of subsequent impact on attitude change and credibility of information source when prior attitudes are taken into account.

As with the behavioural intention model, we believe that the use of specific product examples will improve the quality of research on changes of consumer attitudes towards genetically engineered food products. This is partly due to the lack of experience of consumers with genetically engineered food products, and partly due to the diversity of benefits that genetic engineering can bring about in different applications in food production.

The proposed model for factors affecting attitude change, based on either central or peripheral processing, is shown in figure 3.

Figure 3. Determinants of attitude change and way of information processing



Adapted from Petty & Cacioppo, 1986b

The model should be tested in experiments with realistic product exposure. In the experiments consumers can then be exposed to various kinds of information under varying conditions. Information options focused on the specific product as well as information options focused on genetic engineering in general should also be considered. The experiments can be combined with measures of attitude and behavioural intentions, measured before and after exposure to the information.

When recruiting participants for the experiments, care will have to be taken that the individuals are in fact consumers of the product in question. In

addition, the persons should be screened for their attitude towards genetic engineering in food production and only consumers within the middle 80% of the attitude range should be recruited as subjects. The remaining 20% are not likely to be receptive to the information provided and change their attitudes.

The experiments should be conducted either as choice simulations or by means of a survey. In any case, attitudes should be measured both before and after provision of the information. Although, of course, there is a body of evidence to suggest that people will respond differently after the information intervention simply because the same questions are asked before and after information provision – a kind of "Hawthorne effect"! The consumers' *need for cognition* as well as a range of demographic measures should also be included. Need for cognition is thought to be indicative of individual differences in the consumers' tendency to engage in elaborative cognition between the different experimental conditions, as argued by Cacioppo and Petty (1982).

CONCLUDING REMARKS

So far there has only been limited research into how consumers form attitudes and make purchase decisions with regard to genetically engineered food products. In general the studies undertaken vary considerably in focus and methodology, and it seems impossible to derive general conclusions. It also seems that attitude formation and decision-making with regard to these products are so complex that it is necessary to actually develop a new consumer behaviour theory in order to obtain valid results in subsequent empirical research.

In this working paper, we have presented three models for explaining consumer attitudes, behavioural intentions and attitude change with regard to genetically engineered food products. All three models have adopted a cognitive approach and build on already established consumer behaviour theory.

The models will serve as the theoretical framework for empirical research among British, German, Italian and Danish consumers in the coming years.

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