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A CROSS-CULTURAL COMPARISON OF CONSUMERS' PURCHASE INTENTIONS WITH REGARD TO GENETICALLY MODIFIED FOODS

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Abstract

Consumers' purchase intentions with regard to genetically modified foods are investigated through a cross-national survey in Denmark, Germany, Great Britain and Italy, using beer and yoghurt as examples (n=1000 per product). Results show that generally cognitive structures of Italian consumers are not comparable with cognitive structures of consumers of the three other countries. In all cases, however, purchase intentions are strongly explained by consumers' overall attitudes towards genetic modification in food production.

Introduction

Genetic modification is increasingly used in the development of new foods. Generally, the use of genetic modification is widely advocated by food producers and food technologists, who defend the use of genetic modification in foods for financial as well as quality-related and environmental rea-sons. Consumers in many European countries have, however, been shown to be far less supportive of genetic modification, and particularly so of application in the food domain (European Commission, 1997; Frewer & Shepherd, 1995).

To date, only few studies have investigated consumers' purchase behaviour with regard to foods produced by means of genetic modification (hereafter called genetically modified foods). Based on a review of existing and comparable research in the field, Bredahl, Grunert and Frewer (1998) have proposed a model that explains consumers' purchase intentions through a cognitive approach with the Theory of Planned Behavior (TPB) (Ajzen, 1985; 1988) as its point of departure. TPB explains a behavioural intention by the person's attitude towards engaging in the behaviour, by perceived social pressure, in TPB called subjective norm, and by perceived control over performing the behaviour. The proposed model explains consumers' purchase intentions with regard to a genetically modified food product as a combination of attitudes towards purchasing the product (AB), subjective norm (SN), perceived control (PC), perceived difficulty (PD) and perceived moral obligation to avoid the product (PMO).

In TPB, a person's attitude towards engaging in a behaviour is seen as determined by beliefs about the outcomes of performing the behaviour weighed by the person's subjective evaluation of these expected outcomes. The same principle underlies subjective norm and perceived behavioural control, which are seen as determined by normative beliefs weighed by the person's motivation to comply with the opinions of these normative referents and control beliefs weighed by the power of the control belief, respectively. In empirical research using TPB, this is usually calculated by multiplying measures of belief strengths with measured weighing measures. After that the obtained composite measures are either added and correlated with global measures of the subconstructs or they are regressed on these global measures. In their model, Bredahl, Grunert and Frewer propose an omission of all weighing measures to heed the critique by among others Schmidt (1973) and Evans (1991), who emphasize that results based on such belief composites cannot be trusted because they are scale-dependent. Finally, the proposed model takes consumers' limited experience with genetically modified foods into account by suggesting consumers' overall attitudes towards using genetic modification in food production (OA) as an additional direct determinant of attitudes towards purchasing a specific, genetically modified product. A model overview is shown in figure 1.

FIGURE 1
Bredahl, Grunert and Frewer's (1998) Purchase Intention Model

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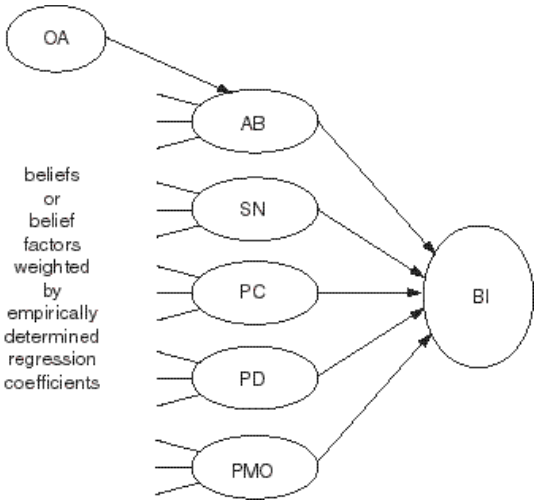


The present research seeks to validate and estimate the proposed model by investigating the purchase intentions of consumers in four European countries with regard to genetically modified yoghurt and beer, using a survey methodology.

Design of the Study and Data Collection

Respondents

Altogether, 2000 consumers were interviewed in Denmark, Germany, Great Britain and Italy. The populations of all of these four European countries have previously been shown to differ in acceptance of food biotechnology and food-related attitudes and behaviour (Askegaard & Madsen, 1995; European Commission, 1997), despite the common characteristics which the populations of these Western World cultures otherwise share.

Products

In each country, 250 respondents were interviewed about yoghurt produced with genetically modified starter culture and 250 respondents were interviewed about beer produced using genetically modified yeast. Prior to the interviews the respondents were shown product photos with basic product information. In the yoghurt case, it was stated that genetic modification had been applied to produce a fatfree full-flavoured product with a rich texture without the use of artificial additives. In the beer example, consumers were informed that genetic modification had been applied to produce a beer that did not require storage for maturation and which could therefore be said to be environmentally friendly due to energy saving. In the photo material, only the yoghurt product was labelled 'genetically modified', which is in compliance with the latest EU regulations.

Elicitation of beliefs and normative referents

Beliefs and normative referents, ie. important, other people who could be expected to influence purchase decisions, were elicited in a qualitative study conducted in the four countries using means-end chain theory and the laddering technique (Bredahl, in press). Nine outcome beliefs, two control beliefs, two difficulty beliefs and three moral beliefs were elicited for each product. One's family was elicited as the only normative referent in the case of yoghurt, while friends were elicited as the salient normative referent for the purchase of beer.

Questionnaire

The questionnaire began by an introduction to the applied response scales along with a brief description of the principles behind genetic modification.

Apart from omitting belief weighing measures, the formulation of questionnaire items and the applied measurement scales generally complied with the recommended structures for empirical research using TPB. All subconstructs were assessed by multiple global measures, which were practically identical across the two products. Individual beliefs were assessed by single-item measures, and were only to some extent identical across products. All items were measured on 7-point Likert-type scales.

Questionnaire translation

The questionnaire was developed in English and then translated into Danish, German and Italian by bilingual researchers. The translated versions were cross-checked by another group of bilingual researchers and were pretested in each country (n=30) to allow linguistic adjustments before the full-scale applications.

Data collection

Data were collected by personal in-home interviews in the autumn of 1998.

Results

Scale reliabilities were first calculated to assess the internal consistency of the applied scales for global measurement of subconstructs (scale reliabilities were not calculated for subjective norm as it was only covered by two items; these were, however, highly correlated in all

data sets). Results are shown in table 1. As can be seen, the scale reliabilities are generally satisfactory, but there are obviously some problems with the scale applied to measure perceived control and, though to a lesser extent, with the scale used to measure perceived difficulty. In addition, scale reliabilities are generally lower in the Italian data.

TABLE 1
Scale Reliabilities

	Denmark	Germany	The UK	Italy
BI	.95/.95[1]	.94/.91	.93/.90	.89/.86
AB	.94/.91	.94/.92	.93/.87	.69/.75
OA	.93/.93	.92/.92	.93/.91	.87/.80
PC	.22/.32	.13/.14	.24/.22	.44/.12
PD	.34/.15	.68/.55	.61/.64	.56/.54
PMO	.84/.83	.87/.84	.87/.75	.53/.67

[1] yoghurt data/ beer data

To identify the causes of the problems with the perceived control and perceived difficulty scales, the correlations of the items under each of the two scales were inspected. This revealed problems with the same difficulty item in all countries, and since also this item did not correlate as expected with the scales used for global measurement of the remaining subconstructs, the item was excluded from the subsequent analyses. The picture for the perceived control items was not as clear. All correlations were generally low, and the items were therefore retained as indicators of three separate perceived control subconstructs.

The mean scores of established purchase intention sum-scales verified the expected acceptance differences among the four countries, with German and Danish consumers as least inclined to purchase either of the two products, and British and Italian consumers as less averse, though not very inclined to purchase any of the products either.

The fact that data were collected in four countries made it necessary to pay special attention to the cross-cultural validity of the data, before estimating the determinants of purchase intentions in the four countries. Cross-cultural validity refers to the extent to which data collected by the same measurement instrument are comparable across the different cultural environments, in this case across countries. Thus, if our data are not cross-nationally valid, it makes no sense to look for universal models of purchase intentions or even to look for cross-national differences and similarities in the responses.

Factor invariance has often been suggested as a criterion of cross-cultural validity in cross-cultural research. Grunert, Grunert and Kristensen (1994) suggest using the degree of factor congruence across samples as a basis for discriminating among five levels of cross-cultural validity, using a multi-sample confirmatory factor analysis framework.

The lowest level of comparability they suggest is when the pattern of factor loadings is the same across the samples. They call this *minimal cultural comparability.* If the matrices of factor loadings are in fact identical across the samples, a higher level of comparability is obviously achieved, and this is what they call *weak cultural comparability.* In both of these instances the correlations of the various factors are free to vary among the samples as are measurement errors and actual scores on the individual items. Thus, in cases where weak cultural comparability has been obtained we can infer that we are tapping on the same cognitive categories in the various cultures, but we cannot be sure that cognitive processes are identical. The authors regard this as a minimum requirement in cross-cultural research. If the factors also correlate in the same way across the cultures investigated, a further criterion of cross-cultural validity has been obtained and the data can be said to fulfil the conditions of *strong cultural comparability.* According to the authors, this is normally the highest level of comparability that can be achieved in cross-cultural research that involves different language areas. The fourth level is *weak cultural identity*, which is when the measurement errors of the individual items are also the same across the cultures investigated. If also item scores are the same we have a case of *strong cultural identity* and cannot speak of different cultures.

Here, the cross-cultural validity of the scales was analyzed for the first three levels of cultural comparability by means of multi-sample confirmatory analyses in LISREL. The applicability of each level was evaluated by measures of overall fit provided by LISREL, notably the normed chi-square, which is technically just chi-square divided by degrees of freedom, the standardized root mean square residuals RMR, and the goodness of fit index GFI. For a model to be accepted, it is recommended that the normed chi-square should be below 3 (Carmines & McIver, 1981). Likewise, it is generally recommended that GFI should be at least .90, while RMR should be below .10 and not jump significantly if a more restricted model is to be accepted (Hildebrandt, 1983).

For both sets of data, results show that the data of the four countries do not even fulfil the requirements of minimal cultural comparability. The contribution of the individual samples to the overall chi-square shows that the Italian data contribute significantly more to the total chi-square than the data of any of the three other

countries. This suggested that the problem might lie with the Italian data. To investigate the comparability of the Danish, German and British data separately, new multi-sample confirmatory analyses were therefore run with these data only. This resulted in significant improvement in the overall fit measures and results suggest that at least weak cultural comparability holds for the Danish, German and British data for both products. The results are shown in tables 2 and 3.

TABLE 2
Results of Tests of Cross-Cultural Validity – Yoghurt Data

	Contribution to chi-square				Normed chi-square (χ2/df)	St. RMR	GFI
	DK	D	UK	I			
All four countries MCC	424	405	260	761	1850/590 = 3.14	.16	.71
WCC	427	413	269	802	1911/620 = 3.08	.17	.69
SCC	440	417	272	812	1940/641 = 3.03	.17	.68
DK, D, UK MCC	381	326	197	-	904/375 = 2.41	.043	.92
WCC	384	328	203	-	915/ 395 = 2.32	.045	.92
SCC	428	395	259	-	102/467 = 2.32	.063	.90
effective sample size	229	247	240	249			

MCC= Minimal cultural comparability; WCC = Weak cultural comparability; SCC = Strong cultural comparability

TABLE 3
Results of Tests of Cross-Cultural Validity – Beer Data

	Contribution to chi-square				Normed chi-square (χ2/df)	St. RMR	GF
	DK	D	UK	I			
All four countries MCC	348	303	314	816	1781/590 = 3.02	.17	.69
WCC	351	307	323	854	1835/620 = 2.96	.19	.66
SCC	357	309	330	897	1892/641 = 2.95	.18	.65
DK, D, UK MCC	276	220	254	-	750/375 =2.00	.051	.90
WCC	278	227	262	-	766/395 = 1.94	.058	.90
SCC	333	293	326	-	952/467 = 2.04	.087	.87
effective sample size	242	257	241	252			

[1] Fitted covariance matrix not positive definite
MCC= Minimal cultural comparability; WCC = Weak cultural comparability; SCC = Strong cultural comparability

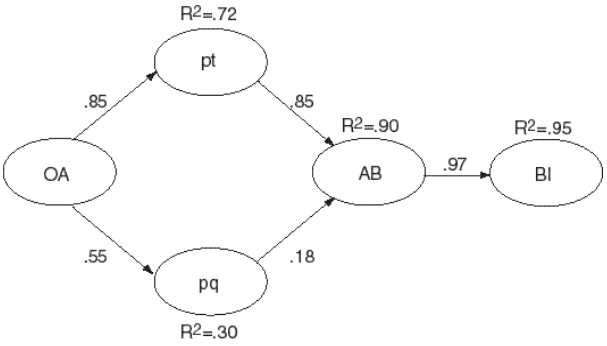
Based on these results, it was decided to proceed with the aim of estimating a joint model using the pooled Danish, German and British data, and a separate model based on the Italian data, for each product.

Before this, the factor structures of the measured beliefs were investigated for the pooled Danish, German and British data and separately for the Italian data by means of principal component analysis. The number of factors was determined by the Kaisor criterion of eigenvalues > 1. In all cases, measured control beliefs constituted one underlying factor, as did the measured normative beliefs, difficulty beliefs and normative beliefs, respectively. For both yoghurt and beer, the analyses based on the pooled Danish, German and British data resulted in two outcome belief factors, one dealing with the perceived quality of the product (pq) and one covering aspects of the perceived trustworthiness of the product (pt). For the Italian data on yoghurt, two outcome belief factors dealing with the perceived quality and trustworthiness of the product were identified as well, but these factors were not characterized by quite the same items. The Italian data on beer, finally, was found to be constituted of three outcome belief factors, covering again perceived quality and trustworthiness and, as a new factor, perceived naturalness and wholesomeness of the product. Here, as well, the perceived quality and trustworthiness factors matched but were not identical with the factors for the pooled Danish, German and British factors as regards loading items.

To confirm the cross-cultural validity of the Danish, German and British data, the identified belief factor structures were also subjected to a check for cultural comparability using multi-sample confirmatory factor analysis. The cross-cultural validity of the belief factors was generally verified by these analyses.

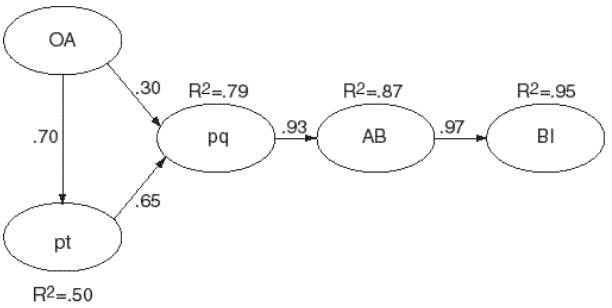
Models explaining purchase intentions with regard to the two products were then estimated in several steps by means of structural equation modelling. First, measurement models were optimized. Then structural relations were investigated using Bredahl, Grunert and Frewer's model as the starting point. Since the proposed model resulted in somewhat unsatis factory measures of overall fit, the modification indices provided by LISREL were applied as a means for establishing better fitting models. The final estimated models based on the pooled Danish, German and British data are shown in figures 2 and 3.

FIGURE 2
Estimated Purchase Intention Model for Genetically Modified Yoghurt – Pooled Danish, German and British Data



Chi-square=484, df=129, P=0.00
RMSEA=.062, P=0.00033

FIGURE 3
Estimated Purchase Intention Model for Genetically Modified Beer – Pooled Danish, German and British Data



Chi-square=407, df=129, P=0.00
RMSEA=.056, P=0.042

As can be seen, attitudes towards purchasing the product are in both cases the only significant determinant of purchase intentions, and in all cases attitudes towards purchasing the product are explained by product-specific beliefs, which are in turn strongly linked to consumers' general attitude towards applying genetic modification in food production. Degrees of variance explained are very high and point to a generally high correlation among the latent variables. For both products, this also goes for correlations of attitudes towards purchasing the product with subjective norm and perceived moral obligation, which may explain their absent effects on purchase intentions, given the high correlations of attitudes towards purchasing the product with purchase intentions as well.

For yoghurt, attitudes towards purchasing the product are determined primarily by beliefs about the product's trust-worthiness and only secondarily by beliefs about the quality of the product. While the perceived trustworthiness is strongly embedded in consumers' general attitudes towards using genetic modification in food production, the perceived quality of the yoghurt is also influenced by other factors.

The case of genetically modified beer is slightly different. Here, attitudes towards purchasing the product is determined by the perceived trustworthiness of the product indirectly through the perceived quality of the product, and both sets of product-specific beliefs are again to a high degree explained by consumers' general attitudes towards the use of genetic modification in food production. This indicates that in the case of the genetically modified beer, consumers have not perceived many other cues for evaluating the quality of the product than the fact that genetic modification was applied to

produce it. As can be seen, perceived quality remains a decisive factor for consumer acceptance, however.

In Italy, purchase intentions with regard to the yoghurt product are also only determined by attitudes towards purchasing the product, and these attitudes are, though to a lesser degree, also explained by overall attitudes towards genetic modification in food production. Furthermore, attitude towards purchas ing the product is far better explained by the perceived naturalness and wholesomeness of the product than by the two other belief factors, which are, however, also significant. Purchase intentions with regard to beer are explained directly by overall attitudes towards genetic modification in food production, as well as by attitudes towards purchasing the product, with perceived quality as its primary determinant, and by perceived difficulty of distinguishing the beer from other beers products.

Concluding Remarks

The study shows that the formation of attitudes and purchase intentions do not follow the same lines across the four countries investigated. Thus, attitude formation and decision-making with regard to genetically modified foods are highly comparable among Danish, German and British consumers but not with attitude formation and decision-making of Italian consumers. This points to a north-south divide among European consumers with regard to food biotechnology. The reasons for this difference are not investigated here, but we consider it likely that part of the difference may be owing to the fact that the public debate on the application of genetic modification in food production is more advanced in countries such as Denmark, Germany and Great Britain than in Italy.

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