Perceived Risk is Important for Consumers' Acceptance of Genetically Modified Foods, but Trust in Industry not Really: A Means-End Analysis of German Consumers

Andreas Boecker
Department of Agricultural Economics and Business, University of Guelph, Canada,
aboecker@uoguelph.ca

Paper prepared for presentation at the 99th EAAE Seminar 'Trust and Risk in Business Networks', Bonn, Germany, February 8-10, 2006

Perceived Risk is Important for Consumers' Acceptance of Genetically Modified Foods, but Trust in Industry not Really: A Means-End Analysis of German Consumers

Andreas Boecker
Department of Agricultural Economics and Business, University of Guelph, Canada,
aboecker@uoguelph.ca

Abstract

Applies the means-end approach to investigate how German consumers' relate GM food attributes to values via perceived consequences in their purchase decisions. Analyses in particular the importance of risk-related dimensions and issues of (dis)trust for different levels of purchase intentions. Identifies two segments: rejecters (n=24) and accepters (n=36). Finds considerable similarities in means-end chains between segments, in particular that risk plays a much bigger role than trust for purchase intentions. Furthermore, for both segments the link between trust and risk is found to be weak which implies to reconsider results from previous empirical studies pointing out the strong interaction of trust and perceived risk.

Keywords: *Consumer trust, risk perception, technology acceptance, genetically modified foods, laddering*

Introduction

In the analysis of consumers' acceptance of new food technologies, such as genetic modification, a growing body of literature has explored the relationship between trust and risk perception. Using standardized questionnaires these studies typically report high levels of correlations both between the two factors and between them and measures of technology acceptance. However, there is some debate about the causal directions in these relationships (see e.g. Poortinga & Pidgeon 2005). And with this debate the question arises how closely associated these two factors really are with consumers' technology acceptance.

This paper takes a different approach and analyzes data from qualitative, semi-structured laddering interviews which provides a more differentiated and detailed picture of the motivations and cognitive structures behind different purchase intentions for genetically modified (GM) foods. Although measurement of theoretically grounded concepts is less precise with this method, it offers the considerable advantage of not imposing these concepts on the subjects' judgments and evaluations, thus allowing retrieval of relevant concepts according to the importance as judged by the subjects, and in their individual wording.

The objectives are thus to identify whether a) differences in cognitive structures between groups with different purchase intentions exist, and b) more specifically, differences in the

importance for purchase intentions exist between risk and trust. The paper is organized as follows. In the next section the sample, the laddering interview technique and the subsequent data manipulation and analysis are described. In the third section then the results are presented in three steps: segmentation of the sample according to purchase intentions, overall similarities between samples and specific analysis of associations between GM-related risks and trust in the segments. Very brief concluding remarks are presented in section four.

Data generation and manipulation

After a brief description of the sample, accounts of the interview technique, coding procedure and data aggregation across individuals, and data analysis are given. The fundamentals of the means-end approach are woven into these three latter parts.

The sample

A total of 60 interviews were carried out between November 2003 and April 2004 in the region of Giessen, Germany. To develop clear interview guidelines and to obtain a common interview style and high levels of inter-interviewer reliability between the three interviewers, an intense interviewer training had been conducted in October 2003. The sample consists of mothers with the following socio-economic and demographic characteristics:

- above average income and education
- between 30 and 50 years of age
- at least one child under 18 years living in the household.
- no restrictions concerning the consumption of animal based food products
- regular consumption of yogurt, i.e. at least once a week

Women were selected because there is evidence that they are generally more concerned about risk exposure of the family in general, and the issue of biotechnology in particular than men are (Sjöberg 2000; Bückling 2002). Furthermore, despite socio-demographic changes, women are still in charge of shopping and meal preparation in most families. The participants were recruited through newspaper advertisements and articles, and mail invitations targeted at higher income areas in the Giessen region.

Laddering Interviews

The means-end approach identifies how consumers link product attributes through perceived consequences of consumption with their values as higher order motivations in a particular purchase decision. For eliciting such cognitive structures the laddering interview technique is used. Starting from concrete product attributes (the means) it elicits motivations behind the

purchase decision at increasingly higher levels of abstraction, i.e. consequences and values (the ends). It does so by repeatedly probing the interviewee with variations of the question "Why is that important to you?" and documenting the answers. While there are a number of different techniques available for the first step of attribute elicitation, subjects were asked to rank the eight stimuli presented in Figure 1. Product stimuli used for attribute elicitation (Source: Boecker et al. 2005: 52)1 according to their preferences. Then, starting with rank 1, subjects were asked to name the attributes that determined the rank of the product. For each attribute the actual laddering then produced a ladder of interlinked statements that is ended when the subject cannot give a meaningful answer to the probing question "Why is that important to you?" This procedure was repeated for each product in descending ranking order. Finally, upon completion of this task, subjects were asked to state their likely purchase intention for each product, if available in their usual shopping environment, as either "Would definitely not purchase it.", "Might purchase it.", or "Would very likely purchase it."

Coding and data aggregation across individuals

The coding of the individual's answers is probably the most important step in the whole data generation and manipulation process. Great care needs to be taken in grouping the qualitative data into different categories of meaning, because while being semantically similar, these chunks of meaning may vary considerably in wording and phrasing. A number of measures were taken in this study to produce a consistent set of categories at the various levels of abstraction (for details see Boecker et al. 2005: 53 ff.). In accordance with the differentiation that is typical for MEC analyses this study produced – in an ascending order of abstractness – 13 concrete and 5 abstract attributes, 7 functional and 10 psycho-social consequences, and 9 instrumental and 10 terminal values.

2 non-GM variants	**6 GM variants with genetic modification of …**		
	…feed	**…yogurt culture**	**…animal**
Product A Without GM ingredients. Traditional flavor. Yogurt culture is present, but not active.	**Product C** Cows are fed GM feed that requires less pesticides. GM component is not transferred to cows and thus not present in yogurt.	**Product E** Contains GM culture that produces a creamier texture and richer flavor. GM culture is present, but not active.	**Product G** Milk from GM cows with increased milk yield resulting in yogurt lower price. GM component is present, but not active.
Product B Without GM ingredients. Traditional flavor. Culture improves the digestive tract's micro flora.	**Product D** Cows are fed GM feed increasing protein content and improves quality of milk. GM component is present and active.	**Product F** Contains a genetically modified culture that reduces blood cholesterol. GM culture is present and active.	**Product H** Milk from GM cows that contains GM component lowering blood cholesterol. GM component is present and active.

Figure 1. Product stimuli used for attribute elicitation *(Source: Boecker et al. 2005: 52)*

After the categories or chunks of meaning had been identified, each individual statement was assigned to the corresponding category. For this the software MECAnalyst© by Skymax DG was used which organizes the data entry into so called ladders for each individual, as produced

by the laddering interviews. However, the central elements of the subsequent analysis are not the categories but the links between them. These are recorded in the cells of the so called implication matrix with *n* rows and *n* columns (*n* = the total number of categories; 52 in this study) by counting each link across individuals, with the restriction that a given link may only be counted once per individual.

The matrix represents the aggregate data across all individuals. But by dividing the whole sample into segments more than one more specific matrix can be obtained. Whether this needs to be done depends on the research goal, because a crucial assumption for the elicited cognitive structure captured in the matrix data to be representative of the sample is that it be sufficiently homogenous. According to the sample selection criteria, this may be assumed for socio-economic and demographic variables. But since the study objective is to test for differences in the cognitive structures between segments with different purchase intentions for GM food, the sample needs to be segmented accordingly. This leads to the data analysis in the next section.

Data analysis

There are several ways of analyzing laddering data. The original one aims at producing a Hierarchical Value Map (HVM) which depicts the sample's cognitive structure that is relevant for the choice decision investigated. This graphical output, which is originally intended for direct managerial decision support, is also produced in our analysis. The units of analysis are the links between the different categories as recorded in the implication matrix. The fundamental assumption behind this is that, in individual processing of internal and external information, concepts of higher abstractness levels are activated by recognizing or identifying concepts of lower abstractness levels. More particular, in the original field of MEC application in brand advertising a certain product attribute that is communicated in an ad activates associations with consequences and values. However, for activation to happen the strength of the link between two categories needs to be above a threshold. Due to the lack of theoretically or empirically derived guidelines, determining this threshold remains a so far unsolved problem in MEC analysis. Although practical recommendations exist, the researcher still has to determine the threshold in a more or less trial-and-error fashion. In that way a so called cut-off level is determined that indicates the minimum number of counts a link must have in order to be shown in the hierarchical value map.

Furthermore, if the sample is divided into segments, first, additional criteria have to be met for determining the "right" cut off level and, second, a test for significant differences between their cognitive structures has to be applied. In the MEC literature, these two areas have only been partially dealt with so that innovative criteria, approaches and methods used by Boecker et al. (2005: 61 ff.) form the basis of the following results section.

Results

In this section, first the segmentation based on the external criterion 'purchase intention for GM food' is presented. Although a heterogeneity test confirmed significant differences between two segments, a large part of the segments' cognitive structures was identical. This part is presented and briefly discussed, before the analysis turns to the central aspect of trust issues in the evaluation of GM foods.

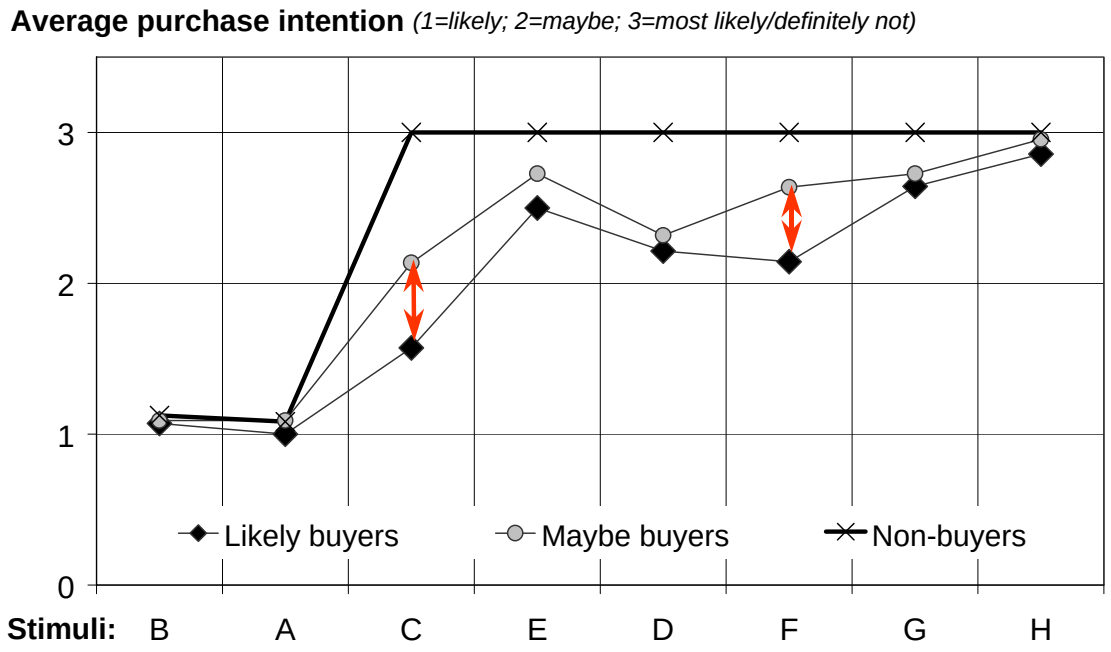

Figure 2. Mean purchase intentions for three segments *(Source: Boecker et al. 2005: 67)*

Segmentation based on likelihood to purchase GM food

For the first step of segmentation we applied a simple heuristic rule that produced three segments. First, rejecters or non-buyers (n = 24) have stated for all six GM variants not to buy them. Second, maybe buyers (n = 22) have indicated for at least one GM variant that they might purchase it but never stated "highly likely" for any GM variant. Third, likely buyers (n = 14) stated for at least one GM variety that they were very likely to buy it. Figure 2. Mean purchase intentions for three segments (Source: Boecker et al. 2005: 67)2 depicts the mean intention rating for each group and each stimulus.

However, after having chosen appropriate cut-off levels for likely buyers (3), maybe buyers (4) and non-buyers (5) to meet the requirements of equivalence, representativeness and proportionality, a heterogeneity test based on the Tanimoto coefficient used in cluster analysis and the expected outcome of random segmentation as test statistic revealed that no significant differences exist between the three segments (Boecker et al. 2005: 69). However, the test results suggested that maybe buyers and likely buyers were more similar to each other than to non buyers.

Consequently, they were merged into one segment called accepters, for which a new cut-off = 6 was determined to take account of the larger segment size. This segment's cognitive structure was indeed found to be significantly different from non buyers.

Similarities in cognitive structures across segments

Inspection of both segments' HVM's revealed two things that are relevant for the objective of this paper. First, a large portion, i.e. about 75% of the segments' cognitive structures were very similar. This congruent part of the HVM's is presented in Figure 3. Congruent part of 2 segments' HVM's (Source: Boecker et al. 2005: 77)3.

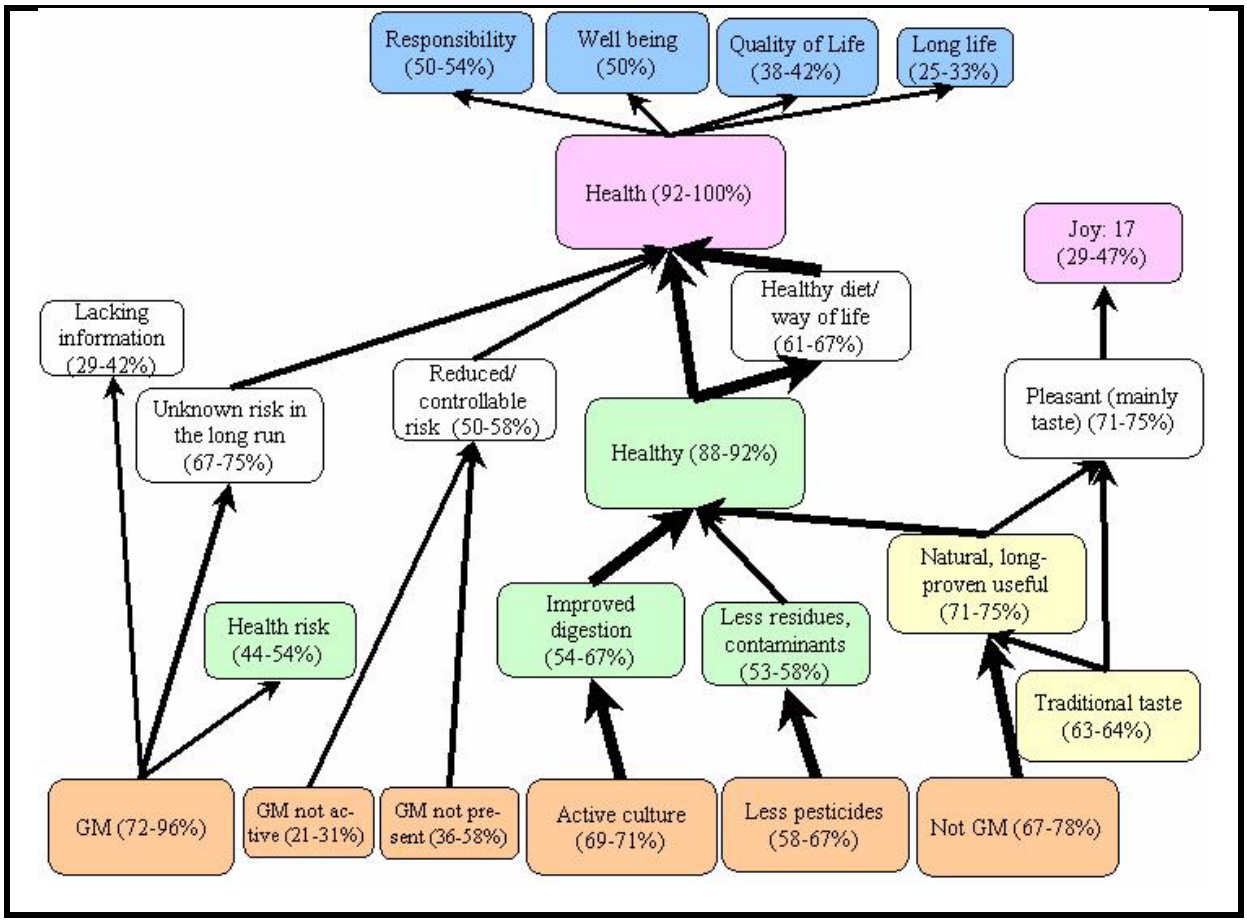

Figure 3. Congruent part of 2 segments' HVM's *(Source: Boecker et al. 2005: 77)*

Specific analysis of trust-related means-end chains

Because the available MEC software does not allow to select specific categories with the associated chains for graphical presentation, a manual count of links associated with the instrumental value 'distrust/control industry' with the corresponding HVM construction was performed. Due to low numbers – as previously stated, trust/distrust considerations did not play a central

role for the subjects' overall evaluation of GM yogurts in this study – some categories were merged for this specific analysis. This will be indicated in the presentation of results. The first step of the analysis is to present key descriptors of the partial HVM centered on trust issues that is to be produced for each segment. These are shown in Table 1. Descriptive segment statistics1. As expected from the inspection of segment-specific overall HVM's, the share of rejecters raising a trust issue and thus being represented in the specific HVM's below is considerably higher than that of accepters. The share of links represented in these specific HVM's, is however rather similar so that the HVM's may actually be compared. The trust-specific HVM of the segment 'accepters' is then shown in Figure 4. Trust-specific hierarchical value map of accepters segment (Cutoff = 2)4, while that of the 'rejecters' is shown in Figure 5. Trust-specific hierarchical value map of rejecters segment (Cutoff = 2)5.

Table 1. Descriptive segment statistics

	Segment size			Number of links			Mean link
Segment	Total	in HVM	Share	Total	in HVM	Share	strength
Accepters	36	13	36%	63	39	62%	2.3
Rejecters	24	13	54%	48	27	56%	3.0

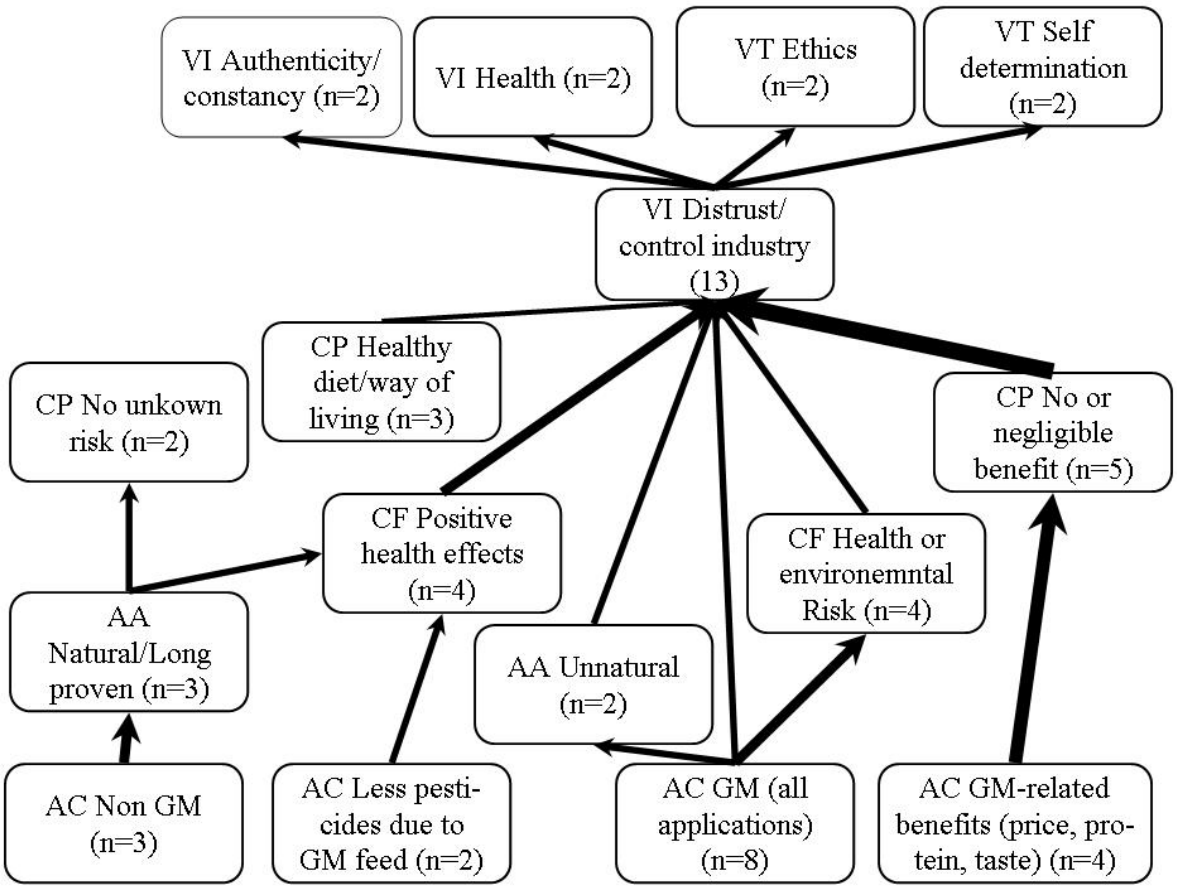

Figure 4. Trust-specific hierarchical value map of accepters segment (Cutoff = 2)

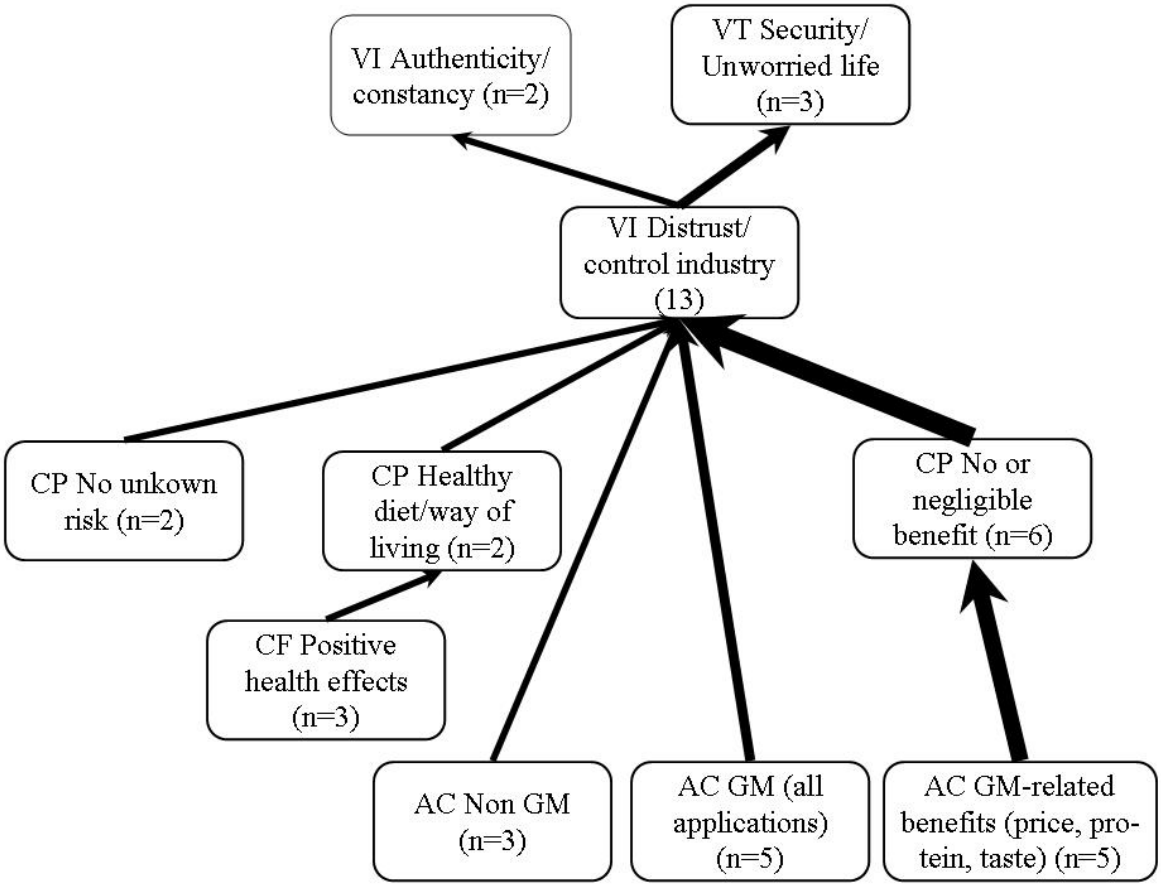

Figure 5. Trust-specific hierarchical value map of rejecters segment (Cutoff = 2)

There are four key observations with respect to this study's research goal. First, only in the accepters segment there is a link between GM-related risk and the distrust category, while no such link exists for the rejecters segment with a strength ≥ cutoff = 2. This is counterintuitive to the results of quantitative surveys which typically report that trust and acceptance are positively correlated. Hence, distrust should increase and become more important, as acceptance declines.

Second, both segments exhibit considerable levels of general distrust against agriculture and the food industry. This is documented in the left side halves of the HVM's, where the parts of the chains are positioned that stand for positive consequences from consumption or for food without GM ingredients.

Third, in both segments the dominant chain is rooted in GM-related personal or tangible benefits, such as reduced price, increased protein content, or richer taste. The trigger for distrust in all these cases is the judgment that these claimed product improvements actually offer no or only a negligible benefit to the consumer (the latter in comparison to possible adverse long term effects). Hardly visible by the thickness of the arrows, this link is stronger for the rejecters segment.

Finally, the segments differ in so far as the rejecters exhibit a clearly less dispersed cognitive structure than accepters do. This can be seen by the differences in numbers of links and catego-

ries, as well as in mean strength of the links (see Table 1. Descriptive segment statistics1). This is in line with the composition of this segment, as nearly two thirds of it, i.e. the maybe buyers have not expressed a strong opinion in their choice decision, in stark contrast to the rejecters who mostly stated very clearly they want to avoid GM food wherever possible.

To conclude the result section, it is of interest to show what aspects of (dis)trust the subjects actually associated with GM-related benefits and with GM applications in general. These were, with the number of counts in brackets, for both segments:

- Deceit, false labeling, marketing fad (6)
- Lacking trustworthiness of sellers (2)
- Greed and profit orientation (2)
- Disappearance of traditional/local farms; consumer alienation from agri cultural and food production (4)
- Misuse of power by large multinational companies (3)
- Development gone to far, lack of control (2)

Due to the small number of counts no attempt is made to identify differences between segments. Instead, when grouping these categories further, two directions can be discerned. The first one addresses primarily (negative) characteristics and activities of the industry, as e.g. lacking trustworthiness or greed, and suspected false labeling. The second one is more concerned with the process of technological development and its outcome. In both samples individuals expressed their discontent with the disappearance of local farm contacts, the overwhelming power of large multinationals and the fast seemingly uncontrollable pace of the development.

Concluding remarks

The key findings for both segments in this analysis are that a) perceived risk is considerably more important for GM food purchase intentions than trust and b) the link between trust and risk is found to be weak. These results imply to reconsider results from previous empirical studies pointing out the strong interaction of trust and perceived risk. Furthermore, the laddering data used in this study allows to identify more precisely how consumers phrase issues of (dis)trust in the process of evaluating GM foods.

References

Boecker, A., J. Hartl and S. Albrecht (2005): Consumer Acceptance of Genetically Modified Foods in Germany. Research report to the Missouri-Illinois Biotechnology Alliance.

Bückling, E. (2002): Grüne Gentechnik – wo stehen die Frauen. Beiträge zur feministischen Theorie und Praxis, 25: 117-126.

Hampel, J., Renn, O. (eds.) (1999): Gentechnik in der Öffentlichkeit – Wahrnehmung und Bewertung einer umstrittenen Technologie. Frankfurt/New York: Campus.

Poortinga, W., Pidgeon, N.F. (2005): Trust in Risk Regulation: Cause or Consequence of the Acceptability of GM Food? Risk Analysis, 25(1): 199-209.

Reynolds, T.J., Olson, J.C. (Eds.) (2001): Understanding Consumer Decision Making: The Means End-Approach to Marketing and Advertising Strategy. Mahwah: Lawrence Earlbaum.

Sjöberg, L. (2000): Factors in Risk Perception. Risk Analysis 20, 1. S. 1-12.