

# Food quality and safety—consumer perception and public health concern

A. Röhr<sup>a,\*</sup>, K. Lüddecke<sup>a</sup>, S. Drusch<sup>a</sup>, M.J. Müller<sup>a</sup>, R.v. Alvensleben<sup>b</sup>

<sup>a</sup> *Institute for Human Nutrition and Food Science, Christian-Albrechts-University at Kiel, Düsternbrooker Weg 17, D-24105 Kiel, Germany*

<sup>b</sup> *Department of Agricultural Economics, Christian-Albrechts-University at Kiel, Olshausenstr. 40, D-24118 Kiel, Germany*

## Abstract

Food safety has become an important food quality attribute within the last decade. In 2002, we conducted a consumer survey with 449 subjects in Kiel to determine actual consumer perceptions to food quality and safety. We compared these data with our former consumer surveys in Kiel. Over the past decade food quality is perceived to have improved. Regarding to food related health risks, the feeling of uncertainty appears to have decreased. With respect to the willingness to pay for food safety, two segments of consumers emerged, i.e. price-sensitive and safety-sensitive consumers. Food manufacturers have gained credibility from 1997 to 2002 although still on a low level. They should communicate actively their food safety initiatives as part of their ethical and social responsibility.

© 2004 Elsevier Ltd. All rights reserved.

*Keywords:* Consumer perceptions; Food safety; Risk communication

## 1. Introduction

Due to recent so-called food crises in Europe, food quality and food safety have become a hot topic in the media. Most often the terms food quality and food safety are interchangeably used. There are substantial differences especially when talking about the communication of food manufacturers and consumer perceptions. Prior to incidents such as the BSE crisis, most consumers simply expected that each food placed on the market had met these two characteristics. This was self-evident and there was no necessity to communicate food safety to the consumer. This situation has changed in the past years, food safety has become a food quality characteristic. Public authorities are pushing the food and the feed industry to develop comprehensive quality

management systems to improve food safety, restructure the food inspection system and try to enhance consumer information to regain consumers trust in food.

Furthermore most food producers run a quality management system according to DIN EN ISO 9000ff. Within this system quality is defined as “Degree to which a set of inherent (existing) characteristics fulfils requirements”. This definition implies a key issue in the revision of DIN EN ISO 9000ff published in the year 2000, which is customer satisfaction.

As one of the measurements of the performance of the quality management system, food producers are required to monitor information relating to customer perception as to whether the organisation has fulfilled customer requirements. Since food safety has become a quality characteristic, food producers consequently are involved in communicating food safety.

In Germany recently the so-called “QS” label<sup>1</sup> for meat and meat products has been launched. The aim

\* Corresponding author. Tel.: +49 431 8805689; fax: +49 431 8805679.

E-mail address: [aroehr@nutrfoodsc.uni-kiel.de](mailto:aroehr@nutrfoodsc.uni-kiel.de) (A. Röhr).

<sup>1</sup> QS=quality and safety.

of QS is to install a system for quality management and control which covers all stages from birth through to slaughtering, cutting and processing and including transportation and storage of meat and meat products and to regain the confidence of consumers over the long term. As Powell (2000) states, it is essential for risk managers to communicate that they are reducing or mitigating a particular risk, but they also have to make sure that actions match their words.

Due to the measures taken by public authorities and the industry, it is postulated that consumers trust in food safety has increased within the last years. The aim of the present study is to determine whether consumer perceptions of food quality and safety reflect these developments.

## 2. Methods

The Department of Agricultural Economics continually conducts ongoing consumer surveys referring to perceptions of agriculture and nutrition. The current survey carried out in 2002 dealt with public perceptions of food quality and food safety. It consisted of 16 questions divided into four parts which are:

- (1) perception of food quality (in terms of purchase criteria),
- (2) perception of food safety and health risks,
- (3) attitudes belonging to food safety (e.g. attitude towards organic production, willingness to pay),
- (4) attitudes towards communicators of food safety.

Within this analysis, we present results of the survey in 2002. We also show developments in consumer perceptions comparing present data with subset data from surveys in 1994, 1997, 1999 and 2001 conducted by the Department of Agricultural Economics. Participants of all surveys were inhabitants of the city of Kiel, older than 18 years and lived in private households. Numbers of participants differed from 225 to 449. The randomised samples were derived from the official address register of Kiel. The surveys were executed using questionnaire-based interviews. In 2002 the interviews were collected in the time from January till March 2002. The sample consisted of 449 persons (response rate 32%). A similar response rate was realised in our recent surveys (Petersen & Bruhn, 2001). The present sample was representative of the Kiel population for age, but not for sex with respect to the 95%-CI (Table 1).<sup>2</sup>

## 3. Results

### 3.1. Perception of food quality in terms of purchase criteria for food

Consumers were asked in an open ended question to relevant purchase criteria for their food choice ( $n=442$ ). The interviewees were allowed to mention up to three criteria. The numbers in percent bear on the top three responses. *Price* appeared to be the most important purchase criterion: 66% of the responders mentioned the *price*. 37% of the participants called for *freshness/not spoiled*. Thirty three percent named *quality*, 15% *appearance*, 15% *ingredients* (fat, sugar, nutritive value) and 14% specified the *best before date*.

Additionally, in a following question consumers were asked to assess the relevance of seven predetermined purchase criteria (price, appearance, taste, place of purchase, production, origin, quality mark) for specific food. Exemplary, we selected eggs, beef and apples which represent animal as well as plant products. *Price* is mentioned as less relevant compared to *appearance* and *taste* for eggs, beef and apples (Table 2). Consumer assessments of purchase criteria are likely to be dependent on the questioning technique used (open ended question vs. predetermined answers) and the specificity of the question (purchase criteria for food in general vs. purchase criteria for specific eatables).

### 3.2. Consumer perceptions to food quality over time

The 2002 survey attempted to monitor changes in food quality perceptions from surveys which were conducted in 1994, 1999 and 2001. Despite BSE and other food scandals in the last few years, consumer perceptions of food quality in general seemed to have progressed in a positive way. The balance of positive and negative perceptions over the time increased. In 1994, the percentage of persons who found food quality deteriorating prevailed. In 2002, a greater proportion of consumers perceived an encouraging positive development in food quality (Table 3).

### 3.3. Associations to “food safety” and “proved quality”

Food quality as well as food safety are abstract terms which can be interpreted in various ways. It is important in relaying information to consumers that subjective interpretations are taken into consideration. Therefore, consumers divided into subset A ( $n=228$ ) and subset B ( $n=207$ ) were asked to call their associations to “food safety” (A) or “approved quality” (B) in an open ended question. Twenty two percent of group A and 21% of group B identified food safety with *controllsurveillancel assay*. Furthermore, “food safety” was associated with *healthy/harmless/non-poisonous* by 18% and with *animal*

<sup>2</sup> 95%-confidence interval (Kreienbrock & Schach, 1995).

Table 1  
Structure of the sample (in %)

Percentage	Total sample ( <i>n</i> =449)	Original ( <i>n</i> =143)	Substitute ( <i>n</i> =299)	City of Kiel ( <i>n</i> =229.598) <sup>a</sup>
	100	32	67	100
<i>Age (years)</i>				
≤34	39	24	46	42
35–49	25	29	23	22
50–64	17	24	14	18
≥65	19	23	17	17
<i>Sex</i>				
Female	61	60	61	52
Male	39	40	40	48
<i>Household</i>				
One person	28	29	29	–
Two persons	43	46	42	–
Three persons	12	9	13	–
Four persons	12	13	11	–
More than four persons	5	4	5	–
<i>Children in household</i>				
With children	26	26	25	–
Without children	74	74	75	–
<i>Age of children (years)</i>				
0–2	11	9	16	9
2–6	19	11	24	22
6–12	26	26	24	35
Older than 12	45	43	37	34
<i>Concerned with daily shopping</i>				
Yes	77	76	77	–
No	5	3	10	–
Sometimes	18	21	13	–

<sup>a</sup> Origin: Bürgeramt der Landeshauptstadt Kiel (2002).

Table 2  
Consumer assessment of purchase criteria for specific food

Eggs		Beef		Apples	
Criterion	Mean	Criterion	Mean	Criterion	Mean
Appearance	1.5	Appearance	1.2	Appearance	1.2
Taste	1.6	Taste	1.4	Taste	1.3
Production	2.0	Production	2.1	Price	2.4
Origin	2.4	Origin	2.1	Production	2.6
Quality mark	2.5	Place of purchase	2.2	Origin	2.6
Place of purchase	2.6	Quality mark	2.3	Place of purchase	2.7
Price	2.6	Price	2.4	Quality mark	2.9

“Could you please tell me what is important for you when purchasing eggs, beef or apples?” Scale: 1=very important, 5=(almost) unimportant, *n*=449.

*husbandry appropriate to species* by 13% of group A. In contrast, consumers in group B named as synonyms for “proved quality”: *no confidence/be wrong* (14%) and *confidence/credence* (13%). This term seems to reveille contradicting emotions.

### 3.4. Consumers' willingness to pay for food safety

Increased efforts in food safety on the part of manufacturers may lead to higher prices for food. Credence

attributes like food safety are characterised by a higher need of information. In the survey, we communicated food safety by mentioning an intensified inspection. Eighty percent of consumers expressed a willingness to pay a premium price for notably approved products (Table 4). Consumers seemed to be willing to pay 30% extra for eggs as well as minced beef and 22% extra for apples which were exposed in terms of food safety. Willingness to pay was more pronounced for animal than for plant food.

Table 3  
Consumer perceptions to food quality over the time (%)

Today's food quality is ... (%)	1994 (n=388)	1999 (n=245)	2001 (n=225)	2002 (n=449)
... (rather) better	20	29	33	36
... (rather) worse	46	31	31	28
... has not changed at all	26	34	31	31
Balance: better–worse	–26	–2	+2	+8

Imagine the time 10 or 20 years ago. Has the food quality changed since then and if so, has it become better or worse? What do you think?

Table 4  
Consumers' willingness to pay for food safety (%)

Willingness to pay for ...	Eggs	Minced beef	Apples
+10%	22.0	16.3	32.6
+20%	37.6	26.1	26.7
+30%	18.3	27.5	18.3
+50%	12.4	12.4	7.3
+100%	7.3	6.2	3.4
No answer/no consumption	2.4	11.5	11.7
Mean price increase	29	30	22

"Do you feel up to paying a higher price for especially proved products which account for a reduced risk with respect to salmonella, BSE or pesticides?" (n=449) (yes, 79.3%; no, 20.7%). If so, could you tell how much you are willing to pay? (n=356) in %. Origin: Röhr et al. (2003).

Referring to the willingness to pay, we analysed if consumers could be differentiated as "price-sensitive" and "safety-sensitive". Those who were unwilling to pay a premium price for specially approved products were defined as "price-sensitive". Examining the theory of price- and safety-sensitivity, we conducted a factor analysis of purchase criteria. As mentioned above, consumers were asked to assess a number of purchase criteria with respect to the relevance for their choice. Two main factors were distinguishable for eggs and beef which could be interpreted as "safety" and "price". For apples, we found an additional third factor "appearance" (Table 5).

Subsequently, we examined correlation between these factors and the willingness to pay for food safety (Table 6). Significant differences were found. Price-sensitivity was correlated negatively with the factor "safety", whereas it was positively correlated with the factors "price" and "appearance". Therefore, we concluded that consumers were relatively consistent in their willingness to pay an increased price for food safety and their relevant purchase criteria.

Furthermore, we were interested in determining the prevailing attitudes of price- and safety-sensitive consumers (Table 7). The characterisation of consumers by correlation analysis indicated that price-sensitive consumers did not perceive organic food as healthier than conventional food and they placed little emphasis on regional production. Price and taste were more important than the place of production. Price was not seen as a meaningful signal of high quality. These results confirmed the findings of the factor analysis.

### 3.5. Consumer perceptions to food related health risks

Consumers seem to be confronted with numerous food related health risks, e.g. zoonoses or toxic agents of plants, pesticides and other chemical residues. Nevertheless, experts appraise that nutrition related risks are more relevant with respect to chronic diseases. In the 2002 survey the importance of most risks had decreased from 1997 (Table 8). People seemed to be less uncertain. Furthermore, the relative importance of risks had changed. *BSE*, *pesticide residues* and *preservatives* had lost relevance as health risks from 1997 to 2002. Risks having to do with life-style (e.g. smoking, eating too much) seemed to become more important.

### 3.6. Credibility of different communicators

Consumers appeared to be less uncertain to food related risks than some years ago. It could be assumed that this is due to the quality management systems implemented in the food industry in the last decade. In fact, food manufacturers gained credibility from 1997 to 2002 although still on a low level (Fig. 1). Regarding to food safety, consumers are dependent on product information given by communicators like food manufacturers, scientists or media. We found that information provided by consumer or environmental organisations, by nutritionists or physicians was perceived to be more trustworthy than information from the Ministry, food producers or the media. Due to changes within the Ministry (which is entitled as Ministry of Consumer Protection, Food and Agriculture

Table 5  
Factor interpretation of consumers' purchase criteria

	Factor 1 "safety"	Factor 2 "price"	Factor 3 "appearance"
Eggs <sup>1</sup>	Place of purchase, production, origin, quality mark	Price	
Beef <sup>2</sup>	Place of purchase, production, origin, quality mark	Price	
Apples <sup>3</sup>	Place of purchase, production, origin, quality Mark	Rice	Appearance, taste

Kaiser–Meyer–Ohlkin–Criterion: <sup>1</sup>0.76 <sup>2</sup>0.54 <sup>3</sup>0.73; rotated factor loading >0.6.

Table 6  
Price sensitivity correlated with purchase factors

Price sensitivity on...	Factor 1 "safety"	Factor 2 "price"	Factor 3 "appearance"
Eggs	−0.352***	0.197***	ns
Beef	−0.260***	0.155**	ns
Apples	−0.187***	ns	0.211***

Spearman correlation coefficient (bivariate), significance \* $\alpha \leq 0.05$ ; \*\* $\alpha \leq 0.01$ ; \*\*\* $\alpha \leq 0.001$ ; ns = not significant.

Table 7  
Attitudes of price-sensitive consumers

Attitude	Correlation to price-sensitivity
"Organic food is healthier"	−0.249***
"Regional production preferred"	−0.203***
"Spending much time and efforts for food choice"	−0.172***
"Consumer demand influences food quality"	−0.156**
"Quality marks stand for food quality and safety"	−0.105*
"Place of production less important than taste and price"	0.286***
"Eating what tastes good"	0.254***
"Price does not say much about quality"	0.144**

Spearman correlation coefficient (bivariate), significance \* $\alpha \leq 0.05$ ; \*\* $\alpha \leq 0.01$ ; \*\*\* $\alpha \leq 0.001$ .

Table 8  
Consumers perceptions to food related health risks in 1997 and 2002

Mean	Risk perceptions 1997 (n=334)	Significant change of means	Risk perceptions 2002 (n=449)	Mean
1.49*	Salmonella	→	Salmonella	1.63*
1.62***	BSE / mad cow disease	↘	Mycotoxins <sup>a</sup>	1.74
1.70***	Pesticide residues	↘	Smoking	1.80
1.74	Smoking	↘	BSE / mad cow disease	1.85***
1.89***	Nuclear power plant	↘	Pesticide residues	1.89***
1.92	Spoiled food	↘	Spoiled food	1.98
1.94	Hormones	↘	Hormones	2.03
2.19*	Road traffic	↘	Nuclear power plant	2.11***
2.34***	Eating too much	↘	Eating too much	2.17***
2.35	Genetically modified food	↘	Road traffic	2.39*
2.39	Electromagnetic pollution	↘	Genetically modified food	2.47
2.46	Cholesterol	↘	Electromagnetic pollution	2.52
2.84***	Preservatives	→	Cholesterol	2.59
			Preservatives	3.09***

"Could you please estimate how dangerous these health risks are for people?" scale: 1 = very dangerous, 5 = (rather) not dangerous. Significance \* $\alpha \leq 0.05$ ; \*\* $\alpha \leq 0.01$ ; \*\*\* $\alpha \leq 0.001$ . Origin: Röhr et al. (2003).

<sup>a</sup> Not asked in 1997.

since 2001), its trustworthiness had increased from 1997. Credibility in different information sources was influenced significantly by consumers personal feelings of uncertainty relating to food (calculated by *t*-test).<sup>3</sup>

<sup>3</sup> Feeling of uncertainty: mean of six statements, 5-grade scale.

The more a person felt uncertain the higher was the trust in environmental organisations ( $p \leq 0.001$ ) and media ( $p \leq 0.05$ ). Additionally, uncertain consumers distrusted the food safety authorities ( $p \leq 0.001$ ) and food manufacturers ( $p \leq 0.001$ ) more than confident consumers.

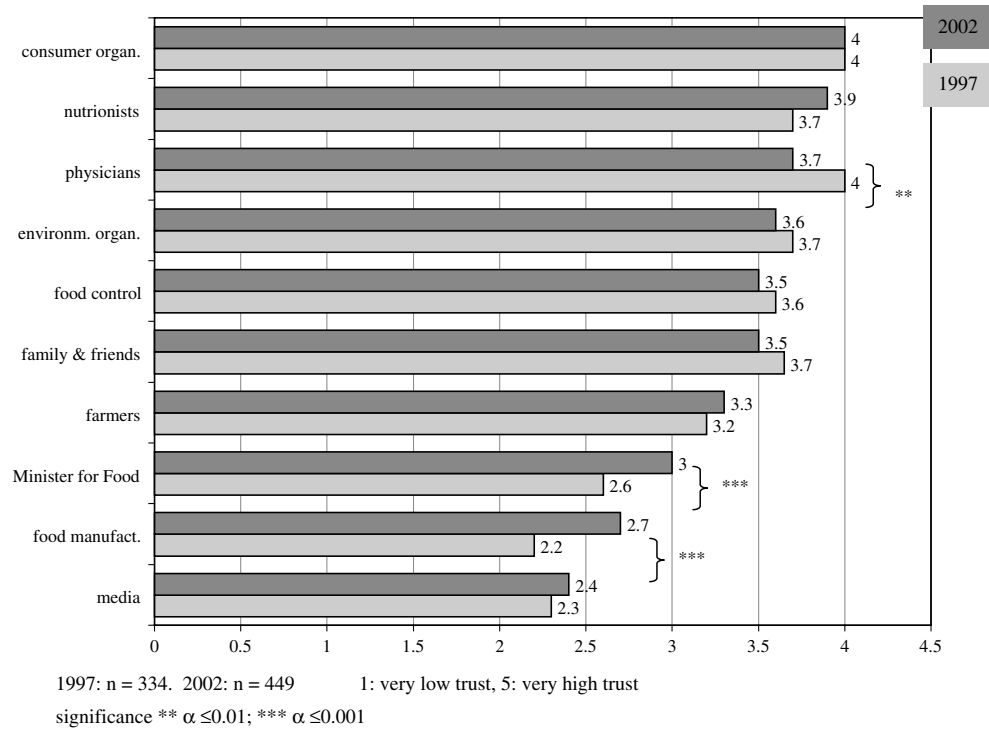


Fig. 1. Credibility of different communicators with respect to information about food related health risks.

#### 4. Discussion

Food quality is a heterogeneous term and consumers definitions of food quality are formed by individual perceptions. Quality is commonly categorised into search, experience, and credence dimensions (Darby & Karni, 1973). Search dimensions are those where the quality can be ascertained by the buyer at the time of purchase (for example the appearance of an apple). Experience dimensions are those where the quality can be ascertained only after the purchase (for example the taste of an apple). Credence dimensions are those where the average consumer him/herself can never ascertain the quality, but has to trust the judgement of others like whether the apple is healthy or organically produced (Bech-Larsen & Grunert, 2001; Becker, 1999). Food safety can be employed as a credence dimension. Credence attributes are characterised by a higher need of information. In our study we communicated food safety by mentioning an intensified inspection. The majority of consumers seems to be willing to accept a premium price for specially approved products. Willingness to pay is more pronounced for animal than for plant food. Kuhnert, Feindt, Wragge, and Beusmann (2002) report similar results.

We differentiated consumers into two categories, price-sensitive and safety-sensitive, based on their willingness to pay this premium. Referring to our data, price-sensitive consumers are not concerned greatly with safety attributes like production, origin and place of

purchase but for the price. In further investigations it might be worked out if consumer segments with respect to food safety fit to established consumer segmentations (Brunso, Grunert, & Bredahl, 1996).

Consumer perceptions are not constant over time (Five-Shaw & Rowe, 1996). Within this study, we monitored the development of consumer perceptions of food quality and safety. We found that the perception of food quality in 2002 increased from 1994. Complementary, the amount of risk perception and the feeling of uncertainty decreased. Perceptions of the importance of different types of risks vary between experts and laymen as shown by Slovic (1987) or Renn and Zwick (1997). Risk perceptions of laymen can be distorted in different ways: Risks that are known, occur frequently and that might be controlled by the individual are believed to be less dangerous and are underestimated more often (Alvensleben, 2002). This distortion appears to decrease. Consumers are still scared about food related health risks but the relative importance of risks seems to change such that nutrition related risks grow in attention.

We postulated that changes in consumer perception of food safety were influenced by safety measures of manufacturers. Food manufacturers especially in the meat industry have spend efforts to increase food safety, however they still seem to have difficulties to communicate these to consumers. "QS" is a current national approach. Effective communication about food risks and safety is influenced by the extent to which people perceive the source to be reliable. Dimensions of trust are



competence, honesty and concern with public welfare (Frewer & Miles, 2001). Food manufacturers suffer from an inherent conflict of diverse interests. They are perceived to protect vested interests. Nevertheless, the amount of distrust seems to decrease. Proactively providing information with regards food safety in untroubled times might help to build up trust which can be called upon in scandalous times. The safety-sensitive consumers should be the prior target group for communication. Food manufacturers should communicate actively their food safety and food quality initiatives as part of their ethical and corporate social responsibility efforts instead taking the stance that “no press is good press”.

### Acknowledgement

The study was funded by the State Government of Schleswig-Holstein.

### References

- Alvensleben, R. v. (2002). Verbraucherbild—Verbraucherverantwortung—Verbrauchererziehung. Ziele und Fakten. *ZLR-Zeitschrift für das Gesamte Lebensmittelrecht*, 2, 139–150.
- Bech-Larsen, T., & Grunert, K. G. (2001). Konsumentenentscheidungen bei Vertrauenseigenschaften: eine Untersuchung am Beispiel des Kaufes von ökologischen Lebensmitteln in Deutschland und Dänemark. *Marketing-ZFP*, 23(3), 188–197.
- Becker, T. (1999). The economics of food quality standards. Proceedings of the second interdisciplinary workshop on standardization research. University of the Federal Armed Forces Hamburg, 24–27 May 1999.
- Brunso, K., Grunert, F. G., & Bredahl, L. (1996). An analysis of national and cross-national consumer segments using the food related lifestyle instrument in Denmark, France, Germany and Great Britain. MAPP Working Paper No. 35, Aarhus.
- Bürgeramt der Landeshauptstadt Kiel (2002). Statistics of the City of Kiel, Amt für Statistik, Kiel, 30.06.2002.
- Darby, M. R., & Karni, E. (1973). Free competition and the optional amount of fraud. *The Journal of Law and Economics*, 16, 67–88.
- Five-Shaw, C., & Rowe, G. (1996). Public perceptions of everyday food hazards: a psychometric study. *Risk Analysis*, 16(4), 487–500.
- Frewer, L. J., & Miles, S. (2001). Risk perception, communication and trust. How might consumer confidence in the food supply be maintained?. In L. J. Frewer, E. Risvik, & H. Schifferstein (Eds.), *Food, People and Society. A European Perspective of Consumers Food Choices* (pp. 401–413). Berlin: Springer-Verlag.
- Kuhnert, H., Feindt, P. H., Wragge, S., & Beusmann, V. (2002). Datensammlung zur Repräsentativbefragung zur Nachfrage nach Lebensmitteln und zur Wahrnehmung der “Agrarwende”. BIOGUM-Forschungsbericht/BIOGUM-Research Paper FG Landwirtschaft, 2/2002. Universität Hamburg.
- Kreienbrock, L., & Schach, S. (1995). *Epidemiologische Methoden*. Stuttgart, Jena, New York: Gustav Fischer Verlag.
- Petersen, G., & Bruhn, M. (2001). Einstellungen der Bevölkerung zu modernen Technologien in der Land- und Ernährungswirtschaft. Arbeitsbericht Nr. 19, Lehrstuhl für Agrarmarketing, Universität Kiel.
- Powell, D. A. (2000). Food safety and the consumer—perils of poor risk communication. *Canadian Journal of Animal Science*, 80, 393–404.
- Röhr, A., Lüddecke, K., Müller, M. J., & Alvensleben, R. von (2003). Analyse der Verbraucherwahrnehmung von Lebensmittelqualität und—sicherheit. In: Zweiter Arbeitsbericht der Arbeitsgruppe Lebensmittelqualität und—sicherheit QUASI der Agrar- und Ernährungswissenschaftlichen Fakultät der Christian-Albrechts-Universität zu Kiel, Kiel. pp. 88–105.
- Renn, O., & Zwick, M.M. (1997). Risiko- und Technikakzeptanz. Enquete-Kommission, “Schutz des Menschen und der Umwelt” des 13. Deutschen Bundestages (Hg.). Berlin: Springer-Verlag.
- Slovic, P. (1987). Perception of Risks. *Science*, 236, 280–285.