



Countermeasures:

ENVIRONMENTAL AND SOCIO-ECONOMIC RESPONSES - A LONG-TERM EVALUATION

Assessment of Consumer Risk Attitudes and Behaviour Related to Countermeasures and Radioactive Contamination of Food



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Assessment of Consumer Risk Attitudes and Behaviour Related to Countermeasures and Radioactive Contamination of Food

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Terms of reference

This report forms the technical deliverable «Consumer Strategy Document» as part of the requirements of work packages 5 and 6 of the CESER project (Countermeasure – Environmental and Socio-economic Responses).

The CESER Project is funded by the European Union's Fourth Framework, Nuclear Fission Safety Programme (DGXII). The main institutions participating in this project are the University of Stirling (UK), University of Bremen (Germany), Finnish Environment Institute (Finland), North-Trøndelag College (Norway) and University of Salzburg (Austria). The project runs from January 1997 until June 1999.

The overall aim of the project is the development of a decision support system to aid the long-term management of radioactively contaminated agricultural land. This is intended to help decision makers in selecting the most appropriate countermeasures for their specific circumstances by applying environmental, economic and social criteria alongside those of radiological effectiveness and practicability. To achieve this, the work programme is structured into the following objectives:

1. To identify the most significant environmental and agricultural impacts arising from application of countermeasures designed to reduce soil-plant-animal transfer of radionuclides.
2. To quantify through modelling, experiments and expert judgement the degree and duration of these environmental and agricultural impacts.
3. To evaluate the combined impacts of countermeasures including differential responses of radiocaesium and radiostrontium under different food production systems.
4. To predict the spatial patterns of side-effects on a regional and national basis through utilisation of geographical information systems and classify geographical areas according to their suitability for countermeasures.
5. To identify and assess consumer attitudes towards contaminated food products, the use of countermeasures in food production and their willingness to pay to avoid damages.
6. To compare the direct and indirect costs and benefits of countermeasures related to changes in economic output, environmental quality and human health.
7. To provide a decision support package, which can be used as a regional and national planning tool in the long-term evaluation of countermeasure suitability of land, incorporating both environmental and socio-economic impacts.

This technical deliverable specifically addresses objectives 6 and 7 of the work programme.

1. INTRODUCTION

After the Chernobyl accident in 1986 scientific research has documented the effectiveness of the different countermeasures fairly well. They have proven efficient means in reducing radioactivity levels in food, and significant amounts of food products have been saved for the food market. Previous studies have shown that countermeasures are fairly accepted by farmers (Nisbet, 1995). However, too little has been known about the consumers' acceptability of these measures. If the consumers' fear implies reduced consumption to such an extent that the countermeasures are not economically justified, one might need to look at other solutions for use of the affected food products.

Countermeasures are likely to generate a variety of costs, both to the farmers and the government as a result of implementing the countermeasures, but also on the society as a whole, including costs of environmental side-effects, welfare loss due to increased fear in the population, and costs due to reduced consumption of food products. Benefits from countermeasures are food saved for human consumption and potential reduction in risk perception among consumers.

An important measure when evaluating consumer welfare loss due to increased fear of health damage, is the perceived risk of the population. As several authors (Schrader-Frechette, 1991, Huang, 1993) have discussed before, there might be a large discrepancy between experts' calculated risk (real risk) and the consumer's perceived risk. The consumers' actions are the result of their own beliefs and their perceptions of the risk, which are found to be strongly influenced by characteristics other than the experts' calculated probabilities of fatalities or ill-health (Slovic et. al., 1980). The theme real risk versus perceived risk will not be discussed any further here, but a further discussion of this issue can be found in Scrader-Frechette (1991) and Drottz-Sjöberg (1991).

The main goal of this report is to introduce a generic approach for assessment of consumer attitudes and consumers' behaviour towards contaminated and treated food products. Empirical findings based on data from surveys in Norway and Scotland, focusing on these questions, will be discussed. Finally there will be given guidelines on how to communicate with consumers to ensure understanding and acceptance of countermeasures.

A brief presentation of general methodology and theoretical background is presented in chapter 2. A description of radioactive contamination of food as a risk source is given in the same chapter. Chapter 3 introduces the consumer survey. Chapters 4, 5, 6, 7, 8 and 9 present results from the consumer survey performed in Norway and Scotland. Chapters 4 and 5 start with results on consumers' general risk perception and narrows the view to radioactive food risk perception. Chapter 6 shows the respondents' risk reducing actions connected to food safety in general and directly connected to the Chernobyl accident. Chapter 7 reveals relationships between consumer characteristics, risk perception and behaviour. Chapter 8 analyses the consumer willingness to pay extra for «clean» food from non-contaminated areas. Chapter 9 discusses aspects of consumer information in case of radioactive fallout. Finally, chapter 10 summarises these findings and give recommendations on how to handle the consumer side in a radioactive emergency situation.

The shaded parts of Figure 1.1 below illustrate how assessment of consumer risk attitudes and behaviour is related to the overall project structure of the CESER-project.

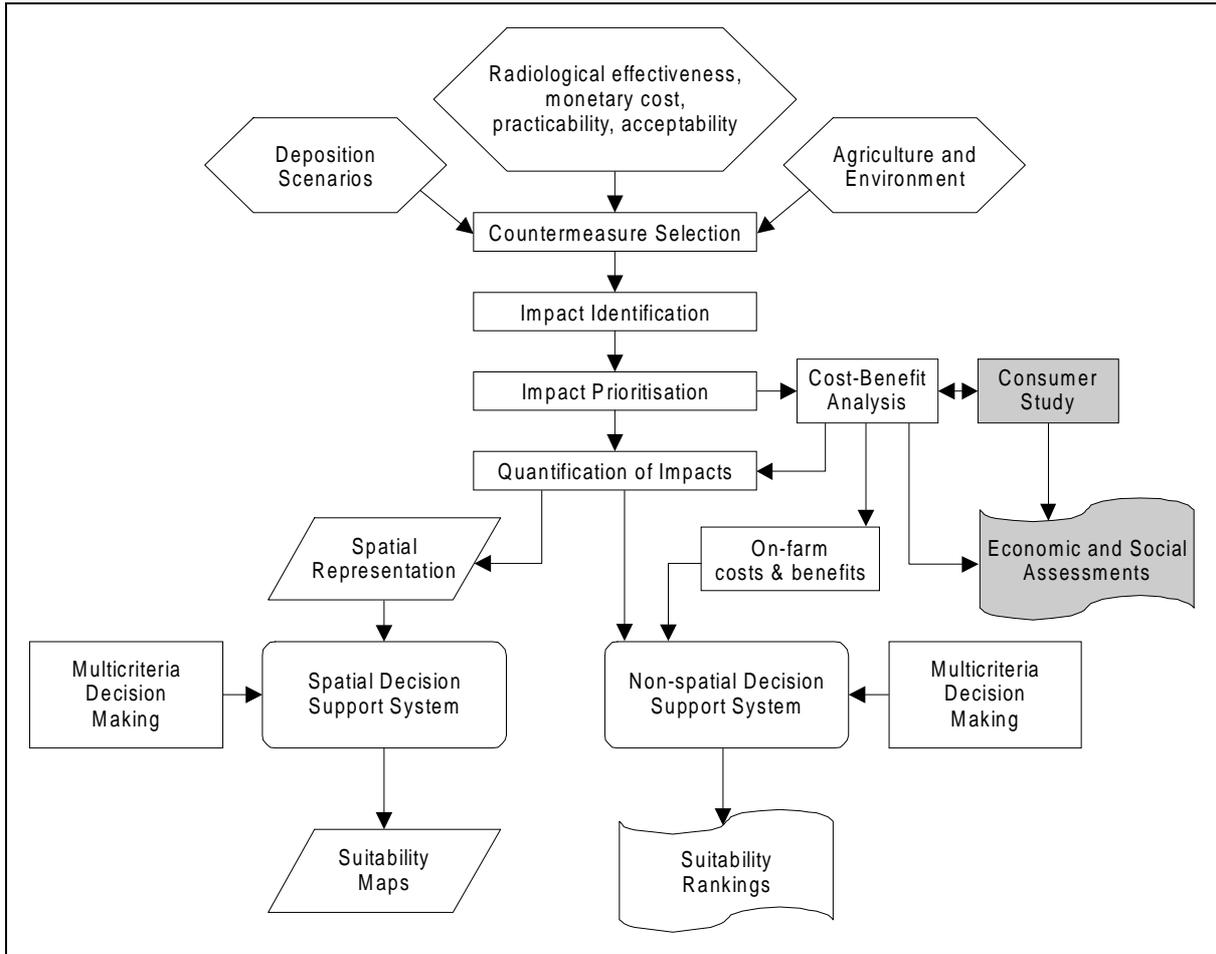


Figure 1.1: Overview of the CESER project.

2. THEORETICAL FOUNDATION AND MODEL DEVELOPMENT

Little work is done on consumer attitudes toward food treated with countermeasures, therefore a thorough study of literature on related food safety issues has been performed. Consumer behavioural theory (Fishbein, 1980) together with findings in the literature study (Grande, 1997) served as a background for developing a consumer model.

2.1 Theoretical model

The model developed is shown in Figure 2.1, illustrating the relationship between consumer characteristics, risk perception and attitude, intention and final behaviour.

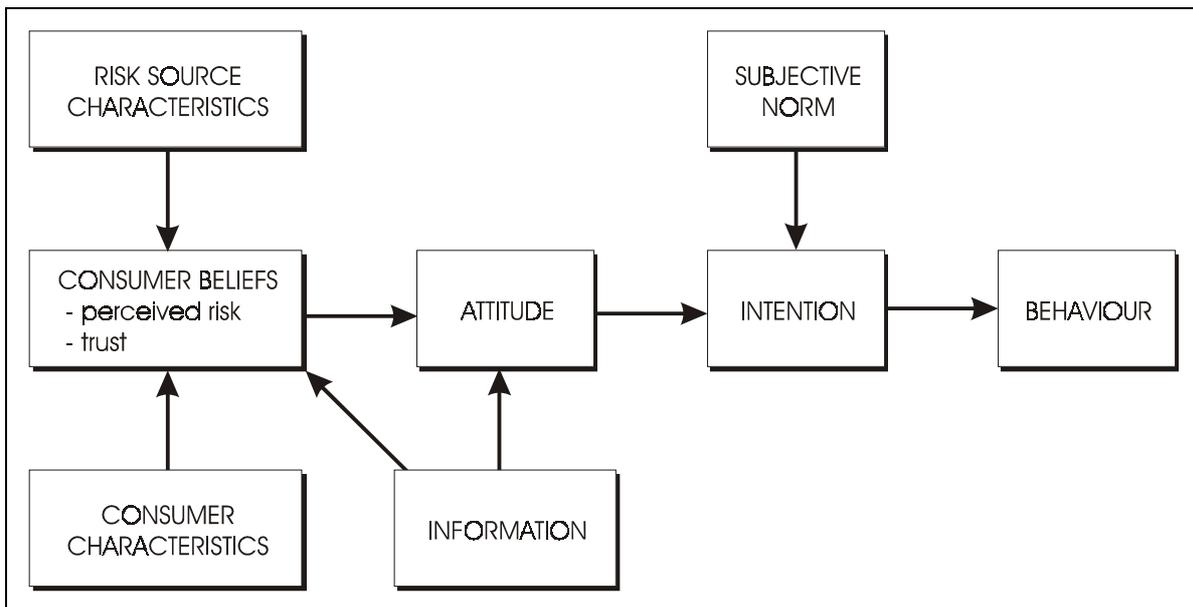


Figure 2.1: Factors influencing consumer attitude and behaviour in food safety issues.

The theory suggests that a set of beliefs forms a person's risk perception and attitude, which, together with a set of variables representing the person's subjective norm, influence his or her final decision and behaviour. An interesting question is what creates and influences beliefs, and what type of consumer characteristics can be connected to certain beliefs? It is also important to note that attitude is not equal to behaviour, the box labelled subjective norm in Figure 2.1 may play a significant role. Subjective norm can be defined as «The person's beliefs that specific individuals or groups think he should or should not perform the behaviour and his motivations to comply with the specific referents» (Fishbein, 1980, p. 8). This means that a person's behaviour does not necessarily have to be in accordance with his or her perceptions or attitudes.

2.2 Risk source characteristics

In predicting consumer behaviour toward CM-treated food, the consumer's own perception of risk is of great interest. As mentioned earlier, consumers' risk perception is often more influenced by the characteristics of the risk source rather than the experts' calculated risk. In general, these characteristics are found to be the risky source's level of familiarity,

controllability-voluntariness of exposure, severity or catastrophic potential (dread), scientific uncertainty, information, technological process, economic considerations, equity and risk to future generations (Slovic, 1987 and 1996). Sparks and Shepherd (1990) found that people tend to be more pessimistic about uncontrollable and diffuse risk sources than more familiar ones. Thus, risk fitting in to these descriptions seemed to be overestimated by consumers as compared to the experts' calculated risk.

Risk characteristics connected to radioactive contamination are likely to be unfamiliarity, little controllability and severity in terms of effects on health if the risky event becomes reality. If this is true, the consumers' perceived risk connected to radioactive contamination of food is likely to be higher than the experts' judgement of the risk level.

Sparse research is done on risk behaviour connected to the fear of radioactivity in food products. However, a lot more work is done on risk perception connected to other food related hazards like genetical engineering, growth hormones, pesticide residues and irradiation of food. These risk sources seem to have many risk characteristics similar to risk connected to radioactivity in food. Experiences in these fields are thus of great interest when looking at the issue of food safety and risk perception connected to radioactivity in food.

3. CONSUMER SURVEY ON RISK ATTITUDES AND BEHAVIOUR

An extensive survey performed in Norway and Scotland has been an important tool in assessing consumer risk attitudes and behaviour related to the Chernobyl accident. The consumer model in Figure 2.1 helped detecting important subject areas where information was lacking in the total picture of consumer radioactive risk attitudes and behaviour. It also served as a background for a questionnaire directed to the general population in the two countries.

The main focus in the survey was to sort out major effects on consumption level, the consumers' perceived risk related to food affected by radioactive contamination, their information needs in emergency situations and willingness to pay extra for «clean» uncontaminated food products. Further, these data were used to identify possible relationships between consumer characteristics and risk perception, risk behaviour and willingness to pay for «clean» uncontaminated food products.

3.1 General information about the populations and samples

The Norwegian version of the survey was a self administered mail survey sent out to 2000 persons in April/May 1998. The respondents were randomly selected from the National Registry. The response rate for the Norwegian survey was 50.6 %, that is a total of 1003 responses. In Scotland the survey was performed by interviewing a random sample of 200 persons. Face-to-face interviews were conducted by Market Research Scotland over a two week period in July/August 1998.

3.1.1 Sample representativeness

A comparison of population statistics and sample data shows that the sample is representative in terms of gender and age distribution. All groups in the sample are represented with a percentage very close to their percentage in the population. Population data tell that the average number of persons per household in Scotland in 1996 was 2.34 (Advertising Association, 1998), and in Norway 2.4 in 1990 (SSB, 1998). In both samples the household size was close to 2.8. This means that people living in larger households are slightly over-represented in both country samples.

OECD (1998) data show that 32 % of the UK population and 22.6 % of the Norwegian population have a university degree when including short university degree programmes. This compares to the sample data where 32.1 % of the Norwegian respondents are university educated, while only 9.5 % of the Scottish sample is educated at university level. This means that university educated people are somewhat over-represented in the Norwegian sample, while quite underrepresented in Scottish.

We should also be aware of that the Norwegian survey might be over-represented by people favouring organic products. 33.9 % seems to be a somewhat high percentage of the population that prefers to buy organic food (see Table 3.1). However, we don't have population statistics on how many buy organic food. It is likely that those buying organic food are more interested in the survey than the average population and thus are more eager to answer the survey. This would not be the case with the Scottish consumers, since the survey was performed through interviews, and all the persons interviewed have given their answers. The Scottish survey

includes 2.5 % vegetarians, counting five persons in total. This is too few to get a reliable comparison with other variables.

Table 3.1: «Green» consumers in the two countries: Shares of respondents that are vegetarians or prefer to buy organic products.

	Scotland	Norway
	%	%
Are vegetarians	2.5	1.3
Usually buys organic products when available	19.1	33.9

4. GENERAL RISK PERCEPTION

First of all, the respondents were asked to indicate their level of perceived risk attached to a number of risk sources including risk both from food sources and other potential health hazards. In this way we get a picture of how consumers rate perceived risk from radioactive contamination of food compared to other risk sources in food, in addition to other non-food related risk sources. The general question asks how likely the respondents think it is that they will suffer ill health due to different causes (risk sources). For each risk source, the answers were measured on a 5 point Likert scale to achieve a metric of the consumers' risk perception, where 1 indicates highly unlikely, 3 somewhat likely, and 5 highly likely.

In Table 4.1 the risk sources are ranged after mean response in Scotland. It shows peoples' risk perception connected to the different risk sources, both by the mean score and by the share of responses falling in the category indicating the highest risk perception.

Table 4.1: The respondents' mean¹ risk perception measured as the likelihood of suffering ill health (an illness, disease or accident) from various causes. Mean of a 5 point Likert scale and percentage of respondents rating the risk as highly likely.

	Mean response		Highly likely	
	Scotland	Norway	Scotland %	Norway %
Bacteria infected food	3.00	2.93	18.09	10.81
Traffic accident	2.93	2.88	17.68	6.14
Chemical additives in food	2.78	2.95	13.13	11.15
Hole in ozone layer	2.74	2.26	15.58	3.87
Pollution from industry	2.74	2.44	18.18	6.85
Smoking	2.72	2.10	24.12	8.46
Radioactive contamination of food	2.55	2.43	14.57	5.71
Bad food habits	2.53	2.12	10.05	3.61
Fire	2.42	2.05	11.56	1.68
Radiation from nuclear plant	2.42	2.01	16.58	4.49
Too little exercise	2.40	2.29	8.04	4.66
Global warming/greenhouse effect	2.36	2.12	7.11	2.41
Alcohol	2.34	1.68	11.56	2.69
Radon gas in home	2.22	1.86	10.66	1.88
Sunbathing	2.19	2.11	9.55	3.83
<i>Average of all 15 causes</i>	<i>2.55</i>	<i>2.28</i>		

1) All means significantly different between the two countries at a 0.05 % level using ANOVA, except «too little exercise»

If we look at the mean score, the three sources perceived the most risky for both countries are bacteria infected food, traffic accident and chemical additives in food. Scotland ranks bacteria infected food as the most risky to health of these sources, whereas Norwegian respondents believe chemical additives in food is the most risky source. Compared to these 15 risk sources radioactive contamination is ranked as the 6th most risky source for causing health damage among the Scottish respondents, and as the 5th most risky source in the Norwegian survey.

By looking at the share of respondents that perceive risk of the different sources to be highly likely, the ranking would change somewhat. This tells which cause people attach the most extreme risk to. By looking at highly likely, the Scottish respondents rank radioactive

contamination of food as number 7 of these risk sources, and Norwegian respondents as number 6. For every risk cause the average response for Scottish respondents is higher than the Norwegian response. This might indicate that people in Scotland really perceive a higher risk than in Norway. Another reason might be that that people in the two countries use the scale differently. The Scottish respondents might be more willing to use extreme points on the scale, whereas the Norwegians are afraid to exaggerate their feelings/opinion.

An attempt to group the different sources of risk into those the respondents can control themselves and those they cannot control, gives no indication that controllable risk sources are found less or more risky than those less controllable. Level of controllability is explained by that you can choose whether or not to smoke, but not whether to expose yourself to a hole in the ozone layer or not. As mentioned earlier research suggests that people attach relatively higher risk to a risk source they can not control, compared to those they are able to control (Sparks and Shepherd, 1990).

4.1 Worriedness

The Scottish survey asked, in addition, the respondents to indicate how worried they are about suffering ill health from the same causes as above. The average score was less on the question about worriedness than on the corresponding question on the likeliness of health risk. This was the case for all risk sources. This is shown by comparing the means for Scotland in Tables 4.1 and 4.2.

Table 4.2: Response¹ to the following question: «How worried are you that you will suffer ill health from the following?» The Scottish survey.

Risk sources	Mean response	Very worried, %
Bacteria infected food	2.67	15.6
Traffic accident	2.52	15.1
Chemical additives in food	2.48	12.1
Pollution from industry	2.47	12.6
Hole in ozone layer	2.43	11.1
Radioactive contamination of food	2.42	11.6
Radiation from nuclear plant	2.28	14.6
Fire	2.26	8.0
Bad food habits	2.20	7.5
Smoking	2.18	8.6
Global warming/greenhouse effect	2.16	6.1
To little exercise	2.11	6.0
Radon gas in home	2.06	11.6
Alcohol	1.94	5.1
Sunbathing	1.78	2.0
<i>Average of all risk sources</i>	<i>2.26</i>	

¹ Measured on a scale 1-5 indicating level of worriedness. 1 is not at all worried, 3 is somewhat worried and 5 is very worried

Radioactive contamination of food products is ranked as number 6 among the 15 risk sources, which is quite high on the list. The top of the list is dominated by non-controllable risk sources, with the exception of traffic accidents.

4.2 Comparing likeliness and worriedness

In the Norwegian survey, the respondents were asked a general question about how worried they are about suffering ill health from all the reasons above, instead of asking separately about each risk source. The responses show that the Norwegians are more worried about suffering ill health than their belief of its likeliness to happen. By looking at the average of all means for the Scottish survey for the question on worriedness (Table 4.2) it is also possible to get an indicator for the general view of the Scottish worriedness. This indicator shows a different picture than the corresponding one in the Norwegian survey: Scottish respondents seem to be less worried about suffering ill health than their belief of its likeliness to happen. In other words, the Scots seem to be more aware of the risk, but don't worry as much compared to what the Norwegians do.

Table 4.3: Comparing general likeliness of suffering ill health and general worriedness

	Norway	Scotland
General likeliness of health injury ¹	2.28	2.55
General worriedness ²	2.62	2.26

1) From Table 4.1: Measured on a scale 1-5 indicating likeliness for suffering ill health, explained in Table 4.1

2) Measured on a scale 1-5 indicating level of worriedness, explained in Table 4.2

Peoples' worriedness could be an interesting factor related to the possibility of inducing change in behaviour. The feeling of being worried about a certain health risk could be a more significant cause of behavioural change than a more clinical perceived likeliness of a certain negative health effect.

5. RISK PERCEPTION AND BELIEFS RELATED TO VARIOUS RISK SOURCES IN FOOD

Assessment of the consumers' risk perception and beliefs attached to various risk sources were done through; 1) Evaluation of consumer responses to statements about radioactive risk and food safety 2) Direct questions to the respondents on the likeliness of getting a disease caused by various food risk sources, including radioactive contamination of food.

5.1 Attitudes towards radioactivity and food safety

The respondents were asked about their attitudes connected to various food safety issues, information on food safety, tax increases to improve food safety regulation and nuclear energy. Table 5.1 lists the statements and shows the consumers' responses to them.

Table 5.1: Attitudes towards radioactivity and food safety. Percentage of answers in categories representing different degrees of agreement to the given statements.

Statement:	Country (number of responses)	Response				
		Fully disagree 1	2	3	4	Fully agree 5
a) Even with the Chernobyl accident in mind, I believe that the benefits to mankind from <u>nuclear energy</u> are greater than the disadvantages**	Nor (976)	50.4	19.7	17.9	4.8	7.2
	Sct (200)	24.5	14.5	38.5	13.0	9.5
b) I would be willing to let my family and I eat food that contains genetically engineered animal and plant products**	Nor (978)	63.6	17.5	11.1	3.1	4.7
	Sco (200)	41.0	21.5	25.0	8.0	4.5
c) The food industry is more concerned about their profits than food safety	Nor (977)	5.8	10.0	20.2	24.7	39.3
	Sco (200)	5.0	9.0	16.1	26.6	43.2
d) I would be willing to let my family and I eat food that has been treated against radioactive contamination**	Nor (974)	50.2	18.5	14.7	7.8	8.8
	Sco (200)	32.5	14.0	30.5	14.0	9.0
e) The authorities spend too much money on information about food safety**	Nor (978)	54.3	22.8	14.2	3.6	5.1
	Sco (200)	46.0	26.0	15.5	6.5	6.0
f) I would be willing to accept a tax increase next year, if I knew the money would be spent on a programme that would impose stricter food safety regulations on the food processing industry**	Nor (976)	25.0	13.9	24.8	15.8	20.5
	Sco (200)	21.0	18.0	20.5	19.5	21.0
g) Food that is produced in Norway/Scotland is safer to eat than imported food**	Nor (985)	8.0	6.2	15.7	22.0	47.5
	Sco (200)	6.5	10.0	37.0	26.0	20.5

** significantly different at 0.05 level (Pearson Chi-Square, two tailed test)

The results show a significant difference in responses between the two countries on:

- Attitudes toward nuclear energy
- Eating genetically engineered food
- Eating food treated against radioactive contamination
- Whether the authorities spend too much money on information about food safety or not.
- Respondents' willingness to accept a tax increase if money would be spent on food safety regulations.

The results indicate that both countries have equal distrust in the food industry. There are no significantly different attitudes in the two countries towards the food industry. The majority in both countries believes the food industry cares more about profits than food safety.

5.1.1 Attitudes towards nuclear energy

The majority of the Norwegians seems to be opposing nuclear energy. Close to 70 % of the respondents disagree to the statement that «the benefits from nuclear energy are greater than the disadvantages». This compares to 49 % of the Scottish respondents possessing the same view. Only 12 % of the Norwegians and 22.5 % of the Scottish respondents agree to this statement. Twice as many, relatively, of the Scots compared to the Norwegians, 38.5 % versus 17.9 %, seem to be uncertain about their point of view on this issue. It should be noted that there are two nuclear power plants in Scotland and that about 50 % of all electricity used in Scotland comes from nuclear power plants. In Norway there are no nuclear power plants. This might influence the respondents' opinion on this issue.

5.1.2 Consumption of food treated against radioactive contamination

The following statement was posed: «I would be willing to let my family and I eat food that has been treated against radioactive contamination». As many as 58.7 % of the respondents in Norway and 46.5 % in Scotland disagreed to this statement. More people in Scotland seem to be uncertain by answering neither disagree nor agree to this statement. However, only 16.6 % of the Norwegians and 13.0 % of the Scottish respondents seem to not mind eating treated food products. This indicates quite a big scepticism toward the process of using countermeasures. Having in mind that most of these countermeasures used are fairly simple (in most cases the CMs are changes in the feeding schemes for the animals), this seems to be somewhat exaggerated. However, the consumers might have perceived the process as more complicated. This indicates lack of knowledge among the consumers, which in turn may be an indicator of an information problem.

Less scepticism in Scotland might be due to the very simple countermeasures used, like relocation of animals to different pastures. No feed additives were used in Scotland, as was done in Norway. In addition, fewer animals were involved in countermeasures in Scotland than Norway. (Brynildsen, 1992, John Murphy, pers. com., 1999)

5.1.3 Enough money spent on information about food safety?

The majority in both countries disagree to the statement that «The authorities spend too much money on information about food safety». As much as 79 % of the Norwegians and 72 % of the Scots think that the authorities spend too little money on information about food safety. This indicates that the government has made too little effort or has not been very successful in informing the public about food safety. It also indicates the feeling of uncertainty and the existence of a risk perception related to food.

5.1.4 Increase taxes to spend more money on food safety regulations?

35 % of the Norwegian respondents and close to 40 % of the Scottish respondents are willing to accept a tax increase if it is spent on food safety. The somewhat lower degree of acceptance to this proposal in Norway might be due to a higher tax level on personal incomes.

5.2 Food risk perception

Table 5.2 shows the respondents' perception of various risk sources in food. They were asked to evaluate how likely they think it is that they will get a serious disease as a result of the seven various food risk sources.

Table 5.2: Risk perception measured¹ by the response to questions on the likeliness of suffering ill health as a result of the various risk sources in food. Norway and Scotland.

Source of food risk	mean response		unlikely (1 and 2) % of responses		likely (4 and 5) % of responses	
	Norway	Scotland	Norway	Scotland	Norway	Scotland
	Chemical additives	2.91	2.68	37.2	50.0	27.4
Use of growth hormones	2.74	2.52	45.5	56.6	25.5	23.7
Infectious bacteria	2.73	2.82	44.1	44.5	22.4	28.0
Genetic engineering	2.62	2.53	50.3	57.7	23.3	21.7
Radioactive contamination	2.54	2.47	52.6	56.3	18.4	22.6
Irradiation of food	2.52	2.48	51.6	57.5	14.7	19.7
Pesticide residues in food & vegetables	2.51	2.57	53.6	50.5	17.5	20.0
BSE	Na	2.75	Na	43.6	Na	27.5

¹ Response measurement: Likert scale from 1 to 5. Endpoints labelled: (1)=very unlikely, (5)=very likely. Na = question not asked

Norway

The risk of suffering ill health from radioactive contamination is ranked as number five by the Norwegian respondents, when compared with the six other food risk sources above. This is concluded by looking at the means of the responses and the percentage responses of 4 and 5 in Table 5.2. This indicates a greater fear of health hazard in the Norwegian population caused by radioactive contamination of food, than by irradiation of food and pesticide residues in food. Irradiation is not very common in Norway, so far it is only used on spices. On the other hand, chemical additives, use of growth hormones, infectious bacteria and genetical engineering is perceived as more risky than radioactivity in food.

One should note, however, that 18 % of the respondents believe that it is likely (4 and 5 on the response scale) they will suffer ill health caused by radioactive contamination of food.

When looking at the mean response and the distribution of responses, radioactive contamination gets scores closest to pesticide residues. This is an interesting finding for the discussion on risk source characteristics. If the conclusion is that radioactive contamination of food as a risk source has many characteristics similar to pesticide residues in food, research findings in that area might be applicable also to radioactive contamination as a risk source. There are several studies on risk perception connected to pesticide residues, among these are studies performed by Mishra, et al. (1991) and Huang (1993).

Scotland

The means of the responses indicate that radioactive contamination is perceived the least risky of the eight risk sources in the Scottish survey. By looking at «how likely» the respondents believe it is they will suffer ill health related to the different causes, the conclusion is slightly different: 22.6 % of the respondents find it likely that they will suffer ill health as a result of radioactive contamination, indicating a higher perceived risk attached to radioactive contamination than genetical engineering, pesticide residues and irradiation of food. It is ranked number five among these eight risk sources, which is similar to the ranking in the Norwegian survey.

It seems like the risk perception pattern attached to radioactive contamination in food among Scottish respondents is fairly similar to the risk perception pattern for genetical engineering, growth hormones and irradiation of food.

In the Norwegian survey, radioactive contamination was also perceived to be more likely to cause health injury than pesticide residues and irradiation of food. The distribution of responses seems to be different in the two countries. The Norwegian respondents have a larger share of «neither» or «somewhat likely» answers than the Scottish respondents. As mentioned before the Norwegians seem more reluctant to show extreme opinions.

Table 5.3: Worriedness measured¹ by the response to questions on how worried the respondent is of suffering ill health as a result of the various risk sources in food. Scotland.

Source of food risk	mean response	(1)=not at all worried and (2) % of responses	(4) and (5)=very worried % of responses
Chemical additives	2.57	49.7	24.2
Use of growth hormones	2.53	51.3	23.2
Infectious bacteria	2.73	43.7	27.2
Genetical engineering	2.49	53.3	21.6
Radioactive contamination	2.49	52.3	21.6
Irradiation of food	2.41	54.3	18.1
Pesticide residues in food & vegetables	2.51	50.0	21.0
BSE	2.72	45.7	28.2

1) Response measurement: Likert scale from 1 to 5. Endpoints labelled: (1)=not at all worried, (5)=very worried.

5.3 Risk perception connecting food safety and the Chernobyl accident

Table 5.4 shows which food products people attached most risk to as a result of the Chernobyl accident. This can be compared to the real risk (experts' scientifically calculated risk) caused by Chernobyl. Scottish people seem to overestimate risk attached to beef consumption relative to lamb consumption. According to this, beef is perceived as more unsafe than lamb meat due to the accident, even though the situation is the other way around. One way of explaining this is that the more recent problem with BSE in beef production has caused the increased risk perception, and that people seem to think about the safety of the products in general (including all causes that might have made the product unsafe) instead of the single cause that they are asked about in the question.

Table 5.4: Risk perception relating food safety and the Chernobyl accident. Measured¹ as a response to the following question: «It is now more than 10 years since the Chernobyl accident: How safe do you think it is NOW for an average person to eat the foods listed below?» Mean and proportion of answers in the unsafe/very unsafe categories.

Food product	Mean response		Unsafe/Very unsafe	
	Norway	Scotland	Norway	Scotland
Lamb	3.36	3.43	19.0 %	11.5 %
Beef	3.66	3.38	11.1 %	13.5 %
Reindeer	2.93	Na	35.8 %	Na
Milk	3.78	3.63	8.6 %	8.0 %
Game (venison/moose)	3.07	3.40	29.4 %	10.5 %
Wild mushrooms	2.94	3.22	34.1 %	16.5 %
Wild berries	Na	3.28	Na	15.5 %
Honey	Na	3.56	Na	8.0 %

1) Measured on a 1 to 5 scale. 1= very unsafe, 2 = unsafe, 3 = neither safe nor unsafe, 4 = safe and 5 = very safe Na = question not asked

Food products perceived as most risky in Norway are reindeer meat, wild mushrooms and game (moose). These products are perceived as unsafe by 29 % - 36 % of the respondents. Lamb meat comes in the middle of this list and is perceived as unsafe by 19 % of the Norwegian respondents. In Scotland wild mushrooms and wild berries are perceived as most risky, where both are perceived as unsafe by close to 26 % of the respondents. Lamb meat is perceived as unsafe by 11.5 % of those included in the Scottish sample.

6. RISK BEHAVIOUR

The respondents' risk behaviour is examined both through the consumers' attitude toward various statements on risk reducing actions and direct questions connected to possible changes in the respondents' consumption levels.

6.1 Risk reducing actions towards food risks

Table 6.1 shows the respondents' actions to reduce potential health risk caused by food intake. It describes which actions they were asked about and the percentage of responses in each category for Scotland and Norway.

Table 6.1: Risk reducing actions by the respondents in Norway and Scotland. Percentage distribution of responses.

During the last 12 months, how often have you ...	Country (number of responses)	Response, %				
		Never 1	2	3	4	Very often 5
a) asked, for food safety reasons, about the origin (country of production) of meat in the store or a restaurant?	Nor (996)	78.9	10.9	5.6	2.2	2.3
	Sco (200)	79.5	13.0	5.5	1.0	1.0
b) avoided buying lamb due to fear of radioactivity in the meat? **	Nor (994)	65.1	14.5	9.0	4.5	6.9
	Sco (200)	68.0	12.0	14.0	4.5	1.5
c) avoided buying lamb due to fear of scrapie? **	Nor (990)	60.1	11.3	13.2	6.6	8.8
	Sco (200)	72.0	8.0	14.0	4.0	2.0
d) bought organically produced milk?	Nor (986)	73.8	12.1	6.2	4.0	4.0
	Sco (200)	74.9	10.6	9.1	4.0	1.5
e) avoided buying poultry or eggs because of fear of salmonella?	Nor (994)	54.8	14.7	14.4	9.1	7.0
	Sco (200)	64.5	10.5	15.0	6.0	4.0
f) bought bottled water rather than used tap water due to uncertainty about tap water quality? **	Nor (1001)	71,8	10.1	8.3	5.0	4.8
	Sco (200)	61,5	9.5	15.5	7.0	6.5
g) Scot: Avoided buying/eating beef because of BSE (mad cow disease)? Nor: Avoided eating hamburgers, because of possible health risk. **	Nor (985)	61.8	14.5	9.8	5.2	8.8
	Sco (200)	47.2	14.1	15.6	11.6	11.6

** significant difference between the two countries at 0.05 level (two tailed test, Pearson Chi-Square)

Significant difference in responses found for b, c, f and g, which ask how often the respondent has;

- b) avoided buying lamb meat due to fear of radioactivity in the meat,
- c) avoided buying lamb due to fear of scrapie,
- f) bought bottled water rather than used tap water due to uncertainty about tap water quality
- g) Scotland: Avoided buying/eating beef because of BSE (mad cow disease)? Norway: Avoided eating hamburgers, because of possible health risk.

On b and c the Norwegians have done more actions than the Scots to reduce risk, whereas the situation is the opposite for f and g.

On the other hand, there was not found any significant difference in the responses between the two countries to question a, e and d, which ask how often the respondent has;

- a) asked, for safety reasons, about the origin of meat in the store,
- e) bought organically produced milk,
- d) avoided buying poultry or eggs because of fear of salmonella.

Comments

In Norway there is no real risk due to scrapie in lamb meat. All animals from possibly infected herds were destroyed to avoid fear, and further spread of the disease. People still fear there is a risk, which indicates that they might not be fully informed about the situation. Recent problems with both radioactive contamination and scrapie has had a negative effect on lamb meat demand in Norway.

6.2 Actions to reduce radioactive risk

In total 65 % of the Norwegian and 68 % of the Scottish respondents claim they have never avoided buying lamb meat due to fear of radioactive contamination in the last 12 months. The rest has avoided it at least once, 35 % of the Norwegians and 38 % of the Scots. Finally, 7 % of the Norwegian respondents say they have avoided buying lamb meat very often, whereas this is the case for only 1.5 % of the Scottish respondents. The distribution of the answers is shown in Table 6.1 and also graphically in Figure 6.1 below.

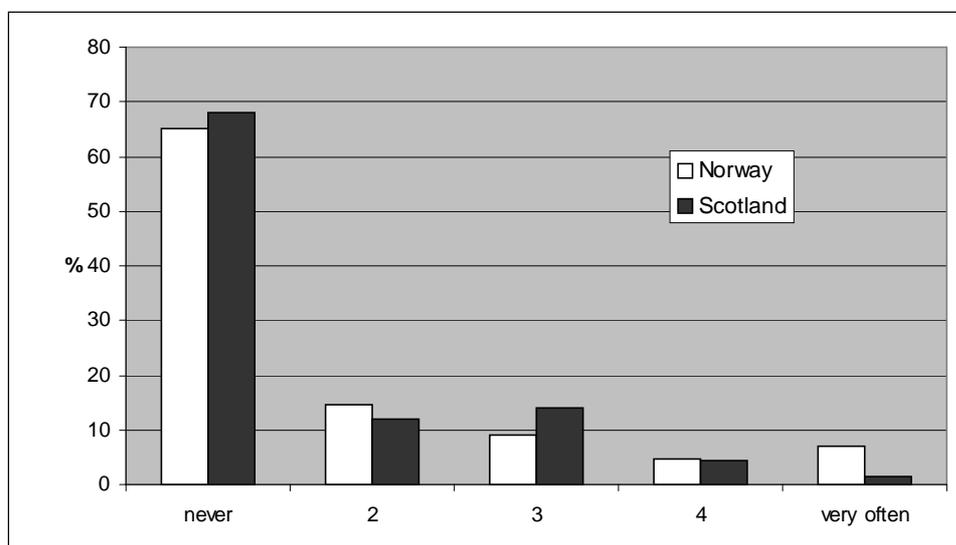


Figure 6.1: Response to: «In the last 12 months; how often have you avoided buying lamb meat due to fear of radioactivity in the meat?» Percent distribution of answers.

6.3 Changes in consumption levels

The respondents were also asked to indicate whether or not they had made any changes in the intake of selected food products in connection with the Chernobyl accident. The answers were also here measured on a 5 point Likert scale, where 1 indicates strongly reduced consumption, 3 no change in consumption and 5 strongly increased consumption.

People have indicated a reduction in most meats here, but normally they would not reduce on all meat consumption. When they reduce consumption of one product it would be natural to think that they eat more of another meat product. Since major meats like pork and poultry are not included here, we don't know whether or not the respondents have changed their consumption of these meats. Therefore it is difficult to evaluate whether the respondents overestimate the reduction in consumption in their answers to these questions.

Table 6.2 summarises the responses to two questions concerning the short and long term changes in the consumption of various foods. The two questions asked were:

Long term changes:

«Has your knowledge about the Chernobyl accident affected your consumption of the different foods? Please indicate how your current consumption of the affected food types compares to what you believe your consumption would have been without the Chernobyl accident.»

Short term changes:

«In the months following the Chernobyl accident in 1986, did knowledge about the accident and its effects cause you to make changes in your (or your family's) consumption of the foods listed below?»

Table 6.2: Short term and long term changes in consumption due to the Chernobyl accident. Percentage of respondents answering reduced consumption (includes strongly reduced consumption)¹.

Food Product	Short term reductions		Long term reductions	
	Norway	Scotland	Norway	Scotland
Lamb	43.9 %	32.7 %	20.8 %	17.0 %
Beef	16.5 %	28.1 %	8.8 %	15.0 %
Reindeer	47.4 %	Na	27.0 %	Na
Wild mushrooms	40.4 %	19.0 %	24.4 %	10.0 %
Game (venison)	37.2 %	17.0 %	21.2 %	11.0 %
Milk	7.8 %	19.6 %	4.1 %	7.0 %
Wild berries	Na	20.3 %	Na	9.5 %
Honey	Na	16.3 %	Na	8.5 %

¹Response measurement: Likert scale from 1 to 5, where 1 = strongly reduced consumption, 3 = no change in consumption and 5 = strongly increased consumption. Na = question not asked.

6.3.1 Short term reductions

The reported reduction in consumption the first months after the accident is shown in the column labelled «short term reductions» in Table 6.2. In the months following the accident, 44 % and 47 % of the Norwegian respondents reduced their consumption of lamb and reindeer meat, respectively. In addition, close to 40 % of the Norwegians claim they reduced their consumption of wild mushroom and «hunted» meat.

In Scotland, fewer said they reduced their consumption of lamb meat, but still as much as 33 % claim they reduced their intake of lamb in the months following the accident.

6.3.2 Long term reductions

In Norway, reindeer meat received most reports of reduced consumption level also in the long term. As much as 27 % of the respondents said they still had a reduced consumption of this meat today compared to what they believe it would have been without the Chernobyl accident. In total, 21 % of the respondents said they had reduced their long term consumption of lamb for the same reason. Only a small number of the Norwegian respondents reported reduced consumption of milk and beef.

The share of respondents that claim to have reduced their long term consumption of food due to Chernobyl is generally less in Scotland than in Norway. Nevertheless, 17 % of the Scottish respondents say they have reduced their consumption of lamb meat. For the other products the comparing numbers are; 15 % for beef, 11 % for venison, 10 % for wild mushroom, 9.5 % for wild berries, 8.5 % for honey and 7 % for milk.

6.3.3 Discussion

Risk perception is measured through several variables. These include variables on general risk perception and risk perception directly related to radioactive contamination of food products. Direct questions on risk perception connected to food products show that Norwegians tie highest risk to reindeer meat, wild mushrooms and game (moose), whereas the Scots seem to perceive wild mushrooms and wild berries as the most risky. In general, it seems like twice as many Norwegians as Scots, in relative numbers, perceive these products as risky. In both countries the respondents perceive risk attached to lamb meat as somewhat lower than for game, berries and mushrooms. This might be due to the respondents' knowledge of countermeasures taken to reduce radioactive content in lamb, while no specific actions are taken to reduce radioactivity in game, berries and wild mushrooms.

The variables on behaviour show that people have acted according to their beliefs. An exception is lamb meat, where risk reducing actions are at the same level as reindeer meat and game, whereas the perceived risk was less than for those two latter products. This might be due to the fact that reindeer meat and game make up a smaller share of total meat consumption than lamb for most consumers. Thus, reduction of lamb meat consumption will be more important in reducing the consumers' total intake of food contaminated by radioactivity.

7. FACTORS INFLUENCING RISK PERCEPTION AND BEHAVIOUR

One of the main goals in the consumer study is to identify consumer characteristics important for explaining possible differences in the consumers' risk perception and risk behaviour. A further aim is to reveal similarities and differences in the risk perception and behaviour patterns emerging from radioactive contamination as a risk source in food compared to other risk sources (general food risk).

As we have seen above, there are several variables in the survey data that give information about the consumers' perceived risk and risk behaviour. Each of these describes a specific and isolated aspect of the more general term «risk». For our analysis of risk perception and risk behaviour as more general concepts, it is necessary to obtain measures that condense into single variables the different sides of the two concepts that are represented by the more specific variables. Methodologically there are several alternative ways of obtaining such measures. We have chosen to construct these measures through two different methods. One is the computation of a simple additive index, the other is factor analysis.

For both methods the starting point is the collection of variables that measure risk perception and risk behaviour. The additive index is formed by taking the arithmetic mean of the relevant variables. This method is simple, and should produce a reasonably valid and easily interpretable measure, provided that the variables upon which it is based are not too widely spread in terms of conceptual focus.

Factor analysis is a more complex method. Based on the information contained in a number of variables, this method aims at representing as much as possible of the information of the original variables in a lowest possible number of new variables, or factors. The factors are underlying unobserved variables that are formed on the basis of the correlation matrix of the original variables.

The difference between the two methods, in the case of this particular study, can be explained with reference to the theoretical model (see Figure 2.1). Risk perception and behaviour are theoretical concepts that we would like to measure. For each concept, a number of questions on the questionnaire have been specifically designed. Forming an additive index on the basis of these specific questions could then be one way of operationalising the theoretical concepts of interest. In this case theory comes first and defines the measurement tool.

A somewhat different approach characterises the factor analysis. In this case the data are more allowed to «speak for themselves», in the sense that the ties to theory are looser, and that the analysis is to a greater extent a task of interpreting the underlying structure of the data. Factor analysis is more a process of data exploration than the production of strict theoretical measures.

Our methodological approach is therefore as follows: Additive indexes are used as baseline measures for the concepts we are analysing. These are based on the variables used to measure the corresponding theoretical concepts. Using the same variables, but allowing for inclusion or exclusion of variables based on findings in the preceding analyses, factor analysis is also performed. The factor analysis plays two major roles. One is to provide a statistical check on the goodness of the additive index. The other is to explore, on the basis of the obtained data, the potential presence of multiple dimensions in the theoretical concepts.

As mentioned above, the purpose of this data reduction procedure is to find some simple measures of risk perception and risk behaviour for use in further analyses. The constructed indexes were thus used as dependent variables in correlation analysis and analysis of variance. As independent variables in these analyses were used an array of consumer characteristics as shown in Table 7.2. In this way these measures of risk perception and risk behaviour are used to uncover possible relationships between demographics and other characteristics of the respondents and their risk perception and behaviour.

7.1 Constructing additive indexes

7.1.1 Radioactive Risk Perception Index - RRPI

The radioactive risk perception index (RRPI) is computed on the basis of seven questions or variables that relate risk perception and attitudes to radioactivity in food. Increasing value of the RRPI indicates an increasing feeling of health risk by the respondent. This RRPI index is the arithmetic mean of these seven variables. The seven variables are obtained through questions about the respondents' beliefs connected to the likeliness of health injury caused by food affected by radioactive contamination, how safe they believe it is to eat various food products, and beliefs connected to the effectiveness of countermeasures. The same variables were selected for the index in both countries, except that venison meat was substituted for reindeer meat in the Scottish index. The rationale for this is that questions about reindeer meat was not included in the Scottish survey.

The expression for the RRPI is:

$(v07j + v09dsn + v17 + v18asn + v18csn(v18fsn) + v23asn + v23c)/7$, where:

- v18asn: how safe or unsafe do you think it is to eat lamb?
- v18csn: how safe or unsafe do you think it is to eat reindeer (Norway)?
- v18fsn: how safe or unsafe do you think it is to eat venison (Scotland)?
- v07j: likeliness of suffering ill health caused by radioactive contamination in food
- v09dsn: agree- or disagreement to the statement «I would be willing to let my family and I eat food that has been treated against radioactive contamination»
- v17: Likeliness of getting a serious disease caused by the Chernobyl accident through food consumption
- v23asn: a) The health risk associated with radioactivity is considerably exaggerated
- v23c: c) Preventive measures against radioactivity in food do not make the food as safe for consumption as the experts claim

7.1.2 Radioactive Risk Behaviour Index (RRBI)

Similarly, radioactive risk behaviour is measured by the Radioactive Risk Behaviour Index (RRBI). This index consists of the mean response to seven questions concerning the respondent's behaviour toward radioactive risk in food. Six of these questions were related to the respondents' changes in consumption of various products and the other question asked directly how often they had avoided buying lamb meat during the last 12 months. Increasing value of the RRBI indicates increasing degree of actions taken by the respondents to reduce the risk of negative health effects caused by radioactive contamination of food.

The expression for the RRBI is:

$$RRBI = (v14b + v19asn + v19csn(v19fsn) + v19esn + v20asn + v20csn(20fsn) + v20dsn) / 7$$
where

- v14b: How often the respondent has avoided buying lamb due to fear of radioactivity in the meat
- v19asn: long term reduction in consumption of lamb due to Chernobyl
- v19csn: long term reduction in consumption of reindeer due to Chernobyl (Norway)
- v19esn: long term reduction in consumption of wild mushrooms due to Chernobyl
- v19fsn: long term reduction in consumption of venison due to Chernobyl (Scotland)
- v20asn: short term reduction in consumption of lamb due to Chernobyl
- v20csn: short term reduction in consumption of reindeer due to Chernobyl (Norway)
- v20esn: short term reduction in consumption of wild mushrooms due to Chernobyl
- v20fsn: short term reduction in consumption of venison due to Chernobyl (Scotland)

The results of the statistical analyses of these indexes will be presented in section 7.3.

7.2 Factor analysis

Factor analysis is, as mentioned above, a statistical technique used to extract a relatively small number of factors representing a statistical relationship between a larger set of variables. The method is used here with the purpose of extracting one or more factors (variables) representing measure(s) of radioactive risk perception, radioactive risk behaviour, general food risk perception and general food risk behaviour from an array of variables measuring different aspects of these concepts. Separate analyses were performed for Scotland and Norway.

7.2.1 Steps in the factor analysis

The first step in the factor analysis is the selection of variables to be included in the analysis. The correlation matrix of all relevant variables shows the interrelationship between the variables and gives an indication on whether the variables share a common factor or not. If they share common factors the variables should be correlated to each other. The correlation matrix of possible variables to include showed that all variables were related to each other. Before proceeding with the factor extraction, standard tests for the appropriateness of factor analysis were performed. The hypothesis that the correlation matrix is an identity matrix, thus indicating a weak or absent correlation pattern among the variables, was rejected by the Barlett test of sphericity. Next all variables were entered into the analysis. Several models were run and a further selection of variables to include was based on which model gave the best KMO-measure, in addition to expert judgement on the importance of the information supplied by each variable and how simple and interpretable the results were. The KMO-measure for the models varied from 0.74 up to 0.86, indicating a good factor solution.

The factors were extracted using the principal component method, and rotated according to the varimax method. The varimax rotation minimises the number of variables that have high correlation with a factor, thus simplifying interpretation of the factors in cases where more than one significant factor is obtained. The number of factors that can be extracted from a factor analysis is always the same as the number of variables that it is based on, but one hopes

to capture a greatest possible proportion of the total variance of the variables in a smallest possible number of factors. The factor analysis might therefore produce more than one measure of risk perception and risk behaviour, while the additive index gives one measure. The results of the factor extraction process is shown in Table 7.1 below.

Table 7.1: Information about the models used in the factor analysis.

	Radio-active risk perception		Radioactive risk behaviour*				General food risk perception		General food risk behaviour	
	Nor	Scot	Short term		Long term		Nor	Scot	Nor	Scot
			Nor	Scot	Nor	Scot				
Number of variables included	11	12	5	7	5	6	13	13	7	7
Number of factors extracted	3	3	1	1	1	1	3	3	2	2
% of variance explained	61	64	66	79	66	79	64	71	56	64

* Since not all respondents answered to the question on short term changes in consumption (respondents aged 20 (Scotland 16) to 30), risk behaviour was separated into short term and long term radioactive risk behaviour.

7.3 Results - factors influencing risk perception and behaviour

The construction of indexes and factor analysis are the methods we have used to find single measures of the variables risk perception and risk behaviour. In this section we will do analyses on these variables in order to find which factors influence them or help explain their variation. The summary of the results is presented in Tables 7.2 and 7.3 below. Table 7.2 shows relationships between consumer characteristics and risk perception, while Table 7.3 focuses on risk behaviour.

Note that the factor analysis resulted in up to three significant factors¹ for several factor extractions. This indicates that there might exist several *dimensions* of risk perception/behaviour. It is not unlikely that these specific dimensions (variables) are quite different in terms of relations to consumer characteristics. As an example, the variable age could correlate negatively to one dimension of risk perception and positively to another.

We have restricted the statistical analyses of the indexes to the standard correlation analysis. The indexes may be viewed as continuous interval level variables, thus being suitable for correlation analysis. For those background variables describing consumer characteristics that are not at least at an interval level, we have constructed dichotomous (or dummy) variables to indicate the appropriate characteristic, such as gender, marital status, education, profession, etc. These variables may then be used in correlation and, if necessary, regression analyses. We also choose to view our Likert scale measures as interval level variables, recognising the fact that the statisticians have not reached an agreement on the appropriateness of doing this.

7.3.1 Radioactive risk perception - Norway

Correlation analysis between RRPI (the simple additive index) and the radioactive risk perception indexes extracted through the factor analysis reveals several relationships between consumer characteristics and risk perception.

Groups identified to have higher risk perception than average are:

- low income households

¹ Factors with eigenvalues greater than 1.

- older people
- women
- widow(er)s
- persons who are divorced
- persons having experienced food poisoning
- persons who prefer to buy organic food
- persons who live in rural areas

Groups identified to have lower risk perception than average are:

- high income households
- younger people
- men
- large households
- households with many children under 20
- university or college educated
- working in primary production

7.3.2 General food risk perception - Norway

The results of the correlation analysis of general food risk perception reveals many of the same relationships as indicated in the analysis of the radioactive risk perception index. However, the survey indicates that there is no significant relationship between general risk perception and whether people work in primary production or not, or whether they live in a rural or urban area.

An interesting finding is related to the different factors from the factor analysis, representing general food risk perception. One factor correlates negatively with the dummy variable married people, the other with single people. This might appear counterintuitive, but it is probably an indicator of the complexity of the risk concepts. It is likely that these concepts have several dimensions, which this finding indicates.

7.3.3 Radioactive risk perception - Scotland

Fewer relationships are found between consumer characteristics of the Scottish population and risk perception. People in Scotland that seem to have a higher risk perception than the rest are:

- those preferring to buy organic food
- those willing to pay extra for «clean» lamb meat

The only negative correlation is found toward primary production, i.e. only people that work in primary production seem to have a lower risk perception than the average population in Scotland.

No other relationships have been identified in radioactive risk perception.

7.3.4 General food risk perception - Scotland

Through factor analysis more consumer characteristics were found to be connected to general food risk perception than to radioactive risk perception. Factors associated with higher general risk perception seem to be

- relatively old age
- women
- number of children between 7 and 20
- people who buy organic food

Factors associated with lower general risk perception seem to be

- people that are college or university educated
- people working in primary production
- widows/widowers

Table 7.2: Risk perception: Results of correlation analyses between possible explanatory variables and Radioactive Risk Perception and General Food Risk Perception.

	Norway			Scotland		
	Additive index	Factor analysis		Additive index	Factor analysis	
	Radio-active risk	Radio-active risk	General food risk	Radio-active risk	Radio-active risk	General food risk
Household income	-	-	-			
Age		+/-	+/-			-/+
Women	+	+	+/-			+
Household size	-	-	-			
Children under 20		-	-/+			
Number of children 0-6			-			
Number of children 7-20						+
Total number of children						
University or college educated	-	-	-			-
Natural science educated (Scotl.)	Na	Na	Na			
Working in primary production		-			-	-
Living in a city		-				
Married			-			
Widow(er)	+	+/-	+			-
Divorced		+				
Single			-			
Experienced food poisoning	+	+	+			
Buys organic food	+	+	+/-	+	+	+
Willingness to pay extra for lamb	+	+	+/-		+	
WTP extra for milk (Scotland)	Na	Na	Na			

Signs (+ or -) indicate correlations significant at the 5 % level. 0 indicates no correlation. Na = not asked
Correlations for dichotomous variables have been verified using ANOVA with RRPI or RRBI as dependent variables.

7.3.5 Risk behaviour - main findings

Like for the analysis of risk perception, a greater number of significant relationships between consumer characteristics and risk behaviour are found among the Norwegian respondents than among the Scottish. Many of the relationships for risk behaviour are the same as for risk perception.

7.3.6 Radioactive risk behaviour - Norway

Groups identified to have stronger risk reducing behaviour than average are:

- Households with low income
- older people
- women
- widow(er)s
- people who are divorced
- people having experienced food poisoning
- people preferring to buy organic food.

Groups identified to have less risk reducing behaviour than average are:

- households with high income
- younger people
- men
- large households
- people having many rather than few children
- people with university or college education

7.3.7 General risk behaviour - Norway

The relationship between general risk behaviour and consumer characteristics show many similarities to radioactive risk behaviour and consumer characteristics. In addition the results indicate that people working in primary production tend to display more risk reducing behaviour than the rest of the population. There is also some indication that people with a university education, and with children - but few, tend to be more aware of reducing risk when buying food. However, the factor analysis reveals both positive and negative correlation here.

7.3.8 Radioactive risk behaviour - Scotland

The radioactive risk behaviour is separated into long term and short term behaviour, based on the questions relating to the respondents' actions after the Chernobyl accident. The only significant finding identified through the additive index was a tendency towards less risk reducing behaviour for people living in urban areas. Otherwise the correlation analysis based on the factors from the factor analysis identified several significant relationships. Characteristics related to an increasing risk reducing behaviour seem to be:

Long term risk reduction:

- high household size
- people having many rather than few children
- people having natural science education
- people having experienced food poisoning

Short term risk reduction:

- people working in primary production

7.3.9 General food risk behaviour - Scotland

In the Scottish sample different variables were found to correlate with general risk behaviour from those correlating with radioactive risk perception. The factor analysis indicates a possible negative relationship between age and general risk behaviour, i.e. younger people seem to have a greater tendency to act in a risk reducing way. Scottish people with college or university education, and/or preferences towards buying organic food, also seem to be more

risk reducing in their general food behaviour. People with a stronger risk reducing behaviour also seem to be willing to pay more for the possibility of buying «clean» milk.

Table 7.3: Risk Behaviour: Results of correlation analysis between possible explanatory variables and Radioactive Risk Behaviour and General Food Risk Behaviour.

Consumer Characteristics	Norway				Scotland			
	Index <i>Radioact. risk</i>	Factor analysis			Index <i>Radioact. risk</i>	Factor analysis		
		<i>Radioactive risk</i>		<i>General food risk</i>		<i>Radioactive risk</i>		<i>General food risk</i>
		<i>Short</i>	<i>Long</i>			<i>Short</i>	<i>Long</i>	
Household income	-	-	-	-				
Age		+	+	+/-				-
Women	+	+	+	+				
Household size	-	-	-	-			+	
Children under 20		-	-				+	
Number of children 0-6			-	+/-				+
Number of children 7-20				-				
Total number of children								
University or college educated	-		-	-/+				+
Natural science educated (Scotl.)	Na	Na	Na	Na			+	
Working in primary production				-		+		
Living in a city					-			
Married								
Widow(er)	+	+	+	+				
Divorced								
Single			-	+				
Experienced food poisoning	+	+		+			+	
Buys organic food	+	+	+	+				+
Willingness to pay extra for lamb	+		-	+	+	+		
WTP extra for milk (Scotland)	Na	Na	Na	Na				+

Signs (+ or -) indicate correlations significant at the 5 % level. Correlations for dichotomous variables verified using ANOVA with RPI or RBI as dependent variable. na: question not asked.

7.4 Discussion of results

We have found fewer explanatory variables that correlate significantly with risk perception in the Scottish sample than in the Norwegian. Possible explanations or hypotheses are:

- Risk perception with respect to radioactivity in food is less in Scotland than in Norway.
- Harder to identify groups with deviating risk perception or behaviour. None of the defined demographic groups in the population seem to have a higher risk perception than others in terms of this issue.
- Relatively small sample size in Scotland; 200 respondents versus 1000 in Norway
- Scottish people also tie risk perception to products having had less problems with radioactivity (i.e. beef), thus information/knowledge about the situation might be more sparse among people in Scotland than in Norway.
- Problems of radioactive contamination generally less in Scotland than Norway
- People in Scotland have forgotten this issue/problem; problems with BSE have dominated the food risk discussion in the 1990s.

People in Scotland seem to be relatively much less worried about radioactivity in food and general risk sources in food than in Norway. This generally low level of risk perception

among all groups of the population might be the reason for the difficulties of finding relationships between various demographic factors and level of risk perception. This rises the question if this is the situation for general risk food perception as well. However, the results show that more of the consumer characteristics have a significant relationship with general risk perception and behaviour than to radioactive risk. Nevertheless, fewer significant relationships are found between risk perception and consumer characteristics in the Scottish data compared to the findings in the Norwegian data.

Common for both countries is that those preferring to buy organic food and people having experienced food poisoning have a higher risk perception than the rest. University education seems to reduce risk perception and behaviour. Those having a higher risk perception or risk behaviour than others are also likely to have a higher WTP for «clean» lamb meat than the average.

8. ANALYSIS OF WILLINGNESS TO PAY (WTP)

Although being a seemingly non-scientific term, «willingness to pay» (WTP) is firmly rooted in the analysis of demand in micro-economic theory with applications in welfare economics (Boadway and Bruce, 1984). WTP indicates the maximum monetary amount a utility-maximising economic agent would be willing to pay for a certain commodity. The difference between the WTP and the actual market price defines the consumer's welfare surplus.

The Chernobyl accident caused increased radioactive levels in some food products, like lamb (Norway and Scotland) and milk (Scotland). Different countermeasures help reduce the radioactive content in these products to a safe level, which is determined by the health authorities. The products are then supplied to the markets the ordinary way, with no particular labelling, information or pricing separating them from similar products that have not been subjected to countermeasures. Our implicit hypothesis is that not all consumers trust the effect of the countermeasures, and would prefer to buy products coming from non-affected areas. By not being able to distinguish between treated and non-treated food (from non-affected areas), these consumers thus perceive some level of risk connected to consuming these products.

In our survey we ask the respondents how much they would be willing to pay extra for food products that are guaranteed never to have been affected by radioactivity, as compared to the current supply of products that may or may not have been affected, and treated if necessary. The resulting WTP-measure can be interpreted in two ways. One is the welfare loss in terms of risk experienced by consumers from not knowing whether the food is unaffected by radioactivity or not. The other interpretation is the potential extra market value of food products (here milk and lamb) that are guaranteed not to have been exposed to radioactivity. The purpose of this section is to find consumers' WTP extra for labelled food from non-affected areas, to analyse which consumer characteristics help understand differences in WTP and to indicate whether the findings differ between the two countries.

8.1 WTP of those preferring untreated food

Since Norway and Scotland have different monetary units, the analysis will present willingness to pay extra as the percentage of the given «normal» price. Table 8.1 shows the WTP extra for lamb and milk for respondents that preferred «clean» untreated food. When including zero bids, Norwegians preferring «clean» untreated food had an average WTP extra at 46.6 % (NOK 18.30) above market price at the time of the survey. For the Scots preferring the same option the average WTP extra is 31.3 %. For milk, which was a subject in the Scotland survey, the WTP extra for milk imported from uncontaminated areas was 62.3 %.

Table 8.1: Willingness to pay extra for respondents preferring «clean» untreated lamb meat and milk in Norway¹ and Scotland. Percentage above given price. Includes zero bids.

	Lamb		Milk
	Scotland	Norway	Scotland
n	108	466	152
Given price	£2.50 per pound	NOK 50 per kg	£0.40 per pint
Mean	31.3	46.6	62.3
Median	20	30	50
5 % trimmed mean	26.1	33.0	350
Maximum	200	200	56.9
95 % confidence interval of mean	13.1 - 39.6	33.7 - 39.5	52.6 - 72.1
Standard error	4.16	1.48	4.94

1) In Norway only WTP extra for lamb

Figures 8.1 to 8.3 show the distribution of the WTP measures. As expected, the distributions deviate from the normal distribution with an overweight of zero and low bids. The Norwegian responses (Figure 8.2) are closest to a normal distribution, including a smaller share of zero bids than the data from the Scottish sample.

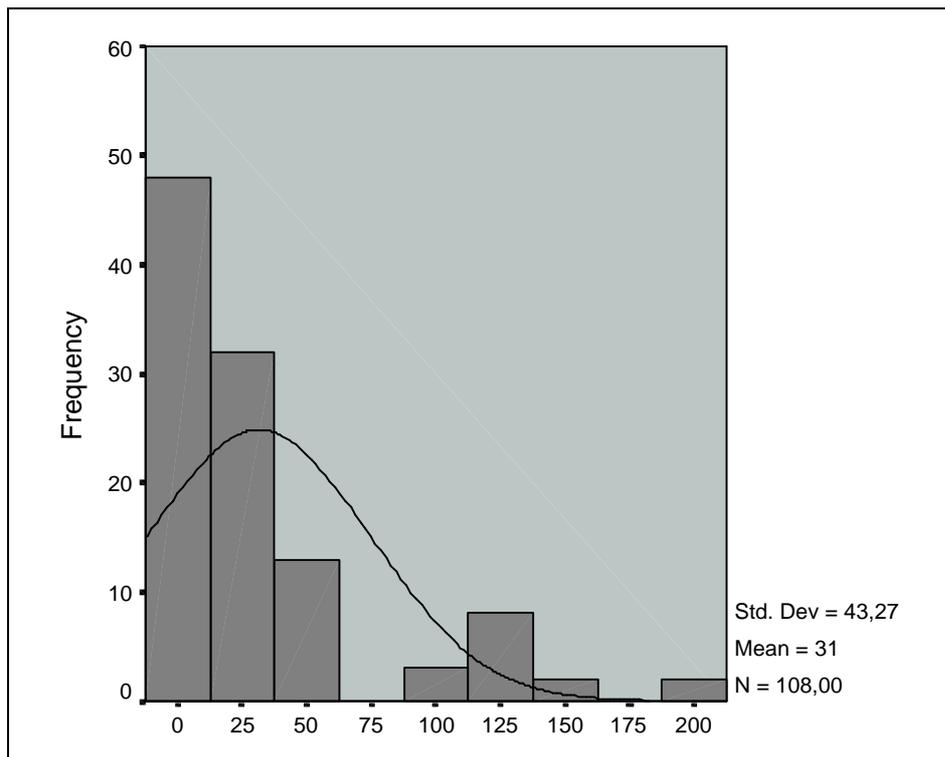


Figure 8.1: Willingness to pay extra for lamb meat in Scotland for those preferring clean - untreated meat. Percentage above «normal» price (£2.50/pound).

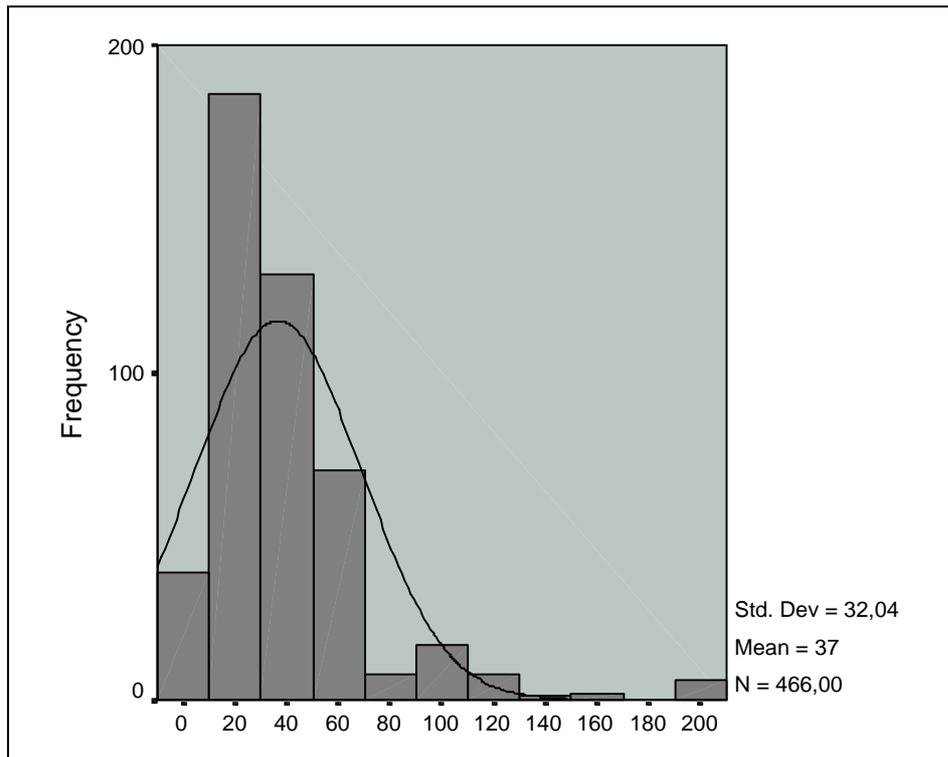


Figure 8.2: Willingness to pay extra for lamb meat in Norway for those preferring clean - untreated meat. Percentage above «normal» price (50 NOK/kg).

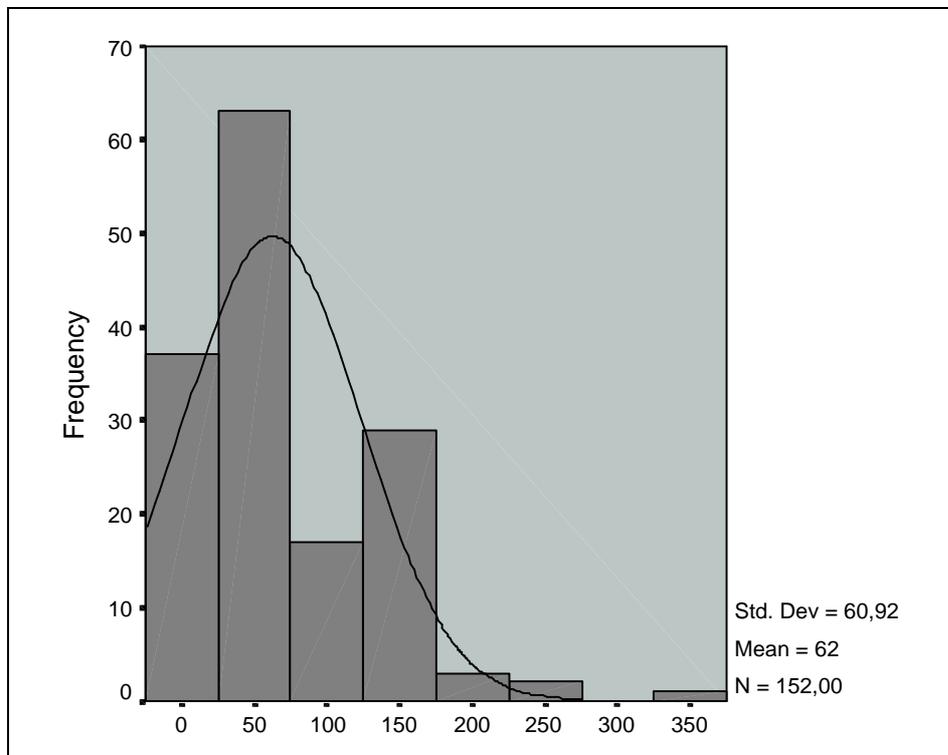


Figure 8.3: Willingness to pay extra for milk in Scotland for those preferring clean - untreated milk. Percentage above «normal» price (£0.40/pint).

8.2 Factors influencing willingness to pay

Through correlation analysis and analysis of variance (ANOVA) several consumer groups were found to have a significantly higher willingness to pay extra for «clean» uncontaminated food compared to other groups.

In Norway these groups were identified as:

- women
- younger people
- people having experienced food poisoning
- people preferring to buy organic food

In Scotland these groups were identified as:

- people having experienced food poisoning
- people preferring to buy organic food
- no children under 20 in household
- small household sizes
- education not focusing on natural science

Table 8.2: Correlation between WTP and consumer characteristics

Socio-demographic factors	Correlation with WTP*		
	Lamb meat		Milk
	Scotland	Norway	Scotland
Women	0	+	0
Age	0	-	-
Married or live-in	-	0	0
Experienced food poisoning	+	+	0
Vegetarian	+	0	0
Buys organic food	+	+	+
University/college education	0	0	0
Education focus on natural science	-	na	0 (- at p=0.055)
Living in a city	0	0	0
Have children under 20	-	0	0
FRBI	0	0	0 (+ at p=0.069)
Household size	-	0	0
Household income	0	0	0

* + and - indicate positive and negative correlation significant at 0.05 level.

8.3 Conclusion WTP

The study shows that consumers may be willing to pay more for food from areas not affected by radioactive fallout. For consumers preferring to buy food from non-affected areas, the average price premium for lamb meat was 31 % and 47 % for Scotland and Norway, respectively, and 62 % for milk in Scotland. People having a higher WTP than others were identified in both countries to be those preferring to buy organic food and those having experienced food poisoning. Also characteristics like small households, single, young age, women and non-natural science education were identified to have a positive relationship with the WTP for food from non-affected areas.

9. COMMUNICATING RISK INFORMATION

The purpose of information in this context is to influence a person's knowledge about a certain topic and induce a certain behaviour by that person. Communication of risk information is thus a major factor influencing risk perception. How this information is processed in the consumer's mind (perceived) depends both on the consumer's previous knowledge, beliefs, attitudes and trust in the information source.

The survey has investigated consumers' experience with information connected to the Chernobyl accident, and their trust in various information sources. This was done by asking the respondents directly about their agree- or disagreement to various statements related to radioactivity and the Chernobyl accident.

9.1 Evaluation of statements related to information and trust

Below is an overview of the distribution of the responses to various statements connected to radioactivity, the Chernobyl accident and the consumers' perception of information. The responses are shown separately for each country.

Table 9.1: Statements related to the radioactivity and the Chernobyl accident. Percentage of respondents agreeing with these statements.

Statements:	Country	Fully disagree 1	2	3	4	Fully agree 5
a) The health risk associated with radioactivity is considerably exaggerated	N	28.6	24.2	29.3	11.4	6.5
	S	24.6	22.6	37.2	9.6	6.0
b) Information about radioactivity is hard to understand for ordinary people**	N	13.6	12.7	23.4	24.3	26.0
	S	6.0	5.5	18.1	37.7	32.7
c) Preventive measures against radioactivity in food do not make the food as safe for consumption as the experts claim**	N	8.1	16.5	43.7	19.1	12.6
	S	3.0	9.1	43.2	28.6	16.1
d) The authorities should withhold information about areas that are severely affected by radioactivity, in order to avoid scaring the population**	N	79.1	7.8	5.5	3.0	4.5
	S	68.5	11.0	11.0	5.5	4.0
e) The consumers in Norway/Great Britain were given too little information about how to act after the Chernobyl accident**	N	6.5	9.6	28.0	23.1	32.8
	S	3.5	8.0	24.6	23.1	40.7
f) All food in the stores should be labelled, stating clearly whether the product has been affected by radioactivity or not.	N	5.4	3.1	13.0	13.2	65.4
	S	2.0	4.0	11.0	15.0	68.0

** significant difference between countries at 0.05 level (two tailed test, Pearson Chi-Square)

A brief comparison of Norwegian and Scottish responses show some similarities but also some statistically significant differences in the perception of various statements connected to information and trust. These responses will be discussed further under the sections on trust and information.

A significantly higher share of agreement were identified among the Scottish respondents than among the Norwegians for the statements b, c and e:

b) «Information about radioactivity is hard to understand for ordinary people.»

c) «Preventive measures against radioactivity in food do not make the food as safe for consumption as the experts claim.»

e) «The consumers in Great Britain/Norway were given too little information about how to act after the Chernobyl accident.»

A significantly higher share of disagreement among the Scots compared to the Norwegians were identified for statement d:

d) «The authorities should withhold information about areas that are severely affected by radioactivity, in order to avoid scaring the population.»

Similar distribution of response in both countries to the questions:

a) «The health risk associated with radioactivity is considerably exaggerated»: the majority disagrees to this statement. Only 17.9 % in Norway and 15.6 % in Scotland agree to the statement.

f) «All food in the stores should be labelled, stating clearly whether the product has been affected by radioactivity or not». Close to 80 % agree to this in both countries.

9.2 Information - the message

How information is perceived, depends on the trust in the information source, in addition to the message itself. Is the message communicated in a language that ordinary people understand? The answers to the statement «Information about radioactivity is hard for ordinary people to understand» show that there is a significant difference in opinions connected to this in the two countries. The majority in both countries believes information about this issue is hard to understand, and as much as 70.4 % of the Scottish respondents and 60.3 % of the Norwegian respondents agree with this statement.

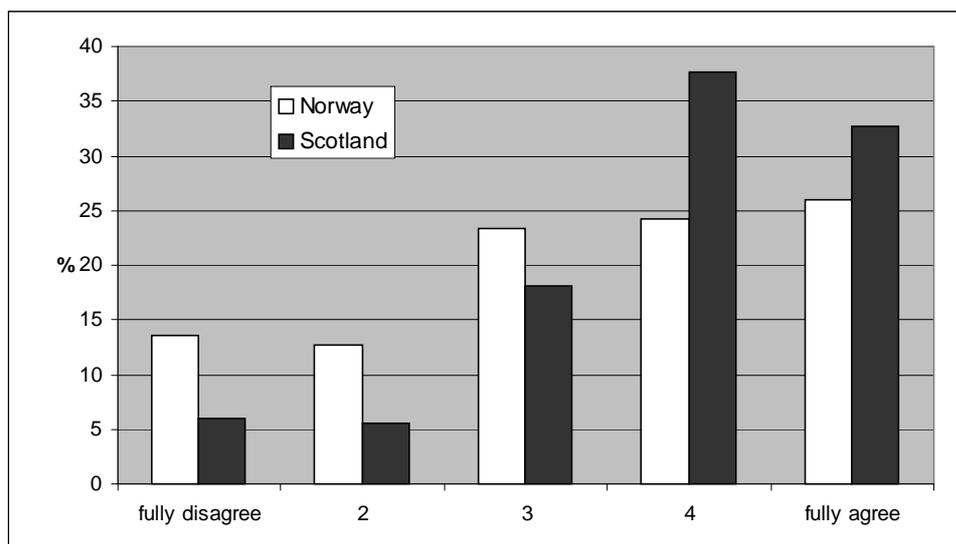


Figure 9.1: Degree of agreement to the statement «Information about radioactivity is hard for ordinary people to understand»

Correlation and variance analyses reveal that in Norway older people, people living in urban areas, and those not university educated find the information harder to understand than the rest

of the respondents. For Scotland this analysis suggests that those with low incomes find the information about radioactivity hard to understand.

When it comes to the amount of information, it is evident that the majority of people in both countries feel they received too little information about the accident. Figure 9.2 shows that 55.8 % and 63.7 % of the Norwegian and Scottish respondents respectively, expressed a lack of information on how to act after the Chernobyl accident. This feeling of need for more information, might not only mean the amount of information, but also that the information given has not been well understood by the consumers. The latter is confirmed by the figure and findings referred to above.

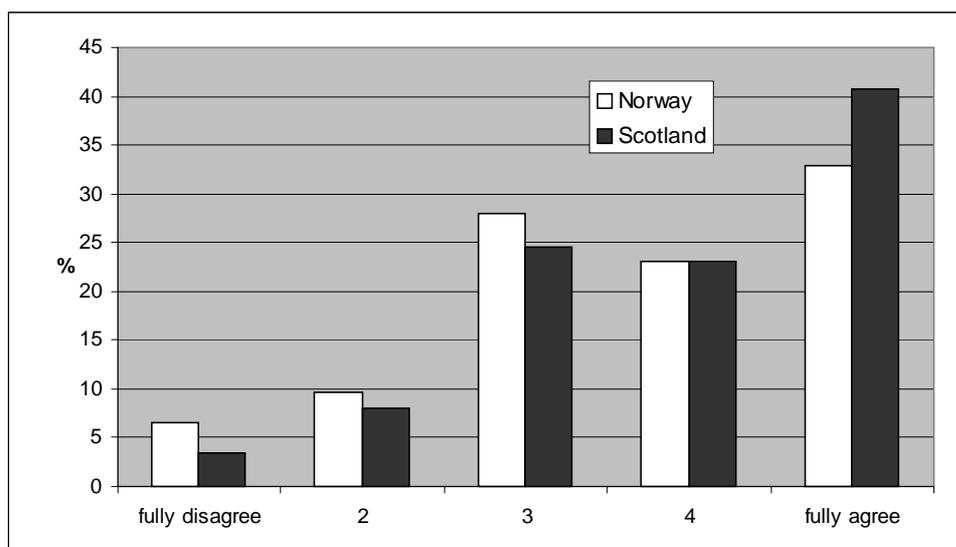


Figure 9.2: Degree of agreement to the statement «The consumers in Great Britain/Norway were given to little information about how to act after the Chernobyl accident».

9.3 Consumer knowledge

One should expect that more knowledge would reduce the perceived risk if the perceived risk is higher than the «official» calculated real risk. A study referred to by Macer (1996) connected to biotechnology, showed that information also could have the opposite effect, i.e. more information about the topic made people more scared. However, a study by Bord and O'Connor (1990) showed that those who were well informed about the food irradiation process seemed to have greater acceptance of this type of food. The information's influence on risk perception seems to be dependent on the food technology, and might also be tied to the population group surveyed.

The Norwegian respondents' reductions in consumption of the various food products correspond very well with the products that were most severely struck by radioactive contamination in the fallout situation after the Chernobyl Accident. This indicates a fairly good knowledge about the situation among the Norwegian consumers. In Scotland this is harder to distinguish, such that the knowledge among the Scottish respondents is more uncertain.

People with university education seem to have a lower risk perception than the rest. This indicates that increased general knowledge might reduce risk perception. Correlation analysis also shows a positive relationship between level of education and the ability to understand information. However, the Scots who have focused on natural sciences in their education tend to perceive more risk than the rest of the Scottish respondents. This points in another direction. One would expect that people with the main focus on natural science in their education have better knowledge about radioactivity and the risk attached to it. This indicates that increased knowledge about radioactivity and risk connected to radioactive contamination of food might not reduce risk perception among consumers.

9.4 How do consumers want to be informed

The majority of the respondents in both countries state that they want labels on food packaging to inform them about whether the product has been affected by radioactivity or not. As shown in Figure 9.3, more than 65 % of the respondents in both countries want to be informed through food labels. Since labelling has not been practiced under these circumstances previously, we do not know how consumers could react to it in a real situation.

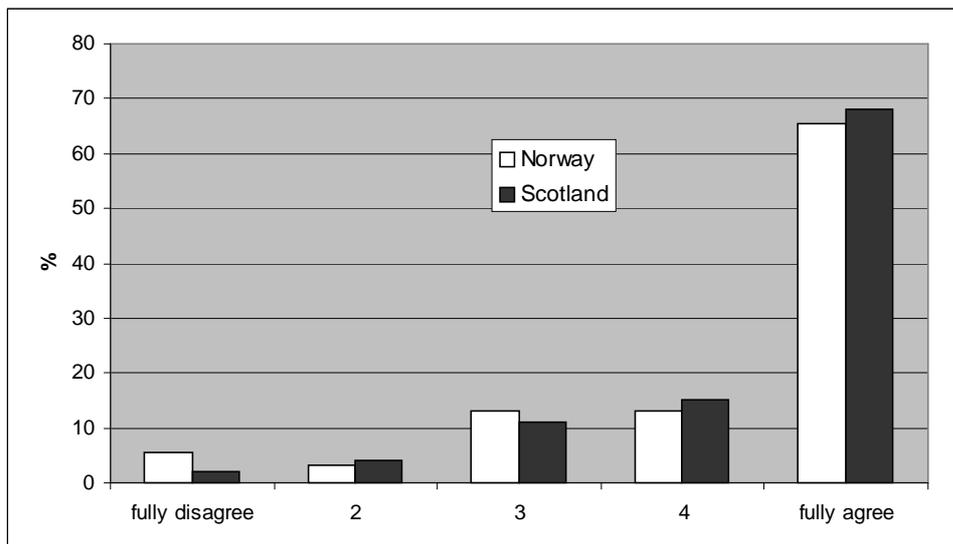


Figure 9.4: Level of agreement to the statement «All food in the stores should be labelled, stating clearly whether the product has been affected by radioactivity or not».

9.5 Trust

An important question when assessing risk is the consumers' trust in the information concerning the risk situation. As Frewer et. al. state (1996, p. 473) «Trust in risk information about food-related hazards may be as important a determinant of consumer reactions as the content of the risk information». Trust is very fragile. It takes a lot of time and effort to create, but can be lost instantly with a single incident (Slovic, 1993, ref. in Henson 1995). This means that if a source loses credibility it is hard to regain this credibility. In addition, people seem to attend to and accept negative information over positive information (Henson, 1995).

Frewer et. al. (1996) also state that «trust is all the more likely to be more important where there is a perception that accurate estimates of risk are not available», which indeed is the

situation for radioactive risk in food products. The distrust can be both in the risk reducing action, the communicated message or those responsible for performing those actions.

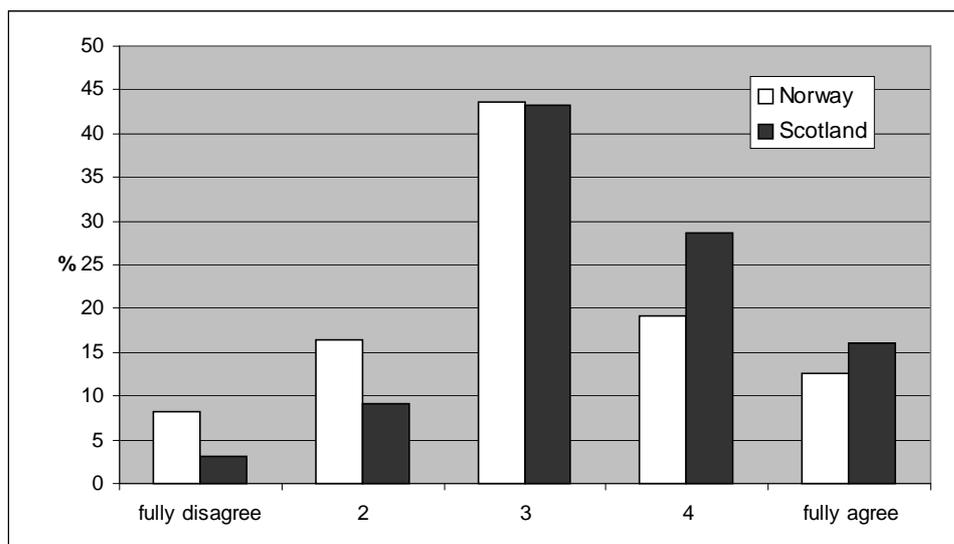


Figure 9.5: Level of agreement to the statement «Preventive measures against radioactivity in food do not make the food as safe for consumption as the experts claim»

As shown in Figure 9.5, close to 32 % of the Norwegian respondents and 45 % of the Scottish respondents seem to distrust the effectiveness of the countermeasures. They agree that the «Preventive measures against radioactivity in food do not make the food as safe for consumption as the experts claim». This also expresses a distrust in experts. The distrust is significantly higher in Scotland than Norway.

When comparing the above responses with the consumers' characteristics through correlation analysis, we find a positive relationship between Scots having a natural sciences education and agreement to the statement «Preventive measures against radioactivity in food do not make the food as safe for consumption as the experts claim». This indicates a distrust from those with natural science education. As mentioned earlier this group also seem to have higher risk perception than the average Scot.

Correlation analyses between responses to this statement and consumer characteristics from the Norwegian sample indicate that the following groups possess most distrust:

- older people
- women
- people with low income
- people buying organic food
- people without university education
- widows/widowers

These groups also represent the majority of those having high risk perception in Norway. As Figure 9.6 shows, only 17.9 % of the Norwegian respondents and 15.6 % of the Scottish respondents believe that the health risk connected to radioactivity is considerably exaggerated. On the other hand, as much as 52.8 % and 47.2 % of the Norwegian and Scottish respondents, respectively, disagree with this statement, i.e. they believe the health risk associated with

radioactivity is not exaggerated. There seems to be a similar distribution of responses to this question in both countries.

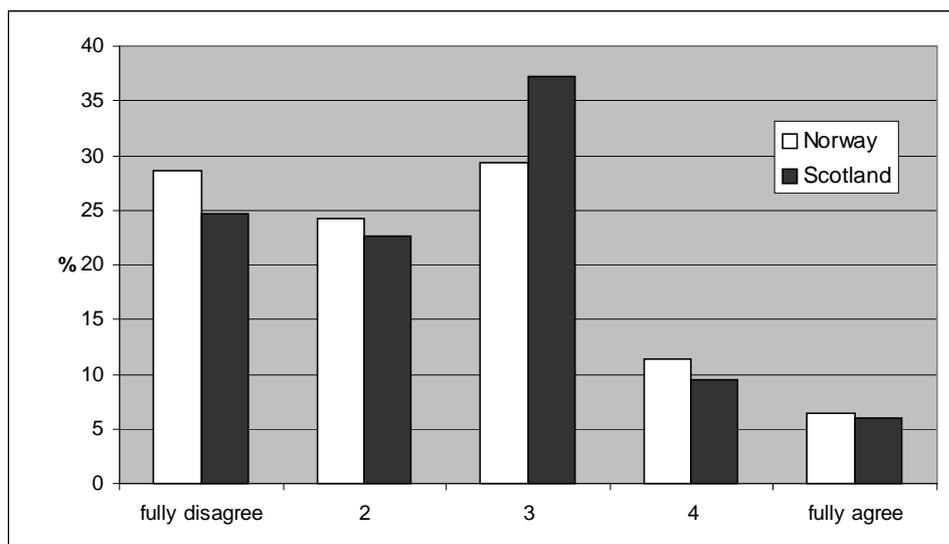


Figure 9.7: Level of agreement to the statement «The health risk associated with radioactivity is considerably exaggerated».

9.6 Trust in information sources

In addition to the above statements, the respondents were also asked to indicate their level of trust in various information sources directly. Table 9.2 below shows the distribution of answers in the two countries.

Table 9.2: Level of trust in various information sources. Sources are ranked by most trusted in Norway.

Information source	No or little trust		Indifferent		Some or high trust	
	Norway	Scotland	Norway	Scotland	Norway	Scotland
National Food Control Authorities	15.1	Na	29.8	Na	55.1	Na
Radiation Protection Authorities	18.2	Na	28.4	Na	53.4	Na
Consumers' Association	13.3	Na	34.4	Na	52.2	Na
Experts (researchers, scientists)	14.8	29.5	34.2	22.0	51.0	48.5
The Health Authorities	20.7	35.0	31.9	18.5	47.4	46.5
Local Health Authorities	23.5	Na	38.8	Na	37.7	Na
Radio/television journalists	47.2	44.5	34.1	33.5	18.7	22.0
Newspaper journalists	54.3	56.0	30.0	30.0	15.7	14.0
The food industry	58.3	48.5	30.4	28.0	11.4	23.5
Politicians	63.7	61.5	28.7	28.0	7.5	10.5

Na = question not asked

In Norway, more than 50 % express trust in the Radiation Protection Authorities, the Consumers' association, experts (researchers, scientists) and National Food Control Authorities. Scottish respondents also seem to have most trust in the Governmental Health Authorities and experts, which are marked as trusted by 48.5 % and 46.8 % of the respondents, respectively. The data further show that even though about a similar share of respondents say they trust experts in both countries, a significant share of the Scottish people

also *distrust* experts. Experts in Scotland are distrusted at twice the rate at which the Norwegians distrust their experts.

The least trusted sources in issues connected to food safety are politicians and newspaper journalists. The food industry is also among the least trusted, especially in Norway.

These results compare well with earlier findings in Weisæth (1990 and 1991) and Tønnesen et. al. (1995), who also found that radiation experts and health authorities were rated very trustworthy, while politicians and journalists were placed at the lower end of the scale.

9.7 Preferred information medium

In what way do people prefer to hear about accidents like Chernobyl? Their answers say something about previous experience and trust in and availability of various information sources. The respondents' answer to this question could be interpreted as a summary of which sources they find the most accessible and which they have the greatest trust in. The responses are shown in Table 9.3 below and give an indication on which sources should be used in the future from the consumers' point of view.

Table 9.3: How the respondents would prefer to hear or learn about an accident similar to the Chernobyl accident. Percentage of respondents answering not preferred and highly preferred in Scotland and Norway.

Information Source	not preferred*		highly preferred*	
	Scotland	Norway	Scotland	Norway
TV	8.5	2.7	58.0	64.3
Radio	11.5	2.7	42.5	56.7
Newspaper	16.0	4.1	34.0	49.9
magazines	18.0	22.5	16.0	14.9
Mail from authorities	11.5	8.8	48.5	45.5
Community meetings	9.5	17.9	37.5	27.7
Labels on food packaging	5.0	6.3	59.5	59.5

*measured on a scale from 1 to 5, where 1 is not preferred and 5 is highly preferred.

When looking at which medium is highly preferred by most respondents, labels on food packaging and information through TV receive the highest scores in both countries. In Norway radio and newspapers are also preferred by at least 50 % of the respondents, whereas the same share of the Scottish sample also prefers mail from authorities.

Magazines are preferred by very few in both countries. Newspapers are preferred by 50 % of the Norwegian respondents, but only by 34 % of the Scottish respondents, indicating less trust in newspapers by Scottish people than Norwegians.

9.8 Consumer characteristics, trust and preferred information sources

It should be noted that even if an information medium is less preferred than others, it might be an important medium for people having high risk perception.

Community meetings look like a better idea in Scotland than in Norway. By analysing possible relationships between preferred information medium and background variables, we find that in Scotland community meetings and radio seem to be relatively more preferred by singles and households without children under 20 of age.

There is a significant positive relationship between high risk behaviour and preference for labelling as an information source. People taking action to reduce the perceived risk prefer information by labelling on food packaging. This indicates that they might have sustained their consumption level if they had the option to buy food from areas not affected by radioactive contamination.

Through variance analysis a relationship was found between distrust in food industry and willingness to pay extra for «clean» food in the Norwegian sample. Similarly the Scottish sample indicates a positive relationship between distrust in experts, governmental agency and the willingness to pay extra for «clean» food.

10. RECOMMENDATIONS TO DECISIONS MAKERS

In a future situation of release of radioactive nuclides, the management of the food production should aim at limiting welfare loss in the population due to fear of risk to their health, and simultaneously limit costs related to possible reductions in consumption of the affected food products. To obtain this aim the decision makers must consider the right use of agricultural countermeasures, marketing strategies of affected food products, information strategies concerning the radiation risks to health from deposition as well as from the food products.

It has been generally accepted that agricultural countermeasures is an appropriate method for managing radiation deposition. Farmers' acceptance of countermeasures is documented by Nisbet (1995). However, too little is known about the consumers' acceptance of these measures. Through the present study of Scottish and Norwegian consumers we learn more about the consumers' attitude and behaviour towards food treated with countermeasures to reduce radioactive contamination.

From the present study we conclude that countermeasures might have some side-effects related to consumers' welfare loss and loss of income in the food market. However, if the situation is managed appropriately according to the given severity of the radionuclide deposition, the nutritional damage of the affected food products might be negligible.

The consumers' food choices in a deposition situation are likely to be affected by the severity of the contamination as well as the size of areas contaminated. Important questions will be: How large a proportion of the products in the food market are affected? What choices will the consumers have? The consumers' behaviour is likely to be dependent on whether only minor food groups have been contaminated or if there are extensive problems with major food groups. Minor foods, less important to the consumers, might be more easily substituted by clean food products from non-contaminated areas, whereas this could be difficult if major food groups are affected.

10.1 Assessing risk perception

10.1.1 Food risk sources related to radioactive contamination of food

Results from the survey indicate that there is a greater fear of health hazard in the population caused by radioactive contamination of food, than from irradiation and pesticide residues in food. The Scottish respondents also believe that radioactive contamination of food is more likely to cause ill health than genetical engineering of food products. On the other hand, chemical additives, BSE (Scotland), use of growth hormones, infectious bacteria and genetical engineering (Norway) seem to be perceived as more risky to health than radioactivity in food.

The risk perception pattern in terms of radioactive contamination of food in Scotland seems to be fairly similar to the risk perception pattern for genetical engineering, growth hormones and irradiation of food. In Norway the consumers' radioactive risk perception pattern seems most similar to the risk pattern of pesticide residues in fruit and vegetables. This indicates that results from risk research on these issues might be applicable also to radioactive food risk. However, one should note that these risk sources have arisen somewhat differently. Radioactive fallout has happened by accident, which the food producers have no control over,

whereas the other risk sources have emerged due to the producers' free use of technology to increase production and profits.

The above risk sources can be described from the consumers' point of view by characteristics as lack of controllability, hard to understand risk, unfamiliarity with risk source and potentially severe damage to health if damage becomes reality. Earlier studies (Sparks and Shepherd, 1990 and Slovic, 1987) demonstrated that people often rate their risk perception attached to risk sources described by these characteristics much higher than the experts' calculated real risk.

10.1.2 Risk perception and behaviour

The survey shows that radioactive risk caused by the Chernobyl accident has had and still has a negative impact on consumption level of sheep, reindeer (Norway), game (venison/moose) and mushroom. This implies that the impact on market demand and consumer welfare loss due to high risk perception might be significantly higher than earlier anticipated.

Risk perception connected to food products shows that Norwegian' tie highest risk to reindeer meat, wild mushrooms and game (moose), whereas the Scots seem to perceive wild mushrooms and wild berries as most risky. In general, the proportion of the population perceiving these products as risky, is twice as large in Norway as in Scotland. In both countries the respondents perceive risk attached to lamb meat as somewhat lower than these food products. This might be due to the fact that consumers have some knowledge about the countermeasures that are implemented in order to reduce the radioactive content in lamb meat.

The results demonstrate that people have acted according to their risk perceptions in relation to the different food products. An exception is lamb meat, where risk reducing actions are at the same level as for reindeer meat and game, whereas the perceived risk connected to lamb was less than for those two products. This might be due to the fact that reindeer meat and game make up a smaller share of total meat consumption for most consumers, whereas the average consumer eats more lamb meat. Thus, a reduction in lamb meat consumption might have a greater effect as a means of reducing the total intake of radioactively contaminated food, than an proportionately equal reduction in the consumption of reindeer and/or game.

10.1.3 Factors influencing risk perception and behaviour

To identify factors influencing risk perception and behaviour, single measures for both risk perception and risk behaviour were needed. Two methods were used to condense several variables on risk perception down to one variable. One method was computation of an additive index, the other method used was data reduction through factor analysis. These methods are discussed in more detail in chapter 7.

For Norway similar relationships were detected between consumer characteristics, radioactive risk perception, and radioactive risk behaviour. Norwegian consumers having higher risk perception and taking actions to reduce risk compared to others are identified by:

- low income households
- small households
- older people
- women
- widow(er)s
- those having experienced food poisoning
- those who prefer to buy organic food

Norwegian consumers having lower risk perception and doing less to reduce risk than the average are identified by:

- high income households
- large households
- younger people
- men
- households having many rather than few children
- university or college educated

For Scotland the results for perception and behaviour were somewhat different. Analysis of the Scottish data indicates that larger households, households with many rather than few children, people having experienced food poisoning and people whose education was focused on the natural sciences, have taken more actions to reduce risk due to radioactive contamination of food compared to others.

10.2 Risk communication

Consumers' prior knowledge and risk information received in an emergency situation will be crucial in the consumers' risk assessment process. Other important issues in risk communication is consumers' trust in the information sources, content and design of the message, information medium and labelling of food products. Other studies related to information and the Chernobyl accident is done by Weisæth (1990 and 1991) and Tønnesen et. al. (1995).

10.2.1 Consumer knowledge and information

Earlier findings on food risk research suggest that beliefs might have a greater influence on risk perception than do information (Grobe and Douhitt, 1995). The consumers' own knowledge will, however, be the platform for processing new information about the topic. Improved knowledge and/or education among the population is likely to have a positive effect on understanding given information. However, this is not to say that information always reduces risk perception. Even though most studies indicate that improved understanding and information of a food risk reduces consumers' risk perception (Bord and O'Connor, 1990), a study by Macer (1996) shows that increased education and understanding of information also might increase risk perception.

The reductions in consumption of the various food products by the Norwegian respondents corresponds very well with which products being most severely struck by radioactive contamination after the Chernobyl Accident. This indicates a fairly good knowledge about the situation among the Norwegian consumers. In Scotland this is harder to distinguish, such that the knowledge among the Scottish respondents is more uncertain.

The survey data for Norway indicate that university educated have a lower risk perception than the rest of the population. This indicates that in case of radioactive contamination of food, increased general knowledge might reduce risk perception. Correlation analysis also shows a positive relationship between level of education and the understanding of information. This corresponds to Weisæth (1990), who reports similar findings.

A higher risk perception among those not having university or college education, indicate that information might have been too advanced for «ordinary» people in order to fully understand the situation. It might also be that academics trust experts and scientists more - because they are «one of them». Information toward groups perceiving especially high risk is important in reducing total risk perception in the population. Several groups have been detected in Norway, whereas these are harder to identify in Scotland.

The Scottish data point another direction, showing that those having focused on natural sciences in their education tend to perceive a higher risk connected to radioactive contamination than the rest of the population.

10.2.2 Consumer trust

What and whom do the consumers believe? The interpretation of the risk information depends on whether the consumers find the source credible or not. Do the consumers believe the experts when they say the food is safe for human consumption? It is no use in information if the consumers don't believe in it. Trust in the source of information is thus very important. An important characteristic of trust is its fragility. Trust takes a lot of time and effort to create, but can be lost instantly with a single incident (Slovic 1993, ref. in Henson 1995). If a source has been perceived as little trustworthy earlier, it is hard to gain the consumers trust again. Frewer et. al. state (1996, p. 473) that «Trust in risk information about food-related hazards may be as important a determinant of consumer reactions as the content of the risk information». Bord and O'Connor (1990) explain that effective risk communication may be more a problem of ensuring trust than an issue of explaining risk/benefit analysis in lay terms.

Survey results indicate high distrust in politicians and journalists, which means that these sources should be avoided in risk information. The information should be delivered by governmental authorities or experts as directly as possible. These findings are supported by results in Weisæth (1990, 1991). His conclusion were also that early information should not be given by journalists and politicians. It should also be noted that even though a large share trust experts in Scotland, there is also a substantial share of the respondents who distrust them (see Table 10.4).

10.2.3 Message

The content of the information or «the message» must be easy to understand for all consumer groups. Crucial is a uniform message, but the language must be designed for or adapted to the different consumer groups. Different consumer groups require information suitable to their prior knowledge, trust in information sources etc. A study by Tønnesen et. al. (1995) concludes that the public were not satisfied with the information given neither right after the accident nor seven years after the first study. They explain this not only by poor information, but also by the fact that radiation risk is hard to understand, and thus very hard to inform

about. Explaining radiation risk in lay-terms will therefore be one of the major challenges in an emergency situation due to radioactive fallout.

10.2.4 Information medium

When looking at which medium is most preferred, labels on food packaging and information through TV receives the highest scores in both countries. In Norway, radio and newspapers are also preferred by at least 50 % of the respondents, whereas the same share of the Scottish sample also prefers mail from the authorities.

Magazines are preferred by very few in both countries. Newspapers are preferred by 50 % of the Norwegian respondents, but by only 34 % of the Scottish respondents, possibly indicating less trust in newspapers by Scottish people than Norwegians.

It should be noted that even if an information medium is less preferred than others, it might be an important medium for those having high risk perception. Community meetings look like a better idea in Scotland than in Norway. In Scotland community meetings (and radio) seem to be relatively more preferred by single persons and households without children living at home. The most vulnerable groups might prefer to be informed through other sources than the general population.

10.2.5 Labelling

The consumer survey also reveals a significant relationship between high risk behaviour and labelling as an information source. This means that persons taking action to reduce the perceived risk prefer information by labelling on food packages.

The respondents state clearly that they want food labelling on food packages in the stores to inform about possible treatment to reduce radioactive contamination. This will make more people aware of the situation, and it is uncertain how they would act in a buying situation if they had the choice between a «clean» product from non-affected areas and a treated food product from affected areas. It might as well increase risk perception for consumer groups that have not been fully aware of the situation earlier. The consumers' reactions to these options will also depend on the price difference between «clean» food from non-affected areas and treated food products.

Furthermore, the content of information on labels will be important. It might be necessary to conduct further studies in order to reveal consumers' reactions and possible changes in risk perception before labelling is put into practice.

10.3 Willingness to pay

The survey has detected a significant willingness to pay extra for meat from uncontaminated areas in a fallout situation. The consumer study indicates that consumers are willing to pay more for foods from areas not affected by radioactive fallout. In Scotland, the respondents were on average willing to pay a premium of 62 % and 31 % above «normal» price for milk and lamb, respectively. Norwegian consumers were willing to pay a 46 % higher price for «clean» unaffected lamb meat compared to treated meat.

As mentioned above we do not know how consumers would react to a situation where they were given the option to choose between «clean» food from non-affected areas and treated food. Maybe this will increase perceived risk to treated food. Consumers might find it strange to be given such an option if both products are claimed to be equally safe.

By giving the consumers the choice between food from contaminated areas (treated) and food from non-affected (clean) areas many would probably prefer to buy the clean «uncontaminated» food and thus reduce their consumption of treated food. This means that less treated food would be demanded.

Variance analysis revealed a positive relationship between distrust in food industry and willingness to pay extra for «clean» food in the Norwegian sample. Similarly the Scottish sample indicates a positive relationship between distrust in experts, governmental agency and the willingness to pay extra for «clean» food.

10.4 Estimating costs

The conclusion of this study is that countermeasures have side-effects due to reduced market income as result of reduced consumption of affected food groups and due to consumer welfare loss emerging from increased risk perception in the population. Costs of consumer welfare loss is difficult to put a monetary value on. However, if the perceived risk among consumers is reduced, we know that these costs have decreased. Total market costs will depend on

- Alternative uses of the food
- Costs of countermeasures
- Consumers reactions to labelling (will it increase risk perception?)
- Consumers willingness to pay extra for «clean» food from non-affected areas
- Severity of contamination and size of areas contaminated

To be able to estimate total market cost a more exact estimate of the reduced consumption is needed. The survey included a question that allowed the consumers to indicate their current consumption level of lamb and other foods, compared to what they believed to be the average per capita consumption in the country. This information could be combined with the consumers' level of reduced consumption. This seemed to be a difficult question for the respondents. The results show that the majority of the respondents think they consume less than the average! Normally, the same percentage of the sample should answer a consumption level below average as above.

One way of improving the accuracy of the information could be to give the consumers the average per capita consumption in Norway to compare against. On the questions on their level of reductions one could ask them to indicate whether it is around 20 %, 50 % or 100 % reduction and so forth. This would make us able to estimate an interval containing the costs figure. Another question that arises in this case is whether the consumers are able to give that accurate estimates? If they did, would it be reliable? Consumers might feel obliged to give an answer even if they are very uncertain.

What we know is that 21 % of the Norwegians reported reductions in today's consumption of lamb meat, and 17 % of the Scots did the same thing. If this could have been avoided by

taking food affected by radioactive fallout out of the consumer market, then costs of countermeasures also include loss in market income due to reduced consumption.

Direct costs of countermeasures (including farm management costs) and costs of environmental side-effects are discussed in Wilson et. al. (1999).

10.5 Conclusion

Three possible strategies seem most suitable for the food market in a radioactive fallout situation. An overview of these strategies are given in Table 10.1. No matter what strategy is chosen, enough and understandable information, adapted to all population groups, must be provided. The trustworthiness of the messenger will also be crucial. These strategies have their pros and cons that must be evaluated toward characteristics of the population and the severity of the situation.

Table 10.1: Possible consumer strategies in a radioactive fallout situation

Use of counter-measures	Food marketing	Information	Effects
1. Yes	All food within safety limits put in the market. Food from contaminated areas not separable from food from clean areas.	No labelling of food. Uniform message at all levels. Easy understandable - lay terms From trusted sources: governmental authorities, experts. Channels: as many as possible	- Perceived risk reduces total consumption of affected foods. - Market costs of reduced consumption - Costs of consumer welfare loss due to increased fear + Market value of affected food, safe food sold in the market
2. Yes	All food within safety limits put in the market. Consumer can choose whether to buy food from contaminated areas (within safety limits) or food from clean non-contaminated areas.	Food labelled, whether from contaminated areas or not. Uniform message at all levels. Easy understandable - lay terms From trusted sources: governmental authorities, experts. Channels: as many as possible	- Increased reduction in consumption of affected food compared to option 1. - Might increase risk attached to affected food. - Costs of marketing and labelling. + Demand for clean food sustain total market consumption. + Higher price on clean food increases market value + Reduced costs of welfare loss due to fear in population ? Consumer trust
3. No	Food from affected areas are withheld from the consumer market. Only food from non-contaminated areas in the market	No labelling of food. Uniform message at all levels. Easy understandable - lay terms From trusted sources: governmental authorities, experts. Channels: as many as possible	+ Reduces risk perception in population + Consumer trust survives + Higher prices on food products - Cost due to alternative uses of affected food products.

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APPENDIX 1: Results from the factor analysis

Correlation between background variables and factors identified through factor analysis

1. Radioactive risk perception

	RRPI nonrotated						RRPI varimax					
	Scotland			Norway			Scotland			Norway		
	F1	F2	F3	F1	F2	F3	F1	F2	F3	F1	F2	F3
Percentage of variance explained by each factor	40	16	9	40	11	11	37	18	9	28	18	16
Women				+	+					+	+	+
Household size				-						-	_*	
Children under 20				_*						_*		
# Children 0-6												
# Children 7-20												
University/college education				-						-	_*	_*
Natural science educated (Sc)												
Household income				-						-	-	
Age				+	-					+		
Working in primary production		_*				_*						-
Living in a city				-						-		
Married												
Widow(er)				+						+		_*
Divorced				+*						+		
Experienced food poisoning				+*	+						+	
Buys organic food		+*		+	+			+*		+	+	+
WTP lamb	+			+						+		+
WTP milk (Sc)												

Sign (+ or -) indicate correlation significant at the 5 % level. 0 indicates no correlation.

Correlation for dichotomous variables verified using ANOVA with RPI or RBI as dependent variable.

2. Radioactive risk behaviour

	RRBI long term		RRBI short term	
	Scotland	Norway	Scotland	Norway
	F1	F1	F1	F1
Percentage of variance explained by each factor	78.8	66.4	78.9	66.4
Women		+		+
Household size	+	-		-
Children under 20	+	-		-
# Children 0-6		-		
# Children 7-20				
University/college education		-		
Natural science educated (Sc)	+			
Household income		-		-
Age		+		+
Working in primary production			+	
Living in a city				
Married				
Widow(er)		+		+
Divorced				
Experienced food poisoning	+			+
Buys organic food		+		+
WTP lamb		-	+	
Single		-		
WTP milk (Sc)				

Sign (+ or -) indicate correlation significant at the 5 % level. 0 indicates no correlation.
Correlation for dichotomous variables verified using ANOVA with RPI or RBI as dependent variable.

3. General food risk perception

	RRPI nonrotated			RRPI varimax			RRPI nonrotated			RRPI varimax		
	Scotland			Norway			Scotland			Norway		
	F1	F2	F3	F1	F2	F3	F1	F2	F3	F1	F2	F3
Percentage of variance explained by each factor	45	14	11	38	15	11	42	16	13	35	16	13
Women		+*		+	-	+				+	+	+
Household size				-						-		
Children under 20				-	-					-	+	
# Children 0-6												_*
# Children 7-20		+*										
University/college education			_*	-		-			_*	_*		-
Natural science educated (Sc)												
Household income			-	-		-			-	-		-
Age		_*		+	+	+		+*		+	-	+
Working in primary production		-					_*					
Living in a city												
Married										_*		
Widow(er)		-		+		+				+		+
Divorced												
Experienced food poisoning				+						+	+*	
Buys organic food	+*			+	-	+	+*			+	+	+
WTP lamb				+	-					+*		+
Single					-							_*
WTP milk (Sc)												

Sign (+ or -) indicate correlation significant at the 5 % level. 0 indicates no correlation.
Correlation for dichotomous variables verified using ANOVA with RPI or RBI as dependent variable.

4. General food risk behaviour

	RRPI nonrotated				RRPI varimax			
	Scotland		Norway		Scotland		Norway	
	F1	F2	F1	F2	F1	F2	F1	F2
Percentage of variance explained by each factor	48	16	38	19	38	26	41	15
Women			+				+	+
Household size			_*					_*
Children under 20								
# Children 0-6				+*		+*	_*	
# Children 7-20				_*				_*
University/college education		+	_*	+*		+	-	
Natural science educated (Sc)								
Household income			-				-	
Age		-	+	-		-	+	-
Working in primary production			_*				_*	-
Living in a city								
Married								
Widow(er)			+				+	
Divorced								
Experienced food poisoning			+*					+*
Buys organic food	+*	+	+	+		+	+	+
WTPplamb			+				+	
Single			+*					
WTPmilk (Sc)		+				+*		

Sign (+ or -) indicate correlation significant at the 5 % level. 0 indicates no correlation.

Correlation for dichotomous variables verified using ANOVA with RPI or RBI as dependent variable.

APPENDIX 2: Consumer survey questionnaires

In Scotland the survey was performed through interviews, and in Norway as a mail survey. On the next pages the Norwegian questionnaire is shown. The equivalent Scottish questionnaire can be found in a separate pdf file.



Forbrukerundersøkelse; risikooppfatning, holdninger og adferd knyttet til maten vi spiser.

DEL 1: BAKGRUNNSOPPLYSNINGER

Sett kryss i riktig rute eller fyll ut:

1. Kjønn

⁽¹⁾ mann
⁽²⁾ kvinne

2. Fødselsår

(fyll ut): _____

3. Hvor bor du?

Kommune: _____ Bor du i en by? ⁽¹⁾ ja
⁽²⁾ nei

Fylke: _____

4. Hva er din sivile status?

⁽¹⁾ enslig
⁽²⁾ gift/samboer
⁽³⁾ enke/enkemann
⁽⁴⁾ skilt/separert

5. Hvor mange personer totalt (barn og voksne) tilhører husholdningen?

(fyll ut antall personer): _____

6. Har du barn som er 20 år eller yngre boende hjemme?

⁽¹⁾ nei
⁽²⁾ ja → Hvis JA, - hvor mange barn 0 - 6 år: _____
- hvor mange barn 7 - 20 år: _____

DEL 2: RISIKOOPPFATNING

7. Det er risiko for negative helseeffekter forbundet med de fleste menneskelige aktiviteter. Nedenfor er en liste over mulige årsaker til helseskader (sykdom eller ulykke). Hvor sannsynlig tror du det er at du en eller annen gang vil få en helseskade av disse ulike årsakene?

Kryss av i den boksen som passer best for hver årsak. (1) er svært lite sannsynlig, (5) er svært sannsynlig.

	svært lite sannsynlig (1)	(2)	(3)	(4)	svært sannsynlig (5)
a) Soling/for mye sol	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b) Brann	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c) Drivhuseffekten/global oppvarming.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d) Kjemiske tilsetninger i matvarer.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e) Bakterier i matvarer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f) Radioaktiv radongass i boligen	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
g) Forurensing fra industri	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
h) Trafikkulykke	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
i) Stråling fra atomkraftverk	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
j) Radioaktiv forurensing i matvarer.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
k) Hullet i ozon-laget	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
l) Røyking	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
m) Alkohol.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
n) For lite fysisk aktivitet	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
o) Dårlige matvaner.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

8. Hvor bekymret er du totalt sett for at du vil bli påført en helseskade av de årsakene som ble opplistet i det forrige spørsmålet?

Kryss av i den ruta fra 1 til 5 som passer best. (1) er helt ubekymret, (5) er svært bekymret.

<input type="checkbox"/>				
(1)	(2)	(3)	(4)	(5)
helt ubekymret				svært bekymret

Nedenfor brukes begrepet «matsikkerhet». I denne sammenhengen handler begrepet om de forhold som påvirker hvor trygg maten er å spise i forhold til risikoen for å få ulike helseskader. Slike helseskader kan være alt fra akutt matforgiftning til mer langsiktige helseskader som f.eks. kreft.

9. Hvor enig er du i disse påstandene? <i>Sett ring rundt det tallet som passer best - 1 betyr helt uenig og 5 betyr helt enig</i>	Helt uenig Helt enig
a Selv med Tsjernobyl-ulykken i mente, mener jeg at atomkraft totalt sett medfører større fordeler enn ulemper for menneskeheten	1 ·· 2 ·· 3 ·· 4 ·· 5
b Jeg har ikke noe i mot at min familie og jeg spiser matvarer som inneholder genetisk modifiserte dyre- og planteprodukter	1 ·· 2 ·· 3 ·· 4 ·· 5
c Matvareindustrien er mer opptatt av økonomisk overskudd enn av matsikkerhet	1 ·· 2 ·· 3 ·· 4 ·· 5
d Jeg har ikke noe i mot at min familie og jeg spiser matvarer som har vært behandlet mot radioaktivitet (f.eks. nedfôring av sau)	1 ·· 2 ·· 3 ·· 4 ·· 5
e Myndighetene bruker for mye penger på informasjon om matsikkerhet.	1 ·· 2 ·· 3 ·· 4 ·· 5
f Jeg vil godta en skatteøkning neste år, hvis pengene øremerkes til en ordning for å skjerpe rutinene knytta til matsikkerhet innen næringsmiddelindustrien.	1 ·· 2 ·· 3 ·· 4 ·· 5
g Mat produsert i Norge er tryggere å spise rent helsemessig enn importert mat	1 ·· 2 ·· 3 ·· 4 ·· 5

DEL 3: HVOR TRYGG ER MATEN?

10. Hvor sannsynlig tror du det er at **du** vil få en helseskade (sykdom) knytta til de ulike årsakene som er nevnt nedenfor? Forutsett det matvareforbruket du har i dag.

Kryss av i den boksen som passer best for hver linje.

	svært lite sannsynlig (1)	(2)	(3)	(4)	svært sannsynlig (5)
a) Rester av sprøytemidler i frukt/grønnsaker.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b) Bakteriefeksjoner (f.eks. salmonella).....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c) Bestråling av matvarer (for å drepe bakterier).....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d) Kjemiske tilsetningsstoffer.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e) Radioaktive stoffer i maten.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f) Bruk av veksthormoner.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
g) Genmodifiserte matvarer.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

11. Hvor **bekymret** er du generelt sett for at du skal få en helseskade (sykdom) forårsaket av maten du spiser?

Kryss av i den ene ruta som passer best. (1) er helt ubekymret, (5) er svært bekymret.

<input type="checkbox"/>				
(1)	(2)	(3)	(4)	(5)
helt				svært
ubekymret				bekymret

12. Har du eller noen i din nære familie noen gang hatt en akutt sykdom knytta til matinntak (f.eks. matforgiftning)?

<input type="checkbox"/>	(1)	nei	
<input type="checkbox"/>	(2)	ja →	Hvis JA, måtte du/vedkommende familiemedlem legges inn på sykehus eller få behandling av lege?
<input type="checkbox"/>	(3)	nei	
<input type="checkbox"/>	(4)	ja	

13. Basert på din egen oppfatning, hvor stort forbruk har din husholdning av de ulike matvarene nedenfor, sammenlignet med en "gjennomsnittlig" norsk husholdning?

Sett ett kryss for hver matvare nedenfor.

	langt under gj.snitt (1)	litt under gj.snitt (2)	som gj.snittet (3)	litt over gj.snitt (4)	langt over gj.snitt (5)
Lam/saukjøtt	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Storfekjøtt	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Reinsdyrkjøtt	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Melkeprod. (melk, smør, ost)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
"Vill" sopp.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Vilt.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

14. I løpet av de siste 12 måneder, hvor ofte har du ...	
<i>Sett ring rundt det tallet som passer best - 1 betyr aldri og 5 betyr svært ofte</i>	Aldri Svært ofte
... spurt, ut fra hensyn til matsikkerhet, om opprinnelseslandet til kjøtt i en butikk/restaurant?	1 · 2 · 3 · 4 · 5
... avstått fra å kjøpe sau/lammekjøtt p.g.a. frykt for innhold av radioaktive stoffer?	1 · 2 · 3 · 4 · 5
... avstått fra å kjøpe sau/lammekjøtt p.g.a. frykt for skrapesjuka?	1 · 2 · 3 · 4 · 5
... kjøpt økologisk produsert melk?	1 · 2 · 3 · 4 · 5
... avstått fra å kjøpe kylling eller andre fjørfeprodukter p.g.a. frykt for salmonella?	1 · 2 · 3 · 4 · 5
... kjøpt vann på flaske i stedet for å bruke vann fra springen p.g.a. usikkerhet rundt kvaliteten på vannet i springen?	1 · 2 · 3 · 4 · 5
... avstått fra å kjøpe eller spise hamburgere p.g.a. frykt for helsefare?	1 · 2 · 3 · 4 · 5

15. Er du vegetarianer?
<input type="checkbox"/> ₍₁₎ nei
<input type="checkbox"/> ₍₂₎ ja

16. Kjøper du vanligvis økologisk dyrket frukt og grønnsaker hvis slike produkter tilbys?
<input type="checkbox"/> ₍₁₎ nei
<input type="checkbox"/> ₍₂₎ ja

DEL 4: RADIOAKTIVITET I MATVARER

Du husker sikkert ulykken ved atomkraftverket i Tsjernobyl i Ukraina i 1986. Denne ulykken førte bl.a. til at vi fikk radioaktivt nedfall i Norge. Et resultat av det radioaktive nedfallet var at enkelte typer matvarer i deler av landet ble påvirket, bl.a. sauekjøtt, reinsdyrkjøtt, kumelk, ferskvannsfisk og sopp. Det ble satt i verk tiltak slik at i følge myndighetene er alle matvarer solgt i butikkene trygge når det gjelder mengden radioaktivt innhold.

17. Tenk deg at du ser ting i et langt perspektiv (30 år). Hvor stor tror du sannsynligheten er for at du vil få en alvorlig sykdom som resultat av å spise de matvarene som ble påvirket av nedfallet etter Tsjernobyl-ulykken (sauekjøtt, reinsdyrkjøtt, kumelk etc.)?

Sett ett kryss for det alternativet som passer best.

- | | | | | |
|-----------------------------|--------------------------|---------------------------|--------------------------|-----------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| svært lav sannsynlighet (1) | lav sannsynlighet (2) | middels sannsynlighet (3) | høy sannsynlighet (4) | svært høy sannsynlighet (5) |

18. Basert på din egen oppfatning og når du tar hensyn til virkningene av Tsjernobyl-ulykken, hvor trygt eller utrygt tror du det er for en gjennomsnittsperson å spise de ulike matvarene som er opplistet nedenfor?

Sett ett kryss for hver matvare nedenfor.

	svært utrygt (1)	nokså utrygt (2)	verken trygt eller utrygt (3)	nokså trygt (4)	svært trygt (5)
Lam/sauekjøtt	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Storfekjøtt	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Reinsdyrkjøtt	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Melkeprodukter (melk, smør, ost)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
"Vill" sopp	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Vilt	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

19. Har din kunnskap om Tsjernobyl-ulykken påvirket ditt forbruk av de ulike matvarene? Forsøk å angi hvor stort det nåværende forbruket av de ulike matvarene er i din husholdning sammenlignet med hvordan du tror det ville ha vært uten at Tsjernobyl-ulykken hadde skjedd.

Sett ett kryss for hver matvare nedenfor.

	sterk reduksjon i forbruk (1)	reduksjon i forbruk (2)	ingen endring i forbruk (3)	økning i forbruk (4)	sterk økning i forbruk (5)
Lam/sauekjøtt	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Storfekjøtt	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Reinsdyrkjøtt	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Melkeprodukter (melk, smør, ost)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
"Vill" sopp	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Vilt	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Svar på spørsmål 20 kun hvis du er født i 1966 eller tidligere (dvs. at du var 20 år eller eldre i 1986)

20. I de første månedene etter Tsjernobyl-ulykken, førte kunnskapen om ulykken og dens effekter til noen kortsiktige (brå) endringer i ditt eller din families forbruk av de matvarene som er opplistet nedenfor?

	sterk reduksjon i forbruk (1)	reduksjon i forbruk (2)	ingen endring i forbruk (3)	økning i forbruk (4)	sterk økning i forbruk (5)
Lam/sauekjøtt	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Storfekjøtt	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Reinsdyrkjøtt	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Melkeprodukter (melk, smør, ost)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
"Vill" sopp	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Vilt	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

DEL 5: INFORMASJON ETTER TSJERNOBYL-ULYKKEN

Etter Tsjernobylulykken ble det gitt informasjon og råd fra ulike kilder om hvordan en burde forholde seg. For at folk skal føle seg trygge i slike situasjoner er det viktig at informasjonen kommer fram til folk og at den blir forstått. Ditt svar på spørsmålene nedenfor vil hjelpe de rette instanser til å gi best mulig informasjon hvis en lignende situasjon skulle oppstå.

21. Hvordan vil du beskrive din oppfatning av troverdigheten til de ulike informasjonskildene opplistet nedenfor når det gjelder informasjon om matsikkerhet?

Sett ett kryss for hver av de ulike "informasjonskildene" nedenfor.

	ikke troverdig (1)	(2)	(3)	(4)	svært troverdig (5)
Sentrale helsemyndigheter	<input type="checkbox"/>				
Statens strålevern	<input type="checkbox"/>				
Statens næringsmiddeltilsyn	<input type="checkbox"/>				
Lokale helsemyndigheter	<input type="checkbox"/>				
Ekspertene (forskere, vitenskapsfolk)	<input type="checkbox"/>				
Matvareindustrien	<input type="checkbox"/>				
Politikere	<input type="checkbox"/>				
Forbrukerrådet	<input type="checkbox"/>				
Avisjournalister	<input type="checkbox"/>				
Radio-/fjernsynsjournalister	<input type="checkbox"/>				

22. Hvis en ulykke som Tsjernobyl skulle skje igjen, på hvilken måte ville du foretrekke å få informasjon om aktuelle spørsmål knyttet til matsikkerhet i tiden rett etter ulykken?

Sett ett kryss for hver av de ulike "informasjonskanalene" nedenfor.

	ikke foretrukket (1)	(2)	(3)	(4)	høyt foretrukket (5)
TV	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Radio	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Aviser	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Blader, magasiner	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Post fra myndighetene	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sammenkomster/møter i lokalsamfunnet	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Merking på matvarenes innpakning	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

<p>23. Nedenfor finner du en del påstander knytta til den informasjonen som ble gitt i forbindelse med Tsjernobyl-ulykken. Hvor enig er du i de enkelte påstandene?</p> <p><i>Sett ring rundt det tallet som passer best - 1 betyr helt uenig og 5 betyr helt enig</i></p>	Helt uenig	Helt enig
Den helsemessige faren knytta til radioaktivitet i mat er betydelig overdrevet	1 ·· 2 ·· 3 ·· 4 ·· 5	
Informasjon om radioaktivitet i mat er vanskelig å forstå for vanlig folk	1 ·· 2 ·· 3 ·· 4 ·· 5	
De ulike tiltakene mot radioaktivitet, som f.eks. nedfôring av sau, fører ikke til at kjøttet blir så trygt å spise som ekspertene påstår	1 ·· 2 ·· 3 ·· 4 ·· 5	
Myndighetene bør holde tilbake informasjon om områder som er særlig hardt ramma av radioaktivitet for å unngå å skape frykt i befolkningen	1 ·· 2 ·· 3 ·· 4 ·· 5	
Forbrukerne i Norge fikk for lite informasjon om hvordan de burde forholde seg etter Tsjernobyl-ulykken	1 ·· 2 ·· 3 ·· 4 ·· 5	
Alle matvarer i butikkene bør merkes, slik at det går tydelig fram om de har vært berørt av radioaktivitet eller ikke	1 ·· 2 ·· 3 ·· 4 ·· 5	

DEL 6: TIL HVILKEN PRIS?

Hvis du er vegetarianer, eller av andre grunner aldri kjøper lam eller sauekjøtt: gå til spørsmål 26.

Noen deler av landet fikk mer radioaktivt nedfall etter Tsjernobylulykken enn andre. Som en følge av dette fikk matvarer produsert i de mest utsatte delene av landet høyere innhold av radioaktivitet.

Det ble imidlertid satt i verk ulike mottiltak for å redusere radioaktiviteten. Ett eksempel på et mottiltak er bruk av cesiumbindere på sau. Dette tiltaket går ut på at sauen blir gitt fôr med spesielle tilsetninger som bidrar til at de radioaktive stoffene i sauen ikke tas opp. I tillegg går sauen på beite som er fritt for radioaktivitet en viss periode før slakting, slik at sauekroppen får et tilstrekkelig lavt innhold av radioaktivitet før slakting.

Alt lamme- og sauekjøtt som selges i butikkene er trygt med tanke på innhold av radioaktive stoffer, enten kjøttet kommer fra dyr som har vært gjennom en slik "behandlingsprosess" eller det kommer fra dyr som ikke har vært påvirket av radioaktivitet. Det er således ikke mulig å skille "behandlet" lamme-/sauekjøtt fra "ubehandlet" kjøtt i butikkenes kjøttdisker.

Tenk deg at butikkene heretter merker lamme-/sauekjøttet med "ubehandlet" og "behandlet", der

- behandlet kjøtt er norskprodusert kjøtt som har vært gjennom en prosess for å redusere radioaktiviteten
- ubehandlet kjøtt er norskprodusert kjøtt der dyret ikke har vært påvirket av radioaktivitet

Svar på spørsmål 24 og evt. 25 på bakgrunn av denne informasjonen.

24. Hvilket av de to lamme-/saueproduktene ville du foretrekke å kjøpe?

(kryss én rute)

- A: Jeg ville foretrekke det behandlede lamme-/sauekjøttet
- B: Jeg ville foretrekke det ubehandlede lamme-/sauekjøttet
- C: Jeg er likegyldig overfor hvilket av de to produktene jeg kjøper

Hvis du krysset i alternativ C ovenfor kan du gå direkte til spørsmål 26.

Hvis du krysset i alternativ A eller B ovenfor, vennligst svar også på spørsmål 25.

25. Se tilbake på spørsmål 24:

Tenk deg at det sauekjøttproduktet du foretrakk minst var det billigste, og det produktet du foretrakk mest var det dyreste.

Veiledende pris på lammekjøtt er kr. 50 pr. kg (vinteren 1998). Hvis kr. 50 er prisen pr. kg for ditt minst foretrukne produkt, hvor mye ekstra ville du være villig til å betale pr. kg for det mest foretrukne av de to produktene?

kr. _____ ekstra (i tillegg til de 50 kr.) er det maksimale jeg ville betale pr kg.

... og så noen utfyllende opplysninger til slutt:

26. Hva er din høyeste fullførte utdanning?

Sett ett kryss ved det alternativet som passer best

- (1) ungdomsskole/grunnskole
- (2) yrkes-/landbruksskole
- (3) gymnas/videregående skole
- (4) høyskole/universitet
- (5) annen → Hvis annen utdanning, oppgi hvilken: _____

27. Hva er din husholdnings omtrentlige årlige brutto inntekt?

_____ kroner

28. Hvis du har eller har hatt inntektsgivende arbeid, innen hvilken næring jobber/jobbet du hovedsakelig?

Sett ett kryss ved det alternativet som passer best

- (1) Primærnæring (jordbruk, skogbruk, fiskeri)
- (2) Industri (næringsmiddel, treforedling, metall, verksted, annen industri)
- (3) Offentlig service (off. administrasjon, skoleverket, helsesektoren, etc.)
- (4) Privat service (bank/finans, transport, hotell/restaurant, etc.)
- (9) Jeg har ikke hatt inntektsgivende arbeid (hjemmeværende, trygdet, under utdanning, arbeidsledig, etc.)

Du er nå ferdig med utfyllingen. Returner skjemaet i den vedlagte svarkonvolutten, og du blir med i trekningen av tre gavekort.

Hvis du har kommentarer, kan du skrive disse på neste side.

Takk for hjelpen!