Consumer Perception of Traceability in the Meat Chain

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Abstract

Despite growing interest in meat traceability systems, very little research has been done on consumer needs and perception of traceability. This gap is partly filled by the present study of consumer perception of meat traceability in Belgium, based on cross-sectional data collected in June 2001. Respondents are segmented, based on their subjective perception of meat quality, and differences in the perceived need for traceability systems between the various segments are investigated. Functional traceability attributes, such as organizational efficiency, chain monitoring and individual responsibility, are important to all consumers. Extensions with respect to process attributes, such as production methods, are less relevant to the general population, being only of interest to specific market segments, i.e. consumers with a more negative perception of meat quality and lower consumption levels. In conclusion, it is recommended that public policy focuses on the level of functional traceability attributes, whereas extensions with respect to process attributes are left to private initiatives, which focus on specific market segments.

Key words: traceability; meat chain; consumer; survey; Belgium

Zusammenfassung

Trotz wachsenden Interesses an der Rückverfolgbarkeit von Agrarprodukten hat sich die Forschung bis jetzt nur wenig damit beschäftigt, wie Verbraucher die Notwendigkeit von Rückverfolgbarkeit auffassen. Der vorliegende Beitrag beschäftigt sich mit der Verbraucherwahrnehmung von Rückverfolgbarkeit von Fleisch in Belgien und basiert auf einer Querschnittsstudie aus dem Juni 2001. Die Befragten werden anhand ihrer subjektiven Wahrnehmung von Fleischqualität segmentiert und die Unterschiede in der wahrgenommenen Notwendigkeit von Rückverfolgbarkeit zwischen den Segmenten analysiert. Funktionelle Rückverfolgbarkeitsmerkmale wie organisatorische Effizienz, Kettenüberwachung und individuelle Verantwortlichkeit sind alle von Bedeutung für die Verbraucher. Erweiterungen im Hinblick auf Prozessmerkmale, z.B. die Produktionsmethode, sind für das breite Publikum weniger interessant und nur für bestimme Segmente relevant, nämlich für Verbraucher mit einer negativen Auffassung von Fleischqualität und niedrigeren Verbrauchsmengen. Es wird empfohlen, sich in der öffentlichen Diskussion auf funktionelle Rückverfolgbarkeitsmerkmale zu konzentrieren, während Erweiterungen auf Prozessmerkmale privaten Initiativen überlassen werden können, die sich auf bestimmte Marktsegmente konzentrieren.

Schlüsselworte: Rückverfolgbarkeit; Fleischwertkette; Verbraucher; Befragung; Belgien

1 Introduction

In response to growing consumer concerns about food safety in recent years, both industry and the public authorities have developed quality and safety assurance systems (BREDAHL et al., 2001). Meat clearly dominates food safety debates, controversies about meat consumption raging at all levels throughout the EU at the end of the twentieth century and beginning of the twenty-first. Initially, these debates focused on the use of growth hormones in beef production, followed by heated discussions on the use of preventive antibiotics and growth promoters in intensive livestock production. The latest developments include safety issues such as mad cow disease throughout Europe, the dioxin crisis in Belgium, and outbreaks of foot-and-mouth disease in several countries. All of these crises led consumers to rethink their attitudes to and behaviour towards meat consumption (BURTON and YOUNG, 1996; LATOUCHE et al., 1999; VERBEKE and VIAENE, 1999; HENSON and NORTHEN, 2000; VERBEKE et al., 2000; BUZBY, 2001).

The emerging issues and related problems pertain to different stages of livestock production and the meat supply chain. The response of industries and governments has been to pin their hopes on the development of traceability systems. Clearly, this interest is demand-driven, with consumers and retailers taking the lead. Many previous consumer studies in the meat area have focused on safety (SAUCIER, 1999; VERBEKE and VIAENE, 2000; CASWELL, 2001), quality (STEENKAMP and VAN TRIJP, 1996; GRUNERT, 1997), origin (SYLVANDER et al., 2001; VANNOPPEN et al., 2001) or labelling (VERBEKE and VIAENE, 1998; STAPELA, 2000; GOLAN et al., 2000; BONNET and SIMIONI, 2001; NAYGA, 2001).

Food safety perception differs between countries (PATTERSON, 1990; HENSON and TRAILL, 2000; BUZBY, 2001). Consequently, consumer concerns and acceptance of measures to monitor food safety can be expected to differ. FRENZEN et al. (2000) have even identified differences within a single country in terms of acceptance and willingness to pay for measures that reduce food safety risks. Although safety issues and safety-related research are strongly intertwined with traceability, for the most part they have not focused specifically on tracking meat from producer to consumer, a notable exception being MCCARTHY and BARTON (1998), who investigated consumer understanding of traceability in Ireland. These authors concluded that the understanding of traceability was very poor, and that interest in the intricate details of the systems was at a very low level. The motivation for the current study was the scarcity of consumer studies that connect the development of traceability to consumer knowledge, perception and behaviour.

The structure of the paper is as follows. Section 2 presents an overview of the relevant recent literature on traceability in meat chains. While there appear to be strong beliefs in the potential benefits and costs of traceability systems, few empirical studies have been carried out. Section 3 sets out the research methodology and framework for the present analysis. Cross-sectional consumer data are used to investigate consumer perception of traceability in beef, pork, poultry and meat mixture chains. Section 4 presents and discusses the empirical findings. A segmentation analysis is carried out, based on the perception of meat quality. Associations between consumer segments, personal consumer characteristics, attitudes to and behaviour towards meat on the one hand, and the perception of traceability on the other, are analysed. The final section presents the con-

clusions and recommendations regarding the development of future traceability systems and traceability-based meat marketing.

2 Traceability systems: background and challenges

WILSON and CLARKE (1998) and JACK et al. (1998) define food traceability as the information necessary to describe the production history of a food crop and any subsequent transformation or process the crop might undergo on its journey from the grower to the consumer's plate. TIMON and O'REILLY (1998) propose a working definition of traceability specifically related to the meat sector as a system that provides the ability to identify an animal, trace its movements throughout its lifetime, and subsequently trace the meat products made from it to the final consumer.

The origins of the traceability systems in today's European meat and livestock chains date back to those set up at the start of the 1950s to eradicate animal herd diseases such as bovine tuberculosis and brucellosis. These early systems included the identification and registration of cattle herds, but gradually, the registration of animal movements, herd owner, farm and farming characteristics were also added. Most of the traceability systems that are operational today used the existing systems of identification and registration as a starting point. The development of traceability systems gained momentum largely as a result of changes at the consumer level (DOWNEY, 1996), and received further impetus through the rapid development of hardware, software and information technology since the 1980s (DOUZAIN, 1998; ELLIOT and STAINER, 1998; OUDE LUTTINGHUIS, 2000; WORTMANN, 2000). While there are numerous reasons for the recent development and adoption of traceability systems, the greatest single driving force is considered to be consumers' increasing health and safety consciousness (DOWNEY, 1996; PALMER, 1996; MEULENBERG, 1997; VIAENE et al., 1998; NORTHEN, 2000; BREDAHL et al., 2001). Today's traceability systems (e.g. Sanitel in Belgium) are still basically concerned with animal health, disease and food safety control. However, they are gradually extending into proactive management and marketing tools, either through the feedback of information upstream or the introduction of labelling schemes with the traceability system as backbone. For example, the Belgian Sanitel system provides the backbone for Meritus beef labelling. In this way Sanitel enables producers to comply with the compulsory EU beef and veal labelling regulation (EC 1760/2000 and EC 1825/2000).

All traceability initiatives employ similar principles, in that they lay down standards and procedures which must be observed by members and which are monitored to ensure compliance. In the case of livestock and meat schemes, these standards, procedures and controls embrace all stages from the farm, including feeding, livestock handling and transportation, slaughtering and meat processing, to distribution (LEAT et al., 1998). Key elements include the identification and registration of animals, herds, meat processors, exporters, data capture, communication, and data management and verification. Critical points are the registration and movement of animals, transfer of identification data and product predecessor-successor relationships. Although the key issues of traceability are reasonably straightforward, their implementation is complicated, primarily by the number of levels within the chain and the numbers of producers supplying the chain (TIMON and O'REILLY, 1998). A further obstacle to installing traceability systems is the low degree of vertical integration in certain livestock and meat chains in specific countries or regions (PORIN and MAINSANT, 1998).

The benefits of traceability are visible at the sector or industry level, the level of other involved participants (e.g. farmers), and the level of end consumers. Improved product traceability is considered an asset by the food industry, since it provides opportunities through adding value or raising entry barriers to restore consumer confidence in food safety (FEARNE, 1998). It should also help reduce production and transaction costs. Since traceability systems can pinpoint the exact place where the system has broken down and which sector or participant is responsible, other participants in the supply chain are vindicated. This means that problems can be detected and rectified without causing irreversible damage to others in the chain (JACK et al., 1998). LEAT et al. (1998) clearly identify the benefits sought by the food industry from traceability in the food production and marketing chain. Benefits perceived from traceability are fivefold. First, it enables the industry to provide consumer assurance about the sources and safety of food. Second, traceability allows the source of infected or substandard products to be identified (see also WILSON and CLARKE, 1998). Third, it allows for disease control and residue monitoring. Fourth, it verifies support measures. And fifth, it meets the requirements of labelling regulations with regard to the potential development of brands (see also SIMPSON et al., 1998).

Economic benefits of the systems include increased efficiencies and savings in several areas: reduced disease levels, reduced compensation payments, more efficient allocation of testing resources. While the fact that traceability involves costs is generally acknowledged (CALDER and MARR, 1998; HOBBS and YOUNG, 2000), there is no mention of the level, quantification or distribution of these costs among chain participants. According to DEN OUDEN (1996), economic quantification of the consequences of vertical co-ordination and traceability is rare and largely incomplete. Such quantification is being developed in the case of genetically modified (GM) foods, where the discussion about mandatory labelling in the EU stimulated research on segregation costs (MIRANOWSKI, 1999; GOLAN et al., 2000; PHILLIPS and FOSTER, 2000). However, even in the case of GM, few estimates of costs are presented. One thing that all studies seem to agree on is that implementing a labelling policy on GM foods is costly. HUFFMAN (2001) has estimated that consumers are willing to pay about a 14 % premium for food they perceive as non-GM.

3 Research objectives, framework and methodology

The research framework, based on a literature review, is presented in figure. The meat chain from producer to consumer constitutes the core of the framework. Tracking meat products within this chain focuses on two types of attribute, namely functional attributes such as organizational efficiency and meat chain monitoring on the one hand, and process attributes such as origin and production method on the other. Functional attributes are linked with the intrinsic opportunities of a traceability system, while the process at-

tributes deal with characteristics of the production process along which the tracking is organized. The tracking serves as a kind of peg for potential consumer benefits.

The main aim of the present study is to assess the importance of each of these attributes (see figure) from a consumer viewpoint. Additional objectives include identifying different consumer segments based on the perception of the quality of fresh meat, and linking these segments to the importance attached to different traceability attributes, claimed and intended behaviour, the current subjective health status and socio-demographic characteristics.

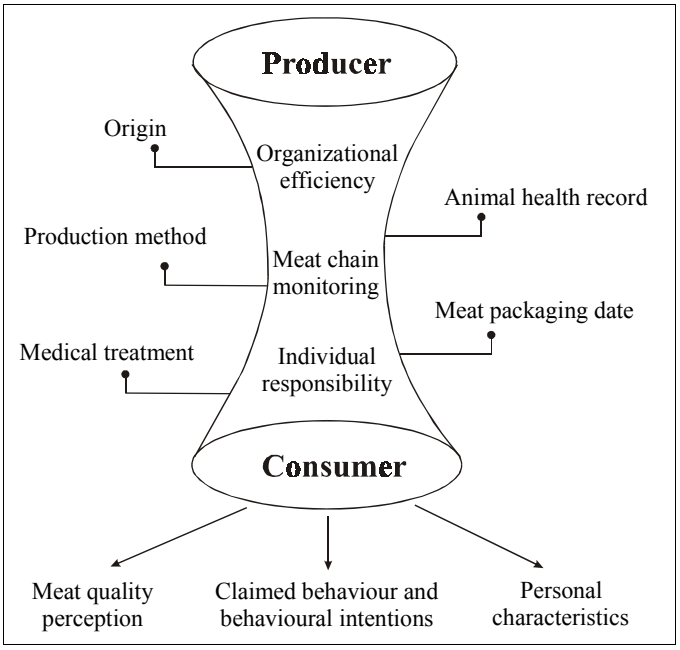

Figure: Research framework

The study is based on cross-sectional consumer data collected from a sample of 149 meat consumers in Belgium in June 2001. The socio-demographic and behavioural characteristics of the sample are presented in table 1. Respondents were selected based on convenience sampling, with the restriction that they were the main person responsible for buying meat in the household. This resulted in a gender distribution of 62 % female and 38 % male respondents in the sample. The highest meat consumption frequencies are reported for beef, with more than one third of the respondents saying that they eat beef several times a week. The lowest consumption frequencies are reported for meat mixtures, with almost half the respondents saying that they eat this less than once a week. The average age of the sample is 37 years. The elderly (>50) and less educated are slightly underrepresented in our sample.

Data was collected by means of a structured questionnaire in five parts. The first part measured claimed and intended meat consumption for beef, pork, poultry and meat mixtures. In the second part, subjective health state was assessed on a 7-point scale, based on the following two items: "I eat healthier than 5 years ago" and "I perceive my present state of health as bad – extremely good". The third part measured attitudes to meat on a 7-point bipolar semantic differential scale. Items included safety, healthiness, animal friendliness, environmental friendliness, taste and price. Part four measured the perceived importance of issues related to traceability on a 7-point scale. An additional question related to the urgency of introducing traceability for beef, pork, poultry and meat mixtures was included. The fifth part of the questionnaire included such socio-demographic characteristics as gender, age, number of children, education and place of residence.

Table 1: **Socio-demographic and behavioural characteristics of the sample, % of respondents** (n=149)

		Consumption frequency			
		Beef	Pork	Poultry	Meat mixtures
	> 1 / week	38.5	24.0	20.3	21.3
	Once a week	34.5	40.4	44.6	29.1
	< 1 / week	27.0	35.6	35.1	49.6
Socio-demographic characteristics					
Gender	Female	62.4			
	Male	37.6			
Education			*Place of residence*		
	has left school <18	28.6	Urban		39.9
	at the age of >18	71.4	Rural		60.1
Age (mean = 37)			*Children under10*		
	< 30	39.9	Yes		30.2
	30 – 50	39.8	No		69.8
	> 50	20.3			

Two versions of the questionnaire were designed in order to check the effect of responses to subsequent questions. It was assumed that starting with the questions on the perceived importance of process attributes would influence responses to the functional attributes, and vice versa. However, a t-test for equality of means resulted in no significant differences between the two versions.

4 Empirical results

This section starts with consumer segmentation based on meat quality perception, differences between consumer groups being identified using behavioural and personal characteristics. This is followed by a discussion of the differences in perception of traceability across the identified segments. Finally, the perceived urgency of introducing traceability in the beef, pork, poultry and meat mixture chains is investigated.

4.1 Consumer segmentation

A hierarchical cluster analysis (Ward's method – squared Euclidean distance), followed by a k-means clustering on the perception of quality of fresh meat now compared with five years ago, results in a three cluster solution (table 2).

Table 2: **Present perception of meat quality compared with five years ago, average attribute ratings of semantic differential from –3 to +3** (n = 141 respondents)

Attribute	Average scores			
	Enthusiasts n = 39	Cautious n = 65	Pessimists n = 37	Total n = 141
Unsafe – safe	1.97[a]	1.02[b]	–0.97[c]	0.76
Unhealthy – healthy	1.79[a]	0.40[b]	–1.14[c]	0.38
Not animal friendly – animal friendly	1.51[a]	0.11[b]	–0.62[c]	0.30
Not environmentally friendly – environment friendly	1.62[a]	0.22[b]	–0.19[c]	0.50
Tasteless – tasty	0.51[a]	–0.15[b]	–0.65[c]	–0.10
Expensive – cheap	–1.33[a]	–0.11[b]	–1.43[a]	–0.79

The various superscripts indicate significant differences in the post-hoc Duncan test ($p<0.05$); identical letters denote no difference.

Quality perception is assessed using six fresh meat attributes, based on a 7-point semantic differential scale ranging from –3 to +3. Fresh meat includes beef, pork, poultry and mixtures such as hamburgers and brochettes. One-way ANOVA was carried out to illustrate the differences in quality perception between the clusters or consumer segments. The clusters are labelled based on an interpretation of their patterns of mean perception scores: enthusiasts, cautious and pessimists.

The total sample scores above the middle scale position of the semantic differential for the attributes safety, healthiness, animal welfare and environmental friendliness, whereas there are negative average scores for taste and price.

The *cautious* are the largest segment, constituting 46.1 % of the respondents. These consumers consider the current quality of fresh meat as safer and healthier than the total sample mean. However, these consumers score below average on animal welfare, environmental friendliness and taste. The *enthusiasts* and the *pessimists* are similar in size, each constituting about 25 % of the respondents. The *enthusiasts* score above average for all fresh meat quality attributes except price, where they perceive meat as more expensive than the average. The *pessimists* score below average for all attributes, and give an extremely low score for healthiness. These consumers have an overall poor perception of fresh meat, and clearly consider current meat quality as much more unhealthy compared with five years ago.

As indicated above, the questionnaire included questions about health status, healthier food consumption compared with five years ago, and socio-demographic characteristics (gender, age, number of children under 10, education, place of residence). There were no statistically significant differences across the segments for any of these personal characteristics. This mainly shows that analysing and describing differences in consumers' perception of food quality using socio-demographic characteristics is increasingly difficult.

A comparison of claimed current, past and future behaviour with the obtained clusters reveals significant differences between the consumer groups for current consumption levels of beef and pork (table 3). The *pessimists* consume beef and pork less frequently, while the other groups have higher consumption levels. This claimed behaviour is clearly related to the types of meat involved in recent food scares (mad cow and foot-and-mouth disease, residues of harmful substances), and which are still treated with suspicion.

Table 3: **Consumption frequency of beef and pork of the different consumer groups, in % of total respondents**
(n = 140 for beef and n = 135 for pork)

		Enthusiasts	Cautious	Pessimists	Total
Beef	> 1/week	35.8	34.0	30.2	100
	Once a week	29.2	54.2	16.7	100
	< 1/week	15.4	51.3	33.3	100
	Total	27.9	45.7	26.4	100
Statistical test: $\chi^2 = 8.756$; $p<0.10$					
Pork	> 1/week	40.6	40.6	18.8	100
	Once a week	29.6	55.6	14.8	100
	< 1/week	20.4	42.9	36.7	100
	Total	28.9	47.4	23.7	100
Statistical test: $\chi^2 = 9.678$; $p<0.05$.					

With regard to claimed past behaviour, about one third of the respondents say that consumption of both beef and pork has declined during the past year. The consumption of meat mixtures declined in about a quarter of the interviewed households, while poultry consumption went in the opposite direction, with a claimed increase in about 20 % of the cases. There were no big differences between the meat types as regards claimed future behaviour. The large majority of the respondents ($\pm$85 %) say they intend to maintain consumption of fresh meat at the current level.

4.2 Consumer perception of traceability in the meat chain

The perception of traceability of fresh meat is determined through the evaluation of eight statements on a 7-point scale (table 4). Consumers were asked to express the degree of importance they attach to possible attributes of traceability systems in the meat chain (see research framework). Thus, a distinction is made between process and functional attributes.

Table 4: **Perception of traceability in the meat chain related to consumer segments, average scores on a 7-point scale** (n = 139 respondents)

Average scores			
Enthusiasts	Cautious	Pessimists	Total
Process Attributes:			
I have access to information regarding the medical treatment of the animal.			
3.50[a]	3.84 [a]	4.65 [b]	3.96
I can check the animal production method.			
4.05 [a]	4.35 [a b]	5.14 [b]	4.48
I can check the origin of the product (region, farmer and slaughterhouse).			
4.32 [a]	4.20 [a]	5.14 [b]	4.48
I can check the meat packaging date.			
5.63	5.40	6.00	5.62
I have access to information regarding the health record of the animal.			
3.97 [a]	4.05 [a]	5.00 [b]	4.28
Functional Attributes:			
Organizations responsible for monitoring public health can intervene in the event of a problem in the meat chain (e.g. dioxin scare: only contaminated products are removed from the shelves, not all products).			
5.58	5.63	5.81	5.66
In the case of abuses, individuals responsible can be clearly identified and held accountable.			
5.73	5.84	6.19	5.91
The meat chain (from animal feed to the consumer's plate) can be organized more efficiently to further reduce costs.			
5.24	4.84	5.17	5.04
The various superscripts indicate significant differences in the post-hoc Duncan test ($p<0.05$); identical letters denote no difference.			

The functional attributes obtain the highest scores in the overall sample. Most importance is attached to 'individual responsibility' and 'meat chain monitoring'. Organizing the chain in a more efficient way is somewhat less important, but still more important than most of the process attributes. All the functional attributes score significantly higher than the process attributes in the t-test for paired comparison of means, except for 'meat packaging date'. This statement was assumed to be somewhat misleading, consumers confusing 'eat-by date' for 'meat packaging date'.

The importance consumers attach to the functional attributes does not significantly differ between segments. It can be concluded that organizing traceability and related marketing efforts around the functional attributes cannot be considered an efficient instrument for changing perceptions

of meat quality, since it does not address concerns about safety, healthiness, environment and animal friendliness. It also shows that organizing traceability based on functional attributes will not meet consumer concerns, as the retail sector often pretends.

Contrary to the functional attributes, most of the process attribute perceptions differ significantly between the segments. The scores given by the *pessimists* are systematically higher than those of the other two segments, which shows that focusing on additional process attributes through traceability could at least meet the meat quality concerns of these consumers. However, it is important to remember that the *pessimists* constitute only a limited part of the sample (25 %). It is therefore debatable whether it would be worthwhile organizing such a traceability system (including opportunities for consumers to personally check process attributes) for the entire meat chain, though individual chain participants or private initiatives might find it useful to address the specific concerns of the market segment we call *pessimists*.

4.3 Consumer perception of the urgency of introducing traceability systems

The questionnaire also focused on the perceived urgency of introducing a traceability system for the different meat types (table 5). The system to be introduced was defined as one with the attributes considered important by the respondent. Consequently, respondents were asked to express the degree of urgency of introduction on a 7-point scale, ranging from 'not at all urgent' to 'extremely urgent'.

Table 5: **Consumer perception of the need for introducing traceability in the meat chain, average scores on a 7-point scale** (n = 139 respondents)

	Beef	Pork	Poultry	Meat mixtures
Average score	5.28	5.08	5.24	5.46
Mean difference				
Beef	–	0.20**	0.04	–0.21**
Pork		–	–0.16*	–0.41**
Poultry			–	–0.25**
Meat mixtures				–

Means are significantly different (** for p<0.05; * for p<0.10) in t-test of paired samples

Table 6: **Consumer segments and perception of the need for traceability according to meat types, average scores on a 7-point scale** (n = 133 respondents)

Urgency of introduction	Average scores			
	Enthusiasts n = 37	Cautious n = 64	Pessimists n = 32	Total n = 133
Beef	4.87 [a]	5.09 [a]	5.81 [b]	5.20
Pork	4.50 [a]	5.06 [a b]	5.47 [b]	5.00
Poultry	4.79 [a]	5.27 [a b]	5.53 [b]	5.19
Meat mixtures	5.08 [a]	5.45 [a b]	5.88 [b]	5.45

The various superscripts indicate significant differences in the post-hoc Duncan test (p<0.05); identical letters denote no difference.

The perceived need for a traceability system is the highest in the case of meat mixtures, followed by beef, poultry and pork. The difference in urgency between beef and poultry is not statistically significant. The top score for meat mixtures can be explained by the fact that evaluating mixture quality is perceived as more difficult than for the other meat types. Moreover, the risk of abuse is highest in the case of mixtures. The second place for beef is connected with its frequent involvement in food scares in recent years.

Table 6 shows differences in the perceived urgency of introducing traceability between the identified consumer segments. *Pessimists* express the strongest need for traceability systems, which for all meat types is more urgent than for the *enthusiasts*. This means that consumers who are more concerned about meat quality and eat meat less frequently indicate a more urgent need for the introduction of traceability systems. The scores for all meat types are higher than the middle scale position.

5 Conclusions

Meat traceability systems are being established and expanded in many European countries, with the aim of restoring consumer confidence in meat quality and safety. Though the potential benefits of traceability are widely accepted, no evidence of their distribution and quantification is available. Similarly, very little research on consumer needs and perception of traceability has been done. This gap is partly filled by the present study of consumer perceptions of meat traceability in Belgium based on cross-sectional data collected in June 2001. Respondents are segmented based on their subjective perception of meat quality, and differences in the perceived need for the introduction of traceability systems between the segments are analysed.

With respect to traceability characteristics, there is a distinction between functional and process attributes, the former referring to the intrinsic opportunities of the systems, i.e. the ability to organize the chain more efficiently, monitor the chain, and assess individual responsibilities. These attributes can be regarded as the minimum requirements of a true 'traceability system'. Process attributes refer to characteristics of the production process at different levels of the chain, i.e. they can be regarded as resulting from extensions to the minimum requirements.

The cluster analysis yielded a three-cluster solution, with segments denoted *enthusiasts*, *cautious* and *pessimists*. None of the clusters can be typified through socio-demographic characteristics. The profile of the pessimists (about 25 % of the respondents) is the most extreme, with the overall most negative scores for the perception of meat quality. There were no significant differences between segments in terms of perceived importance of functional traceability attributes. The functional attributes are all, bar one, more important to consumers than process attributes. Process attributes are significantly more important to the *pessimists*, i.e. this segment attaches more importance to the ability to personally check production process characteristics.

Our empirical findings contribute to the debate about who is responsible, and to what extent, for providing meat quality and safety. Since functional attributes are broadly supported by all consumer groups, public policy plays an important role in guiding and monitoring this aspect of traceability. Extensions with respect to process attributes, such as production methods, are less relevant to the broad public and only interest specific market segments. Government

intervention or regulation on the process attribute side of traceability is thus less evident. These attributes are more appropriate for private initiatives of chain participants.

The introduction of traceability is regarded as the most urgent in the case of meat mixtures. However, organizing traceability for mixtures in terms of functional attributes is the most difficult, because different meat types can be an ingredient in one and the same product. Despite the fact that the *pessimists* consume meat the least frequently, they regard the introduction of traceability in the meat chain as the most urgent, which means that traceability could be an answer to their concerns.

Future research could focus on *pessimists'* willingness to pay for traceability systems, which are extended with process attributes on the one hand, and on a more precise characterization of this market segment (e.g. purchase outlet, moment of meat consumption) on the other. At the level of the meat chain, it could be interesting to quantify costs and benefits for all participants in the meat chain. Another future research topic could be the distribution of these costs and benefits among chain participants, as well as the role of the retail industry as potential chain leader/gatekeeper.

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