

PERCEPTION OF CONSUMERS AND PRODUCERS ON MILK TRACEABILITY SUPPLY CHAIN

Dan BODESCU¹, Alexandru-Dragoș ROBU¹, Florin Daniel LIPȘA¹

e-mail: dbodescu@uaiasi.ro

Abstract

Food traceability (FT) is an important tool for reducing the occurrence of foodborne diseases in the current context of a continuously growing volume and movement of food. The aim of the research was to determine the perception of consumers and producers regarding FT, the impact on purchase / sale and loyalty to traceable food products (FTP). Thus, a survey was conducted on the milk supply chain in Neamț County, Romania with two questionnaires: for consumers and for producers. The TwoStep Cluster analysis allowed the establishment of 2 clusters for consumers and 2 for producers. Cluster 1 consumers (40.6%) priority: rural area, between 30 and 60 years old; secondary education, women are informed about FT. They consider that FTs are 10% more expensive than non-traceable products and traceability is a formality. Cluster 2 consumers (34.8%) priority: urban environment, with secondary education, men, well informed about FT and are willing to buy for food safety even if the price would increase by 20%. Cluster 1 producers (61.1%) priority: rural area, secondary education, information on FT at medium level and appreciate that traceability is expensive and the information provided can reduce the competitive advantage and increase taxation. Cluster 2 producers (38.9%) priority: rural area, with secondary education, women who have above average information about FT consider that FT allows the legal assurance of their own activity and can determine the increase of sales.

Key words: traceability, food, milk supply, consumer perception, producer perception

Traceability of food (FT) as an efficient and fast system is a key to minimizing the occurrence of foodborne diseases in terms of increased volume and increased movement of food (Zhang J.R., Bhatt T., 2014).

Over the last decade, traceability term has proved difficult for consumers. The results of some surveys show that they failed to define or describe it. In the case of beef, the term is increasingly vague as respondents' skills and income decline (Giraud G., Amblard C., 2003). Participants in a European-representative questionnaire proved to have very different skills. Those in southern Europe face more difficulties in ensuring the competence of their current food system. Except the French and Dutch, participants do not know any national certification labels; they know only strong, traditional and regional trade ethics. The future of food traceability seems to be linked to the branding strategy of agri-food companies. Food traceability basically includes cognitive difficulty. (Gallen C., 2005; Giraud G., Halawany R., 2021)

For marketing purposes, the region may be important due to the knowledge of where the food

comes from, the trustworthy environment, the transparency and the identity of the product (Hendriks K et al, 2004). Instead, some customers find that traceability systems are more beneficial for manufacturers and controllers. They see the usefulness for consumers if there is something wrong with the product. (Gauthier M., 2005; Hobbs J.E. et al, 2005).

Nilsson H. Considers that most consumers need to ensure a credible traceability system by involving more stakeholders and extending responsibility from processors to retailers (Nilsson H. et al, 2004). In 2013, after the discovery of horse meat in beef products, many European consumers said they bought fewer processed meat products after this event. Their confidence in processed meat foods has become lower than before. Participants in some UK and Irish researchers suggested restoring confidence by improving traceability and clearer label information on the composition and origin of products. (Barnett J. et al, 2016). Research in Italy has shown that better traceability has led to an improvement in the distribution of responsibilities between meat agencies and a strengthening of

¹ Iasi University of Life Sciences, Romania

vertical arrangements.. Consumers also showed significant interest in the information on the labels: the origin of the meat, the system of rearing the cattle and the date of slaughter. (Banterle A., Stranieri, S., 2008).

Zheng S., shows that some Chinese consumers are willing to pay an amount of \$ 0.7 / kg for traceable pork (Zheng S., et al, 2012). In contrast, the share of consumers who have information on the traceability system is quite low. Many of them are not interested in the quality standards or the information on the label. (McEachern MG., Seaman C., 2005).

The aim of the research presented in this article was to determine the main coordinates of

consumers' and producers' perceptions of FT in terms of impact on purchasing / sales and traceability of food products (FTP).

MATERIAL AND METHOD

This objective led to a field research on the milk supply chain in Neamț County, Romania. Two questionnaires were used in them: one for consumers (Table 1) and the other for producers (Table 2). The consumer questions were aimed at: determining the profile of the subjects, the information held on FT, the price of the food for which a traceability system (FTP) is provided, the reason for the preference for FTP, and the fidelity for FTP.

Table 1

Consumer questionnaire - content and form

Nr. crt.	Objective	Form	Answer / content variants
1	Gender	multiple answers	female, male
2	Age	items to complete	text (age)
3	Education level	multiple answers	studies: primary, secondary, superior
4	Environment	multiple answers	rural, urban
5	Income per family member	multiple answers	<2.000, 2.000-4.000, >4.000 (lei/capita)
6	Health status	multiple answers	poor, acceptable, good, very good
7	Knowledge about the FT concept	multiple answers	not at all, to a small extent, well, very well
8	FTP purchase reason	items to select, short text answer	food safety, producer protection, others
9	FTP Non-purchase reason	items to select, short text answer	FT – a formality, higher price, preference for products from small producers, others
10	FTP price (from authorized sellers)	multiple answers	-30, -20, -10, +10, +20, +30
11	Price increase from which they cancel buying FTP	multiple answers	+10, +20, +30, +40, +50

The questionnaire for producers was structured on the following sections: subjects profile, knowledge on FT, the price of the products (FTP) from their perspective, the reason for the FT implementation, and the fidelity to the FTP.

The questions were asked on the basis of the progressive difficulty in two stages: for the consumer questionnaire: 1-2, 8-11, 3-7 and for the

manufacturers' questionnaire: 1-2, 6-11, 3-5. The Google Forms platform was used to develop and distribute them (<https://www.google.com>). The sampling of the results took place in the second quarter of 2021, online, from subjects from Neamț County of Romania. Database creation, data validation and analysis required the use of Microsoft Office and IBM SPSS Statistics 23.

Table 2

Producer questionnaire - content and form

Nr. crt.	Objective	Form	Answer / content variants
1	Gender	multiple answers	female, male
2	Age	items to complete	text (age)
3	Education level	multiple answers	studies: primary, secondary, superior
4	Environment	multiple answers	rural, urban
5	Type of production (sales type)	multiple answers	authorized, directly in the community, in the agricultural market, others
6	Knowledge of the FT concept	multiple answers	not at all, somewhat, well, very well
7	FTP production (sale) reason	items to select, short text	legal insurance, social responsibility, others
8	Non-FTP production (sale)	items to select, short text	The information required by the FT may affect competitive advantage, additional costs, unavailable human resources, increased taxation, etc.

9	the price of FTP compared to the others	Multiple answers	-30, -20, -10, +10, +20, +30 (%)
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The validation of the results of the questionnaires was done with Exploratory Factor Analysis (EFA) from the SPSS application because of the possibility it offers to determine the covariation of a set of measured variables, to identify common factors that establish the structure and order between variables. (Tucker L. R., & MacCallum, R. C., 1997).

The data analysis was also performed with the TwoStep Cluster Analysis function in the SPSS application because it allows the creation of natural groups from a data set that would not otherwise be obvious in another way. This grouping uses both categorical and continuous variables, involves selecting the number of clusters, and uses a measure of the probability distance that assumes that the variables in the modeled cluster are independent (Bacher J., 2000).

RESULTS AND DISCUSSIONS

After the validation stage of the subjects' answers to the questionnaires, a representative distribution was obtained for the researched area. Consumer subjects (n = 138 respondents out of 185 administered questionnaires) were structured in: urban 41.2% and 58.8% rural; 48.5% women and

51.5% men; 33.0% aged 0-29 years, 41.3% aged 30-59 years and 25.5% over 60 years. studies: primary 31.8%, secondary 55.6%, higher 12.6%, incomes less than 2,000 lei (32.6%), 2,000 lei - 4,000 lei (45.2%) and over 4,000 lei (22.2%).

The producing subjects (n = 32 respondents out of 69 administered questionnaires) had the structure: urban 42.8% and 51.2% rural; 48.6% women and 51.4% men; 33.4% aged 0-29 years, 41.3% aged 30-59 years and 25.3% over 60 years. education: primary 31.5%, secondary 56.2%, higher 12.3%.

Exploratory Factor Analysis was performed on 138 consumers and 32 manufacturers. The data set was suitable for the EFA, the coefficient Kaiser-Meyer-Olkin = .62, Bartlett's sphericity test, (x^2) = 148.331 $p < .001$ for the analysis of consumer responses and respectively, Kaiser-Meyer-Olkin = .68, Bartlett's sphericity test, (x^2) = 1668.532 $p < .001$ for the analysis of the producers' answers. EFA was applied on 6 items and only one factor was identified, FTP prices from the perspective of consumers and from the perspective of producers.

Table 3

Consumer and producer responses

Nr. crt.	Obiectiv	Variante de răspuns / conținut
	Consumers	
7	Knowledge of the FT concept	not at all (23.5%), somewhat (41.3%), good (21.5%), very good (13.7%)
8	FTP purchase reason	food safety (57.2%), protection of preferred producers (11.6%), other (31.2%)
9	FTP Non-purchase reason	FT - a formality (62.6%), higher price (16.3%), preference for products from small producers (21.2%), others (%)
10	FTP price (from authorized sellers)	0 (48.3%), +10 (28.2%), +20 (16.8%), +30 (6.7%)
11	Price increase from which they cancel buying FTP	0 (42.8%), +10 (12.9%), +20 (8.5%), +30 (6.7%), +40 (2.5%), +50 (0.0%)
	Producers	
6	Knowledge of the FT concept	not al all (6.4%), somewhat (22.5%), good (46.3%), very good (24.8%)
7	FTP production (sale) reason	legal insurance (%), social responsibility (%), increase in sales (%), others (%)
8	Non-FTP production (sale)	information may affect competitive advantage (%), additional costs (%), unavailable human resources (%), increased taxation (%), others (%)
9	the price of FTP compared to the others	0 (7.4%), +10 (25.9%), +20 (7.4%), +30 (9.3%)

Applying the TwoStep Cluster analysis to consumers on the 11 characteristics resulting from the questionnaire allowed the construction of two clusters with good quality (0.67) with the main

predictors of importance: level of education, age, home environment and sex. The continuous variables were the level of information about FT, the level of fidelity to FTP.

Cluster 1 for consumers (40.6%) consisted (fig. 1) of people living in rural areas (ff. 71.0% - frequency), aged between 30 and 60 years (ff. 16.2%); with secondary education (ff. 52.0%), women (ff. 57.4%); states that they are informed about the traceability process (ff. 44.2.5%); say they are in very good health (ff. 32.7%); considers that FTPs are 10% more expensive than non-traceable products (ff. 29.4%); and are safer (ff. 11.9%) but traceability is a formality (ff. 10.7%). This group consists of 56 people, with an estimated level of information of 11.4% and a loyalty level of 12.1%.

Cluster 2 for consumers (34.8%) consisted of people from urban areas (ff. 63.1%), with secondary education (ff. 72.2.3%), men (ff. 81.5%); declare that they are well informed about the concept of traceability (ff. 42.1%), consider that they are in good health (ff. 44.8%), obtain an income between 2,000 and 4,000 lei (ff. 34.7%), consider that the prices these products are 20% higher than non-traceable ones (ff. 33.4%), they are willing to continue to buy even if the price would increase by 20% (ff. 31.0%), they are young under 30 (ff. 19.2%) and considers traceability to be an important tool for food security (ff. 25.3%).

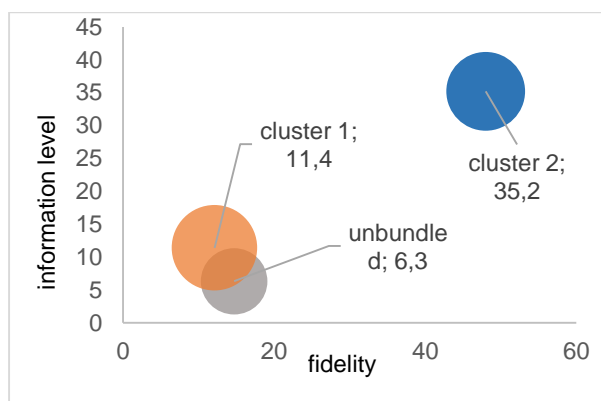


Figure 1 The level of information and loyalty of consumers grouped in clusters

These consumers represent 48 respondents with an information level of 35.2% and a fidelity of 30.6% and are similar to the population surveyed by Ladwein R. who states that there is a positive relationship between trust in producers and that in traders depending on the perception of traceability. (Ladwein R., Romero A.M.S. 2021).

These consumers are more interested in the impact of food because they are younger than cluster 2, higher level of education and urban residence. They agree to pay a higher price than for non-traceable products and remain loyal even to a significant price increase.

Ungrouped consumers are represented by

34 people with an information level of 6.3% and a level of loyalty to FTP of 14.7%.

Applying the TwoStep Cluster analysis to the producers on the 9 characteristics resulting from the questionnaire allowed the construction of two good quality clusters (0.57) with the main predictors of importance: level of education, age, home environment and gender. The continuous variables were the quantities, the level of information, the level of fidelity.

Cluster 1 (fig. 2) for producers (61.1%) consisted of producers from rural areas ff. 85.9% (frequency) with secondary education (ff. 65.4%), men (ff. 62.7%); they have information on medium traceability (ff. 57.1%) and appreciate that their products are up to 10% more expensive under the conditions of implementing the traceability system (ff. 42.4%). This group was represented by 18 people with an FT information level of 21.5% and fidelity to FTP 6.8%. They believe that the provided information can reduce competitive advantage and increase taxation. The results are consistent with the research of Belanche A. et al. on small farmers, which prioritized the main challenges of the European agri-food industry: unfair trade, lack of traceability associated with poor farm training in business management, lack of professionalism, slow adoption of innovations, researchers who do not address real issues and society as a whole characterized by low education. (Belanche A., et al, 2021).

The producers in cluster 2 are represented by 11 people with an information level of 42.5% and fidelity to FTP 16.4%. Cluster 2, which has a share of 38.9% of the total subjects, was made up of producers from rural areas (ff. 56.2%) with secondary education (ff. 62.1%), women (ff. 61.1%), who have above average information about FT (ff. 72.9%) and consider that they are priced 20% higher than the price of non-traceable foods (ff. 37.2%). They consider that FT allows the legal assurance of its own activity, the reduction of risks in case of unwanted events (34.5%), believe that the production of FTP is related to social responsibility for the health of customers (10.5%) and can increase sales (22.5%). Among other things, they (11.1%) state that in the conditions of a low knowledge of FT by customers, the market advantages are negligible.

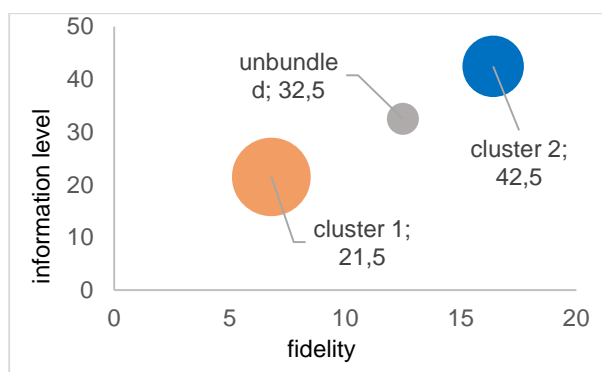


Figure 2 The knowledge degree and the loyalty of the producers grouped on clusters

We consider that the producers characterized by this cluster can represent support vectors of the traceability importance in Romania. These producers correlate consumer requirements for food safety with their own economic interests and take responsibility for the role of actors in traceable food chains. These results are consistent with the research of Hoorfar J et al. profiling producers concerned that food is not only safe, healthy and tasty but also sustainable, reducing its carbon footprint and taking animal welfare into account (Hoorfar J. *et al.*, 2011).

Non-grouped producers are represented by 3 people with an information level of 3.5% and a level of loyalty to FT of 12.5%.

The population outside the clusters is characterized by a significant diversity in terms of demographic profile, perception of prices and the marketing process. The limitations of this research lie in the difficulties in determining such a profile which is less developed and outlined but which could be properly defined in a larger research.

CONCLUSIONS

Consumer subjects ($n = 138$) were structured in: urban 41.2% and 58.8% rural; 48.5% women and 51.5% men; 33.0% aged 0-29 years, 41.3% aged 30-59 years and 25.5% over 60 years. studies: primary 31.8%, secondary 55.6%, higher 12.6%, incomes less than 2,000 lei (32.6%), 2,000 lei -4,000 lei (45.2%) and over 4,000 lei (22.2%).

The producing subjects ($n = 32$) had the profile: urban 42.8% and 51.2% rural; 48.6% women and 51.4% men; 33.4% aged 0-29 years, 41.3% aged 30-59 years and 25.3% over 60 years. education: primary 31.5%, secondary 56.2%, higher 12.3%.

Applying the TwoStep Cluster analysis to consumers on 11 characteristics allowed the construction of two clusters with important predictors: education level, age, home environment and gender. The continuous variables were the

level of information to FT and the level of loyalty to the acquisition of FTP.

Cluster 1 (40.6%) was formed primarily from rural areas, aged between 30 and 60 years; with secondary education, women who state that they are informed about the traceability process and have a very good state of health. They consider that FTs are 10% more expensive than non-traceable products, they are safer but, nevertheless, traceability is a formality.

Cluster 2 for consumers (34.8%) was made up of people from urban areas, with secondary education, men who say they are well informed about the concept of traceability, consider that they are in good health, get an income between 2,000 and 4,000 lei and estimates that the prices of these products are 20% higher than non-traceable ones. They are willing to buy even if the price increases by 20% and consider traceability to be an important tool for food security.

Applying the TwoStep Cluster analysis to producers on 9 characteristics allowed the construction of two clusters with the main predictors of importance: level of education, age, home environment and gender. The continuous variables were the amounts of the level of information on FT and the level of fidelity to FTP.

Cluster 1 for producers (61.1%) was made up of rural producers with secondary education who have information about FT at the intermediate level and appreciate that their products are up to 10% more expensive than non-traceable products. They believe that the information provided may reduce their competitive advantage as it becomes available to competitors. Those with household production activity do not have and do not agree with the implementation of a traceability system because it would increase the tax burden.

Cluster 2, which has a share of 38.9% of the total subjects, was made up of producers from rural areas, with secondary education, women who have above average information about FT and consider that they have a price 20% higher than the price of non-traceable foods. They consider that FT allows the legal assurance of own activity, the reduction of risks in case of undesirable events; FTP production is socially responsible for the health of customers and can lead to increased sales.

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