

Article

Food Origin Traceability from a Consumer's Perspective

Anna Walaszczyk * and Barbara Galińska

Faculty of Management and Production Engineering, Lodz University of Technology, 90-924 Lodz, Poland; barbara.galinska@p.lodz.pl

* Correspondence: anna.walaszczyk@p.lodz.pl

Received: 30 January 2020; Accepted: 28 February 2020; Published: 2 March 2020



Abstract: The awareness of food origin in the consumers' perspective has gradually become more significant not only in reference to consumers from highly developed countries but also from emerging ones, which are already on their way from a developing to developed economy. The purpose of the paper is to answer the research question by verifying four hypotheses formulated in the research process. The research question is: "Do the variables which characterize consumers of food products in Poland, including gender, age, education and financial status, affect the aspects related to food traceability, such as identification of the producer, importance of food product features when shopping, importance of the information given on food product packaging and influence of the shopping place and frequency on tracing the food origin?" The paper presents the results, analysis, and conclusions from the study in reference to the four assumed hypotheses related to the above-mentioned research question. The study was carried out on a group of 500 consumers of food products in Poland. The study topic selection is justified by the assumed significance of tracing back a food product's origin for a consumer who functions in a globalization-based economy; this was confirmed by the subject literature presented in the paper.

Keywords: traceability; food; consumer; consumption; behavior; security

1. Introduction

Food traceability, defined as the possibility to trace back the history of a food product, is a very important process from the point of view of ensuring food safety for consumers all over the world. The safety of produced food can be maintained only when full traceability of raw materials, semi-finished products, and processes are ensured on all stages of the food chain [1–5]. Adequate organization of the market of food products is difficult considering the size of the market and the strict legal requirements in force. Despite stringent control of the market by authorized control units, every week the Rapid Alert System for Food and Feed (RASFF) registers several dozen alerts in Europe, regarding food launched in the market that has been labeled dangerous for human life and health (RASFF was introduced by means of EC regulation No. 178/2002 of the European Parliament and the Council on 29 January 2002).

The literature on food safety presents different definitions of the term "traceability" [6]. The term originally appeared back in 1996 in the international ISO 8402 standard concerning quality management and quality assurance. According to the definition in the standard, traceability stands for the ability to trace the history, application, or location of a unit by way of an analysis of records allowing its identification [7]. The publication by Moe (1998) entitled "Perspectives on Traceability in Food Manufacture" contains a wider definition stating that traceability stands for the ability to trace a batch of products and its history throughout the entire production chain or part of it, from harvesting through to transport, storage, processing, distribution, and sales (this is known as the traceability chain) or internally—in a single step of the production chain (this is known as the internal traceability

chain) [8]. According to the Efficient Consumer Response (ECR) strategy enforced in 2004, the essence of traceability lies in the possibility of monitoring the handling and origin of a reference product (production batch) in each stage of the supply chain, by all companies in the food sector (ECR Europe 2004). The ECR integrates producers, suppliers, and sellers in the supply chain to build a cost-effective system which responds to specific needs of a consumer; consequently, the total cost of the system and stock level are reduced with a simultaneous increase in value for the end customer [9]. Identification is an intrinsic element of traceability, determining its success in relation to tracing the history of products [10]. Schwagele defines traceability through the concept of identification and states that identification enables the acquisition of data from a previous stage of the chain (what was received and from whom) and the provision of information for the following stage (what was sent and to whom) [11]. In the opinion of Rabade and Alfaro, traceability stands for the registration and tracing of processes and materials used in production [12]. A definition of the concept of traceability can also be found in the first international standard—ISO 22005 of 2007—applying to food safety management in the context of tracing its history. The standard contains the following definition: “traceability stands for the ability to trace the flow (movement) of feed or food through specific production stage(s), processing and distribution; movement can refer to the origin of materials (raw materials), history of processing and distribution of feed or food” [13,14].

Gradually more attention was paid to scientific research carried out not only in Europe but also globally on the consumers’ perception of food origin tracing. Recently such research was conducted in China [15], Japan [16], and Brazil [17]. The general conclusion from the research, which either applies to a particular country or compares the issue of consumers’ approach to food traceability in different countries [18], is that consumers want information regarding where a product comes from, what production methods were used, whether production was certified, and if information on the packaging is complete and reliable [19,20]. Consumers have become highly concerned about the safety of their food and so the speed of obtaining information about contamination and diseases transmitted by food, effective risk management, and efficient management of non-compliant products’ withdrawal from the market, have become more important [21]. Consumers’ concerns about food safety are also related to genetic modification of food [22]. In order to face the challenge of an increasingly demanding process of food product traceability, China uses extensive and advanced food origin tracing methods based on DNA [23], whereas in reference to food origin tracing management, an additional consumer fee, called WTP (Willingness To Pay), is used for information about the food [24].

Regulation No. 178/2002 issued in January 2002, sets out the general rules and requirements of food law; the establishment of the European Food Safety Authority and procedures concerning food safety are fundamental for the food laws of communities (including Poland, on which the research was based). Article 18 of the Regulation obliges all EU member states to establish and implement traceability procedures as of 1 January 2005. The core of traceability is in tracing the path of a finished product “forwards” and “backwards” [25]. Backward traceability helps to identify the cause and sources of a hazard (e.g., via data by the producer or number of product batches). Forward traceability involves withdrawing a finished product from the market owing to identification of the location where a non-compliant batch was delivered. The trade quality of products in Poland is supervised by two bodies: the Trade Inspectorate (retail) and the Inspectorate for Trade Quality of Agricultural and Food Products (producers). Moreover, in the food supply chain, there is no continuous exchange of information about the course of each measure taken by subsequent actors, which impairs the traceability of products. The growth of a company in the food sector and the adaptation of the internal and external traceability system to ensure food safety, are possible if the traceability system is treated as a subsystem whose presence is necessary to manage product quality [26,27]. This is because traceability is indispensable to ensuring the quality of production and the product itself [28].

This study’s research problem, formulated based on the subject literature review, is expressed as a research question, the answers to which are the paper’s objective. The research question is as follows: “Do the variables which characterize consumers of food products in Poland, including gender, age,

education and financial status, affect the aspects related to food traceability, such as identification of the producer, importance of food product features when shopping, importance of the information given on food product packaging and influence of the shopping place and frequency on tracing the food origin?".

The validity of the research issue to be verified is justified by the fact that under current globalization-based economic conditions, food origin is of paramount importance. Consumers in highly developed and developing countries have a wide variety of food product criteria (including origin) to choose from [29]. Observations of consumer behavior revealed that people want to know more about the food they buy. Knowledge of the food origin, and as a conscious choice in this respect, contributes to the consumer's self-assurance about food safety [30–33]. The issue of the requirements that particular consumer groups establish for particular food products is also very important for food producers and developers of production-related processes. Clients' requirements are the key requirements to be faced by producers because a consumer is the key stakeholder for a conscious producer [34].

In order to assign a quantitative dimension to the research issue, which can be confirmed by statistical indicators, four research hypotheses were formulated and verified in the study:

1. **H1.** *There is a relationship between the identified groups of consumers and the kind of food producer they choose, as regards market coverage.*
2. **H2.** *There are significant differences in the ranking of the validity of aspects taken into account when people from the identified consumer groups buy food.*
3. **H3.** *There are significant differences in the way that people from the identified consumer groups rank the validity of information on food packaging.*
4. **H4.** *There are significant differences in the way that people from the identified consumer groups rank the significance of a food product's origin.*

The presented hypotheses determined the use of the following study methods.

2. Materials and Methods

The study was carried out in the first half of 2017 in Poland on a population of 500 consumers. It was a pilot study in which 50% of the studied group of respondents were men and 50% were women. The integrity of the study sample was the only parameter of purposeful selection of the study subject matter. Other selection conditions of consumers participating in the study were randomized and comprised of:

- respondents in four age brackets (20–30 years, 31–40 years, 41–50 years, and over 60 years);
- four levels of education (primary or lower secondary education, vocational education, secondary education, and university education);
- size of private household in terms of number of persons included (1 person, 2 people, 3–4 people, more than 5 people);
- place of residence presented in four categories (countryside, city up to 50,000 people, city with 50,000–100,000 inhabitants, and city with a population above 100,000);
- per capita gross income in the household (up to 400 EUR, 401–600 EUR, 601–950 EUR, over 950 EUR).

Following a demographic analysis of the respondents taking part in the study, regarding their sex, age, education and income, some similarities and relationships were observed between the characteristics. An analysis of concentrations was performed in order to group the respondents

according to uniform or highly similar characteristics [35]. Grouping was intended to focus attention on the groups of consumers participating in the study, which could become representative groups from the point of view of the conclusions drawn from the study. A two-step concentration analysis was applied to divide the study participants into four groups. The Bayesian information criterion (BIC) was used to separate the subgroups, while the distance between the study participants was measured with a credibility logarithm. The two-step concentration analysis facilitated the identification of the following four groups; most homogeneous within a specific group and also most diversified as compared to other groups, based on such variables as sex, age, education, and income:

- men of all ages, with a secondary degree, medium income
- people aged 31–60, with a university degree, medium income
- women of all ages, with a secondary degree, medium income
- younger people (20–30 years old), with a university degree, medium and higher income.

Table 1 presents the quantitative characteristics of the identified groups.

Table 1. Profiles of the four identified groups of respondents.

		Concentration Number in Two-Step Grouping							
		1		2		3		4	
		<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Age	20–30	39	32.5			10	6.0	50	47.2
	31–40	11	9.2	3	2.9	45	26.8	40	37.7
	41–50	2	1.7	52	51.0	34	20.2	11	10.4
	51–60	24	20.0	21	20.6	49	29.2	5	4.7
	60+	44	36.7	26	25.5	30	17.9		
Sex	Male	120	100.0	85	83.3			43	40.6
	Female			17	16.7	168	100.0	63	59.4
Education	Primary/lower secondary			12	11.8				
	Vocational			36	35.3	39	23.2		
	Secondary	120	100.0	10	9.8	128	76.2		
	Tertiary			44	43.1	1	0.6	106	100.0
Income	401–600 EUR	6	5.0	2	2.0	6	3.6		
	601–950 EUR	83	69.2	98	96.1	136	81.0	54	50.9
	over 950 EUR	31	25.8	2	2.0	26	15.5	52	49.1

Source: data developed based on our own study.

A proprietary questionnaire consisting of eight main questions and six identification questions concerning sex, age, education, household size, and income of the respondents (based on the analysis of concentrations, household size and place of residence did not matter from the point of view of respondent grouping) was the study tool. Among the main questions there were six multiple-choice questions and two questions where one needed to assign rank on a 1–6 and 1–5 scale. "1" meant most important, and "5" or "6" least important. The ranked questions concerned those factors most important for consumers when they buy food. They involved such aspects as knowledge of the brands, guarantee of product quality and freshness, low price, best before date, product origin, and ingredients. Moreover, the questions touched upon information that in the consumers' opinions should be placed on food packaging (i.e., information about the producer, the product's energy value, best before date, detailed information about raw materials, and product ingredients).

Collection of empirical materials by means of an interview questionnaire developed by the authors was justified by the specificity of the research and the necessity to reach a wide range of respondents.

A focused group interview (i.e., a focus group), composed of representatives of academic staff and entrepreneurs was involved in the study in order to:

- use the opinions of the focus group members (as one of the factors) to formulate four study hypotheses (presented in the introduction of the paper) and to develop an interview questionnaire;
- extend the interpretation of the obtained results of the study.

The study used both direct tools (proprietary interviews) and indirect tools (e-mails and Google surveys). The data from the study were collected in an Excel spreadsheet and then summarized and analyzed quantitatively using Statistica (a statistical data-processing software). The following statistical measures were used to analyze the results of the study:

- Chi-squared test of cross tabulation;
- Cramer's V test, effect size;
- non-parametric Mann–Whitney U test;
- non-parametric Kruskal–Wallis test.

The majority of analyses in the study were based on data in the form of ranks or ordinal variables. Therefore, referring to the characteristics of each statistical measure, when testing hypotheses mentioning different distributions of ranks in different groups, the Kruskal–Wallis test was used. Pearson's Chi-squared test was used for verification of the presence of relationships between the variables according to the hypotheses. The following symbols were used for presenting the study results:

- M—arithmetic mean
- SD—standard deviation (the lower the value, the more focused the observations around M)
- MR—mean range (non-parametric equivalent of M)
- Mdn—median (value of a characteristic above and below which the number of observations N is the same)
- N—number of observations
- "p"—relevance, for the value <0.05 we have over 95% certainty that there is a relationship between classifications and the selected variable (i.e., that the observed relationship is not incidental)
- χ^2 —general statistics for the reference analysis, based on which "p" is calculated
- Cramer's r, V—effect size: it gives information about the size of the relationship between two variables (up to 0.30 the effect is assumed to be weak; between 0.30 and 0.50 the effect is assumed to be medium, while over 0.50 the effect is assumed to be strong)
- Z—general statistics for the reference analysis, based on which "p" and "r" are calculated.

3. Results of the Study

The first hypothesis assumed there would be a relationship between the identified consumer groups and the food producers they chose for their market coverage. An analysis performed with a Chi-squared test of cross tabulations revealed the presence of a strong relationship between the identified groups and their preferred producers. Details of the study results in this respect are presented in Table 2.

The second hypothesis assumed there would be significant differences in the ranking of the validity of aspects, which the representatives of the four identified groups of consumers took into account when buying food. Analysis using the Kruskal–Wallis test revealed that differences in the ranking of validity occurred in three (brand, best before date, and product ingredients) out of six analyzed aspects, which included brand, quality guarantee, price, best before date, origin, and ingredients. Details of the study results in this respect are presented in Table 3.

Table 2. First hypothesis results.

		Most often You Choose Producers among:				χ^2	<i>p</i>	Cramer's V	
		Global Market Leaders	Domestic Producers	Regional Producers	It does not Matter to Me				
Group number	1	N	51	52	10	20.78	<0.05	0.12	
		%	42.5%	43.3%	8.3%				5.8%
	2	N	49	50	1				2
		%	48.0%	49.0%	1.0%				2.0%
	3	N	65	82	19				2
		%	38.7%	48.8%	11.3%				1.2%
	4	N	51	42	12				1
		%	48.1%	39.6%	11.3%				0.9%

Source: data developed based on our own study.

Table 3. Second hypothesis results.

Question	Group Number	N	MR	M	Mdn	SD	χ^2	<i>p</i>	Significant Differences
How important is the brand?	1	120	221.52	2.50	3.00	1.34	12.56	<0.01	1 < 4
	2	102	245.48	2.72	3.00	1.22			
	3	168	248.51	2.76	3.00	1.26			
	4	106	281.93	3.07	3.00	1.17			
How important is the best before date?	1	120	282.14	2.47	2.00	1.66	11.74	<0.01	1 > 3; 1 > 4
	2	102	247.41	1.94	1.50	1.24			
	3	168	239.65	1.93	1.00	1.36			
	4	106	225.50	1.80	1.00	1.29			
How important are the ingredients?	1	120	208.39	3.88	4.00	1.01	13.47	<0.01	1 < 2; 1 < 3; 1 < 4
	2	102	260.32	4.34	4.00	1.25			
	3	168	262.68	4.38	4.00	1.30			
	4	106	260.06	4.38	4.00	1.32			

Source: data developed based on our own study. N, number of observations; MR, mean range; M, arithmetic range; Mdn, mean; SD, standard deviation.

The third hypothesis assumed there would be significant differences in the ranks assigned by the representatives of the identified consumer groups to the validity of information given on food packaging. A quantitative analysis revealed that the assumed differences did not actually occur. Details of the study results in this respect are presented in Table 4.

In the last (fourth) research hypothesis, it was assumed that significant differences existed in the ranks that the identified groups of consumers assigned to food product origin. The variables included the place of food purchase (Table 5) and the frequency of shopping (Table 6). The results of the performed analysis did not confirm the hypothesis.

Table 4. Third hypothesis results.

Questions	Group No.	N	MR	M	Mdn	SD	χ^2	<i>p</i>	Significant Differences
How important is information about the producer?	1	120	253.81	5.13	5.00	0.84	1.72	0.63	-
	2	102	243.72	5.06	5.00	0.87			
	3	168	240.32	5.04	5.00	0.83			
	4	106	260.06	5.16	5.00	0.86			
How important is information about the energy value?	1	120	251.33	2.29	2.00	0.46	2.47	0.48	-
	2	102	242.22	2.25	2.00	0.44			
	3	168	257.24	2.32	2.00	0.47			
	4	106	237.49	2.24	2.00	0.43			
How important is information about the best before date?	1	120	245.67	2.71	3.00	0.46	2.47	0.48	-
	2	102	254.78	2.75	3.00	0.44			
	3	168	239.76	2.68	3.00	0.47			
	4	106	259.51	2.76	3.00	0.43			
How important is information about the raw materials the product is made of?	1	120	242.48	5.00	5.00	0.77	1.11	0.77	-
	2	102	257.92	5.09	5.00	0.77			
	3	168	243.74	5.01	5.00	0.80			
	4	106	253.79	5.07	5.00	0.73			
How important is information about ingredients?	1	120	248.15	4.88	5.00	0.84	3.20	0.36	-
	2	102	245.35	4.85	5.00	0.80			
	3	168	261.22	4.95	5.00	0.82			
	4	106	231.77	4.77	5.00	0.81			

Source: data developed based on our own study.

Table 5. Product origin vs. place of purchase.

	Where do You Buy Food Most Often?	N	MR	M	Mdn	SD	χ^2	<i>p</i>
How important is product origin?	Supermarket	103	237.03	5.09	5.00	0.84	1.22	0.75
	Mini market	279	253.37	5.18	5.00	0.83		
	Grocer's	89	251.61	5.19	5.00	0.78		
	Marketplace	27	250.17	5.07	5.00	1.07		

Source: data developed based on our own study.

Table 6. Product origin vs. frequency of doing shopping.

	Frequency of Doing Shopping	N	MR	M	Mdn	SD	χ^2	<i>p</i>
How important is product origin?	Every day	55	251.27	5.16	5.00	0.83	1.37	0.71
	Several times a week	107	237.54	5.12	5.00	0.75		
	Once a week	318	254.39	5.18	5.00	0.84		
	Once or twice a month	20	255.83	5.05	5.00	1.19		

Source: data developed based on our own study.

4. Analysis of Results and Discussion

In reference to the four hypotheses made at the beginning of the study, only two were confirmed; there are relationships between the identified groups of consumers and the kind of producer they chose as regards market coverage (H1), and there are significant differences in the ranking of the validity

of aspects taken into account when representatives of the four identified groups of consumers buy food (H2).

As for the first hypothesis, women of all ages (no age diversification), with secondary education and medium income, were the ones who chose products from “global market leaders” least often (group 3). Global brand products were most often chosen by people aged 31–60, with higher education and medium income (group 2), and by younger people (aged 20–30) with higher education and medium or higher income (group 4). Consumers from group 2 tended to buy products from domestic producers as often as products from global market leaders, while regional producers were the least popular in the group. This can be justified by the maturity of this group of consumers, as exemplified by their age and education, and hence greater confidence in a producer operating on a global market and having a more extended control system of the food produced.

Confirmation of the second hypothesis reveals that males of any age, medium income, and secondary education (group 1) ranked the significance of a brand much lower than younger people (aged 20–30) with higher education, and medium and higher income (group 4). Additionally, the same men ranked the significance of the product ingredients lower than any other identified group. They considered the best before date as a much more important factor than people from group 3 (women of any age, secondary education, and medium income) and group 4 (younger people aged 20–30, higher education, of medium and higher income). From the point of view of the aim of the study, product ingredients form the most important aspect for food traceability. The study revealed that this mattered to all consumers participating in the study, but it was least important for men with secondary education and medium income. Such a result can be justified by the fact that medium income does not always give consumers the freedom to choose food with the ingredients they would prefer, and secondary education may be indicative of a lack of knowledge on how to analyze the ingredients of a food product correctly. In addition to the above, men typically pay less attention to more pragmatic issues, such as best before dates or prices, than the product’s composition/ingredients. The reasons for this behavior could form the subject of a sociological or psychological enquiry.

Two hypotheses were not confirmed in the course of the study. They included H3: there are important differences in the rank assigned by representatives of the identified consumer groups to the validity of information given on food packaging, and H4: there are significant differences in the rank assigned by the identified groups of consumers to the aspect of food product origin. Referring to H3, it should be pointed out that the identified groups of consumers were quite unanimous about the significance of information on the raw materials that the product is made of (which is a positive result from the point of view of the importance of traceability for consumers). The greatest discrepancies in answers were observed in relation to information about the product composition/ingredients (the greatest differences were observed between groups 3 and 4). It can be concluded that all studied information on food packaging, including identification of the producer, energy value of the product, best before date, raw materials used for production, and composition/ingredients are of equal importance for men and women, regardless of age, education, or income.

In reference to H4, assuming significant differences in the assessment of the validity of food origin, it turned out that differences in the answers given by different consumers were so small that they could be considered unanimous as for the significance of product origin vs. the following two variables: place of doing shopping and frequency of doing shopping. This suggests that food traceability is important for all study participants, regardless of the frequency or location of doing shopping.

Referring to the research question posed, the results of the study showed that the origin of food products mattered to consumers, regardless of the analyzed conditions. Differences in relation to the identified groups of consumers were noticeable in the following respect: some aspects of traceability were approached in a different way and have a different significance priority assigned to them. Perhaps it would be worth analyzing the issue of specific information that should—in the consumers’ opinion—be placed on food products and reviewing if the scope of data complies with the

current legal requirements. Identification of how far back the process of backward traceability of food should reach from the point of view of consumers could form an interesting focus for further studies.

5. Conclusions

The results of the study on food traceability from a consumer's perspective, carried out on a group of 500 randomly selected representatives in Poland and presented here, revealed that the issue of food traceability in Poland is important. This is evidenced by the fact that of all the aspects available in the study for selection, the one that consumers paid most attention to was food origin, while the presence of information about producers was considered necessary for food packaging.

Food traceability by consumers is an interesting and diversified phenomenon, which strongly affects the organization of a food chain. Consumer requirements are conditioned by organizational and management decisions by food suppliers on different levels of production, especially when their decisions apply to food safety. The research constraints, which could be used as an idea for subsequent consumer research related to food traceability include:

- a lack of comparison with other research results conducted worldwide, pertaining to similar research topics;
- a lack of initial in-depth verification of the knowledge of the traceability notion among the responders.

Author Contributions: Conceptualization, A.W. and B.G.; methodology, A.W.; software, A.W.; validation, A.W. and B.G.; formal analysis, A.W.; investigation, A.W.; resources, A.W. and B.G.; data curation, A.W.; writing—original draft preparation, A.W.; writing—review and editing, B.G.; visualization, A.W.; supervision, A.W. and B.G.; project administration, B.G.; funding acquisition, B.G.. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Conflicts of Interest: The authors declare no conflicts of interest.

References

1. Skilton, P.F.; Robinson, L.J. Traceability and normal accident theory: How does supply network complexity influence the traceability of adverse events? *J. Supply Chain Manag.* **2009**, *45*, 40–53. [CrossRef]
2. Adrian, A.M.; Norwood, S.H.; Mask, P.L. Producers' perceptions and attitudes toward precision agriculture technologies. *Comput. Electron. Agric.* **2005**, *48*, 256–271. [CrossRef]
3. Hoorfar, J.; Jordan, K.; Butler, F.; Prugger, R. *Food Chain Integrity: A Holistic Approach to Food Traceability, Safety, Quality and Authenticity*; Woodhead Publishing Limited: Sawston, UK; Cambridge, UK, 2011.
4. Bennet, G.S. *Food Identity Preservation and Traceability: Safer Grains*; CRC Press: Boca Raton, FL, USA, 2009.
5. Bosona, T.; Gebresenbet, G. Food traceability as an integral part of logistics management in food and agricultural supply chain. *Food Control* **2013**, *33*, 32–48. [CrossRef]
6. Olsen, P.; Borit, M. How to define traceability. *Trends Food Sci. Technol.* **2013**, *29*, 142–150. [CrossRef]
7. ISO 8402:1994—Quality Management and Quality Assurance—Vocabulary. British Standards Institution, London, 1994. Available online: <https://www.iso.org/standard/20115.html> (accessed on 20 March 2019).
8. Moe, T. Perspectives on traceability in food manufacture. *Trends Food Sci. Technol.* **1998**, *9*, 211–214. [CrossRef]
9. ECR Europe (Efficient Consumer Response). *Using Traceability in the Supply Chain to Meet Consumer Safety Expectations*. ECR Europe, 2004. Available online: <https://www.ecr-community.org/publications/> (accessed on 15 June 2015).
10. Beulens, A.J.M.; Broens, D.F.; Folstar, P.; Hofstede, G.J. Food safety and transparency in food chains and networks: Relationships and challenges. *Food Control* **2005**, *16*, 481–486. [CrossRef]
11. Schwagele, F. Traceability from a European Perspective. *Meat Sci.* **2005**, *71*, 164–173. [CrossRef] [PubMed]
12. Rabade, L.A.; Alfaro, J.A. Buyer-supplier relationship's influence on traceability implementation in the vegetable industry. *J. Purch. Supply Manag.* **2006**, *12*, 39–50. [CrossRef]

13. ISO 22005:2007—Traceability in the Feed and Food Chain—General Principles and Basic Requirements for System Design and Implementation. European Committee for Standardization, CEN 2007. Available online: <https://www.iso.org/standard/36297.html> (accessed on 29 February 2020).
14. Shengnan, S.; Xinping, W. Promoting traceability for food supply chain with certification. *J. Clean. Prod.* **2019**, *217*, 658–665.
15. Kendall, H.; Kuznesof, S.; Dean, M.; Chan, M.-Y.; Frewer, L. Chinese consumer’s attitudes, perceptions and behavioural responses towards food fraud. *Food Control* **2019**, *95*, 339–351. [[CrossRef](#)]
16. Jin, S.; Zhou, L. Consumer interest in information provided by food traceability systems in Japan. *Food Quality and Preference* **2014**, *36*, 144–152. [[CrossRef](#)]
17. Matzembacher, D.E.; Stangherlin, I.; Slongo, L.A.; Cataldi, R. An integration of traceability elements and their impact in consumer’s trust. *Food Control* **2018**, *92*, 420–429. [[CrossRef](#)]
18. Rijswijk, W.; Frewer, L.J.; Menozzi, D.; Faioli, G. Consumer perceptions of traceability: A cross-national comparison of the associated benefits. *Food Qual. Prefer.* **2008**, *19*, 452–464. [[CrossRef](#)]
19. Smith, I. *Meeting Customer Needs*; Routledge: London, UK, 2012.
20. Smith, I.; Furness, A. *Improving Traceability in Food Processing and Distribution*; Woodhead Publishing: Sawston, UK; Cambridge, UK, 2006.
21. Astill, J.; Dara, R.A.; Campbell, M.; Farber, J.M.; Yada, R.Y. Transparency in food supply chains: A review of enabling technology solutions. *Trends Food Sci. Technol.* **2019**, *91*, 240–247. [[CrossRef](#)]
22. Boccia, F.; Covino, D.; Sarnacchiaro, P. Genetically modified food versus knowledge and fear: A Noumenic approach for consumer behaviour. *Food Res. Int.* **2018**, *111*, 682–688. [[CrossRef](#)] [[PubMed](#)]
23. Zhao, J.; Xu, Z.; You, X.; Zhao, Y.; Yang, S. Genetic traceability practices in a large-size beef company in China. *Food Chem.* **2019**, *277*, 222–228. [[CrossRef](#)] [[PubMed](#)]
24. Liu, R.; Gao, Z.; Nayga, R.M.; Snell, H.A.; Ma, H. Consumers’valuation for food traceability in China: Does trust matter? *Food Policy* **2019**, *88*, 101768. [[CrossRef](#)]
25. Council of the European Union. *Regulation (EC) No. 178/2002 of the European Parliament and of the Council*; Council of the European Union: Brussels, Belgium, 2002.
26. Coff, C.; Barling, D.; Korthals, M.; Nielsen, T. *Ethical Traceability and Communicating Food*; Springer Science & Business Media: Dordrecht, The Netherlands, 2008; Volume 15, pp. 1–18.
27. Eckschmidt, T. *The Little Green Book of Food Traceability: Concepts and Challenges*; Booksurge Publishing: Charleston, SC, USA, 2009.
28. Bertolini, M.; Bevilacqua, M.; Massini, R. FMECA approach to product traceability in the food industry. *Food Control* **2006**, *17*, 137–145. [[CrossRef](#)]
29. Galińska, B. Changes in Supply Chains in the Light of Emerging Market Procurement. In Proceedings of the 19th International Scientific Conference Business Logistics in Modern Management (BLMM2019), Osijek, Croatia, 10–11 October 2019; pp. 533–545.
30. Wales, C.; Harvey, M.; Warde, A. Recuperating from BSE: The shifting UK institutional basis for trust in food. *Appetite* **2006**, *47*, 187–195. [[CrossRef](#)] [[PubMed](#)]
31. Montserrat, E.; Santaclara, F.J. *Advances in Food Traceability Techniques and Technologies: Improving Quality Throughout the Food Chain*; Woodhead Publishing Limited: Sawston, UK; Cambridge, UK, 2016.
32. Resende-Filho, M.A.; Terrance, M. Hurley, Information asymmetry and traceability incentives for food safety. *Int. J. Prod. Econ.* **2012**, *139*, 596–603.
33. Lees, M. *Food Authenticity and Traceability*; Woodhead Published Limited: Sawston, UK; Cambridge, UK, 2003.
34. ISO 9001:2015—Quality Management System. Requirements. ISO 2015. Available online: <https://www.iso.org/standard/62085.html> (accessed on 29 February 2020).
35. Everitt, B.S.; Landau, S.; Leese, M. *Cluster Analysis*; Oxford University Press: New York, NY, USA, 2001.

