

# Consumer Trust in Food Safety Requires Information Transparency

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## Abstract

This paper proposes a conceptual model to understand how information transparency matters can support consumer trust in food safety. Beside food labels, food product information can be disseminated by the support of technologies including traceability systems and social media. This article studies extant literature to provide a knowledge base for the development of a conceptual model. Information provided by traceability systems is deemed to increase a consumer's knowledge of a food product. Furthermore, social media is considered as a well-informed source that provides some useful information to consumers. Therefore, we argue that technology-supported information supports and enhances the information consumers need to make their own judgement about the safety of a food product. Three testable propositions are developed from a conceptual model that provides insights into food information that consumers find helpful for developing trust in food safety.

**Keywords:** Tracing systems, social media, consumer trust.

## 1 Introduction

Is information along food supply chain from farm to fork beneficial in increasing consumer trust in food safety? This question is posed when scandalous food safety issues are reported and cause public concern (Marucheck, Greis, Mena, & Cai, 2011). The association between risk management of the food supply chain and food safety has received scholars' attention (De Boeck, Jacxsens, Bollaerts, Uyttendaele, & Vlerick, 2016; H. L. Lee & Whang, 2005; Marucheck et al., 2011; Pyke & Tang, 2010; Tang, 2008). Disruptions to the food supply chain can threaten food safety especially where food safety incidents are vulnerable to a global supply chain (Narasimhan & Talluri, 2009). The provision of sufficient food product information on the labels and the production process is all related to perceived product safety (Marucheck et al., 2011). Therefore, legislated standards, quality management, and tracking management are helpful for tackling product safety issues as well as reducing negative consequences to consumers (Marucheck et al., 2011).

Indeed, food safety scandals have occurred and reoccurred regularly across countries and local areas in the world. Table 1 shows some serious food safety incidents occurring between 1996 and 2014.

Food safety incident	Country / Area	Year	The relevance of the examples of food safety scandals and information transparency	Supporting literature
Mad cow disease	Britain	1996	Infected meat and bonemeal were used to feed cattle. Therefore, the governments have required producers to use traceability systems in order to ameliorate monitoring process and manage information sources.	Berg, (2004)
Commercial feed contained high concentrations of the toxic chemical Dioxin	Germany	2010	Toxic animal feed was used to feed livestock and poultry. Hence, consumers require additional product-related information before food purchase.	Rieger, Kuhlitz, & Anders, (2016)
Phthalate-tainted food scandal	Taiwan	2011	Phthalates were purposefully added to several kinds of food in Taiwan. Therefore, Taiwan Food and Drug Administration has required relevant food producers to set up their own traceability systems for monitoring process.	Tsai et al., (2016)
Using expired meat	China	2014	Stinky and expired meat was mixed with non-expired meat. Hence, production records are useful for regaining consumer trust.	Xie & Yao, (2016)
Waste oil, recycled oil, and feed oil scandal	Taiwan	2014	Contaminated cooking oil was intentionally labelled as high-quality cooking oil. Therefore, Taiwan Food and Drug Administration has regulated the use of food traceability systems to collect information regarding ingredients and materials.	Ko, (2015)

*Table 1 Some Serious Food Safety Incidents*

In September, 2018, the strawberry needle tampering crisis occurred in Australia when needles were found inside punnets of strawberries (Wikipedia, 2019). The source of the contaminated strawberries was unknown. Supermarkets and distributors across Australia and New Zealand had to dump strawberries because supermarkets and distributors would not accept the risk that the strawberries may contain needles. Many farmers went out of business as a result of this product recall and strawberries were withheld from sale for several weeks during the investigation. The strawberry scandal badly damaged the 160-million dollar strawberry industry in Australia as well as the Australian strawberry export business (Bavas, 2018). Food Standards Australia New Zealand has proposed the use of traceability systems along the supply chain to communicate food product information to the public through social media (The Food Standards Australia New Zealand, 2018) in an effort to restore consumer trust in food products. As a result of these instances, it is debatable whether information retrieved from food traceability systems and online social networking websites is enough to restore consumer trust.

Because many food consumers rely on detailed food information to make food choices (Chen, 2011), providing food product information from the food supply chain can enhance consumers' perspectives on food quality and safety (Lehmann et al., 2011). Traceability systems enable consumers to trace back food product information from raw materials to final products (Australia New Zealand Food Authority, 2017). We pose the first question that is: "How does food product-related information provided by food traceability systems influence consumer trust intentions?" Trust intention refers to a person's willingness to count on something or someone (Morgan & Hunt, 1994). Online social networking communication about food safety issues between food consumers is also influential in shaping consumer trust (Mou & Lin, 2014), so, we raise the second question that is: "How does online social networking food product-related information influence consumer trust intentions?" This paper continues the studies on the major elements that affect consumer trust in food safety by assimilating the extant information systems management and consumer behaviour literature paradigm.

This paper includes the study into previous literature about food safety, traceability systems, online social networking information, and consumer trust. Social Cognitive Theory (SCT) is employed in developing the conceptual model. The rationale is that when consumers obtain knowledge about food products through traceability systems and social media, their levels of trust in the safety of a food product will change accordingly. Finally, theoretical and practical implications are discussed in last section.

## **2 Literature Review**

### **2.1 Previous Literature**

In relation to food safety management, information systems refer to data collection, storage, assessment and retrieval (McMeekin et al., 2006). Information systems influence and frame the way users make decisions about the safety of food (McMeekin et al., 2006). A Hazard Analysis of Critical Control Points (HACCP) is an organised and well accepted approach that carefully documents all information and actions on food processing and operations necessary for a food safety evaluation (McMeekin et al., 2006). Information systems can facilitate the collection and documentation of HACCP initiatives. Szymanska (2015) also suggested that electronic information systems were a tool supporting food processing at all stages of formation and supervision. The computer-based tool provides information about farmers and food producers to customers and shows a product's origin and composition (Szymanska, 2015). Thus food safety management systems (FSMSs) instruments, that provide food producers with information via reports of authentication and corroboration, have been developed (Kirezieva, Jacxsens, Uyttendaele, Van Boekel, & Luning, 2013).

FSMSs provide accountability for both the origin of food and transparency in its processing (Motarjemi & Mortimore, 2005). Food safety management and the control of risks should be approached proactively through efficient FSMSs (Zwietering, Jacxsens, Membré, Nauta, & Peterz, 2016). Swoffer (2009) indicated that food safety management included raw materials management, usage delineation, and the scrutiny of final products. However, product safety has been perceived as also resulting from technical issues such as risks from flawed operational processes that may cause negative consequences for internal and external stakeholders (Lewis, 2003) – Table 2 details stakeholders in the food processing and supply chain.

Stakeholders	Role	Information relevant to food processing and supply chain	Supporting literature
Food producers	Ensuring consumers that food is safe	Information about food processing and its supply chain	Motarjemi & Mortimore, (2005); Govindan, (2018)
Consumers bodies or organisations	Providing guidance	Information about guidance on food safety	Motarjemi & Mortimore, (2005); Govindan, (2018)
Governments	Formulating, implementing and administering policies on food safety	Information about the occurrence of any foodborne illness and other food safety issues	Motarjemi & Mortimore, (2005); Govindan, (2018)
Governments	Communicating and educating	Information on up-to-date foodborne issues via mass media and on the Internet	Motarjemi & Mortimore, (2005); Govindan, (2018)
Various middlemen including distributors, wholesalers and retailers	Coordinating with manufacturers and consumers	Information about actions such as distribution and storage	Motarjemi & Mortimore, (2005); Manders, Caniëls, & Ghijzen, (2016)
Consumers	Consuming food products	Information concerning blame and/or experience	Barbarossa, De Pelsmacker, Moons, & Marcati, (2016); Manning (2015)
Consumers		Information about discussions on food safety and risk issues	Mou & Lin, (2014); Wu (2015)

*Table 2 The Extant Literature on Stakeholders in the Food Processing and Supply Chain*

From a safety perspective, food safety has causal relationships with food supply chains that typically have numerous vulnerabilities, e.g. warehouse and transportation management (Whipple, Voss, & Closs, 2009). As a result, the analysis of information concerning FSMSs in a produce chain is likely to provide insights about quality assurance, and elicit appropriate responses to product safety concerns (Kirezieva et al., 2013). The fundamental component of FSMSs is a traceable system that collects information about all activities involved in the production and distribution of a food product.

## **2.2 Traceability Systems and Trust**

Traceability systems refer to techniques for identification, provision, collection, storage and corroboration of data (Starbird & Amanor-boadu, 2006). Traceability systems integrate information about product supply, transactions and logistics with the support of technical components such as database, information carriers, information systems and methods of information provision (Engelseth, 2009). Due to globalisation, food supply chains necessitate traceability systems to help ensure safety and identify failures in food processing. As a result, many countries have imposed a requirement for traceability systems (King et al., 2017). Food traceability systems require producers to properly record information regarding manufacture and distribution in order for consumers to trace back the production processes and supply chain of ingredients (K. Zhang, Chai, Yang, & Weng, 2011). The recorded information consists of cultivation processes, source of origin, chemicals used, and other inputs to the production process and supply chain (Choe, Park, Chung, & Moon, 2009; Hall, 2010; Liao, Chang, & Chang, 2011).

The benefits of traceability include ensuring the safety and quality of products (Mattevi & Jones, 2016), and ameliorating food supply chain performance by monitoring information about potential vulnerability (Wang & Huang, 2010). Traceability systems can help diagnose problems and provide information about suppliers to competent authorities and customers (McMeekin et al., 2006). In addition, traceability systems assist in tracking potentially unsafe products in order to take timely preventative and corrective actions (Jansen-Vullers, Van Dorp, & Beulens, 2003).

Therefore, traceability systems help reduce information asymmetry between producers and consumers as well as supporting their purchase decisions (Chen & Huang, 2013) because information asymmetry increases consumers' perceived risk (Yoo, Parameswaran, & Kishore, 2015). Information provided by traceability systems throughout the food processing and supply chain can be disclosed to stakeholders by mobile applications (Cagliano, De Marco, & Rafele, 2017). As a result, information transparency through providing timely and reliable information impacts consumers' perceived knowledge of a food product (Li, Liu, Liu, Lai, & Xu, 2017). When information provided by traceability systems increases consumers' knowledge about the safety of a food product it either aids in restoring consumer trust in the food product if the information is positive (Bánáti, 2014), or else decreases trust in the food product. The retention of transparency in a food chain enhances consumers' confidence in food safety (Chiu, 2016).

### **2.3 Food Product Communication and Online Social Networking**

Yiannas (2009) recommended the use of multiple forms of media for communicating food safety information such as leaflets, videos and websites. A variety of information sources exert a positive and significant influence on consumer trust (Liu, Pieniak, & Verbeke, 2014). Consumers' trust in food information communicated by public organisations is greater than by private associations (Nocella, Romano, & Stefani, 2014). For example, L. Zhang, Xu, Oosterveer, and Mol (2016) found that government was the most trustworthy source of information concerning food safety, compared to private certification schemes, e.g. the Safe Quality Food (SQF) Program, a civil-society organisation. In addition, promotional materials related to food safety and health risks increase consumers' awareness of food safety issues (Verçuni et al., 2016).

Online social networking websites have provided users with a unique platform for sharing and discussing food safety information (Mou & Lin, 2014). Online social networking (OSN) refers to social interactions between individuals about their everyday experiences by providing a venue with appropriate online tools (Merchant, 2012). According to Wu's (2015) findings, social media users having positive emotions and concerns about food safety issues tend to search for food safety information and learn from others. The use of social networking websites for risk consultation pertinent to food safety issues is influenced by risk awareness, sentiment, social trust, and social assistance factors (Wu, 2015). As such, information and discussions about food products and food safety matters between consumers through social media help to develop trust intentions in food products.

### **2.4 Consumer Trust**

From social theory perspective, the underlying assumption of trust is the belief of a trustor (e.g. food consumers) in a trustee (e.g. food producers) who has competence in satisfying a trustor's requirements honestly in a given context (Grandison & Sloman, 2003). According to

Chen (2008), actors in a food system, monitoring bodies, and truth telling are determinants in consumer trust in food safety. De Jonge, Van Trijp, Renes, and Frewer (2010) found that optimism and pessimism about food safety were strongly related to trust in food manufacturers. A recent study also shows that perceived country of origin is positively associated with consumers' perception of the reliability and controllability of food incidents, thus lessening consumers' ascription of untrustworthy brands (Barbarossa et al., 2016). Another approach developed by Lassoued and Hobbs (2015) indicates that consumers' perceived brand competence is positively associated with brand trust, i.e. confidence in the safety and quality of food products. A summary of the existing literature on consumer trust in food safety is in Table 3.

Theory & Literature	Independent Variable(s)	Dependent Variable(s)	Supporting Literature
From culture perspective	1. Actors in a food system 2. Monitoring bodies 3. Truth telling	Consumers' trust in food safety	Chen, (2008)
Consumer confidence in the safety of food	Trust in food manufacturers	Optimism and pessimism about food safety	De Jonge et al., (2010)
The combination of attribution theory, country of origin, and national stereotypes frameworks	Perceived country of origin	Consumers' attributions of blame	Barbarossa et al., (2016)
Perceived brand competence	Perceived brand competence for quality and safety in food	Brand trust	Lassoued & Hobbs, (2015)

*Table 3 The Extant Literature on Consumer Trust in Food Safety*

Table 3 illustrates that consumer trust in food safety has been subject to different approaches including national culture and marketing perspectives. However, the concept of trust is multi-dimensional, and providing truthful information is generally regarded as a prominent characteristic of trust (Frewer, Howard, Hedderley, & Shepherd, 1996).

## 2.5 An Extended Search from International Peer-reviewed Journals

This study adopted a systematic review strategy that synthesised the extant literature and provided a scholarly critique of current literature (Kekäle, de Weerd-Nederhof, Cervai, & Borelli, 2009). The above supporting literature about consumer trust is from the international peer-reviewed journals of *Risk Analysis*, *Food Quality and Preference*, and *Food Policy*. According to the SCImago Journal and Country Rank portal, *Risk Analysis* has h-index 105 and is ranked Q1 in Safety, Risk, Reliability and Quality. *Food Quality and Preference* has h-index 89 and is ranked Q1 in Food Science. *Food Policy* has h-index 76 and is ranked Q1 in Development and Food Science. The h-index articulates the number of articles (h) in one journal that has at least h citations. It indicates journal scientific productivity and impact (please see h-index Wikipedia definition). Quartile 1 (Q1) is the quarter of the journals with the highest values. Journals in Q1 are cited much more and by more high-ranked journals than those in other quartiles.

To ensure that all relevant high-quality research forms the foundation of this research project, an extended search was conducted on three journals: *Risk Analysis*, *Food Quality and Preference*,

and *Food Policy*. Those journals are peer-reviewed, scholarly journals with English, and full text articles. Figure 1 outlines the screening process undertaken for identifying articles relevant to this research topic.

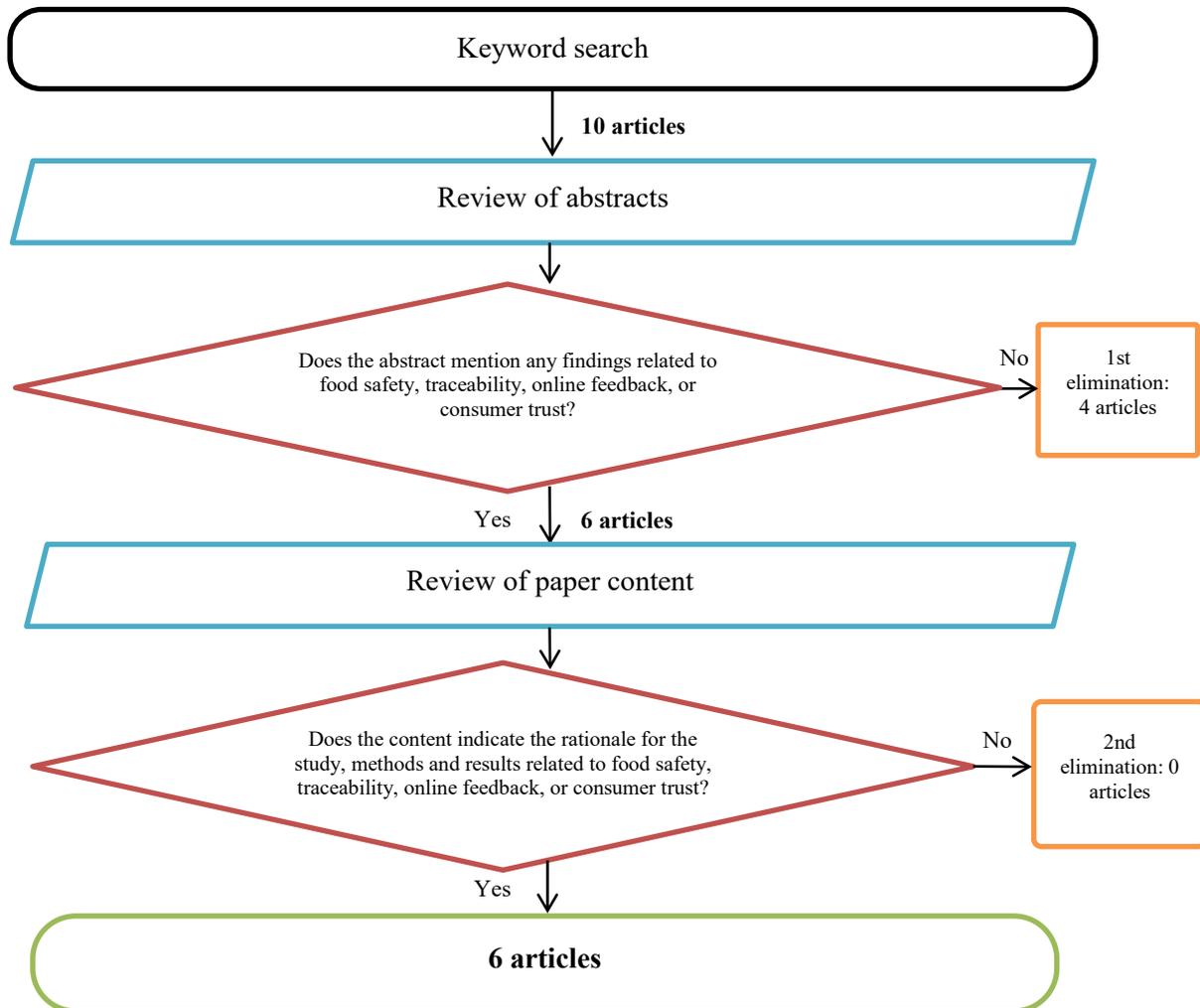


Figure 1. The Screening Process

The outcomes of the extended search for relevant articles is presented in Table 4.

	Journal	Keyword search	The number of articles	The number of articles after reading abstract	The number of articles after reading content
1	<i>Risk Analysis</i>	Trust food information risk traceability systems online feedback	0	-	-
		Trust food information risk	2	1	1
2	<i>Food Quality and Preference</i>	Trust food information risk traceability systems online feedback	3	2	2
3	<i>Food Policy</i>	Trust food information risk traceability systems online feedback	5	3	3
	<b>Total</b>		<b>10</b>	<b>6</b>	<b>6</b>

Table 4 The Outcomes of Extended Search for Relevant Articles

The rationale for the study, “What determines trust in information about food-related risks? underlying psychological constructs” (Frewer et al., 1996), is that the reliability of information sources is the major dimension in establishing trust. That is, communicator’s competence and trustworthiness (McGuire, 1985). Methods: First, a semi-structured interview was used for obtaining basic constructs forming trust or mistrust in a variety of sources revealing food risk information (n = 35). Second, the repertory grid interviewing technique was used to obtain information about terminology provided by respondents when they mentioned food information sources (n = 39). Finally, a survey was carried out to validate the constructs (n = 888). Factor analysis suggests that well-researched information sources are trusted, and distorted/wrong/biased information sources are discredited. In addition, the results show that information provided by trustworthy groups should be understandable. When one information source interacts with other trustworthy sources, it will increase trust in the public arena.

The rationale for the study, “Preferred information strategies for food allergic consumers. A study in Germany, Greece, and The Netherlands” (Voordouw et al., 2011), is that information and communication technologies (ICT) are likely to ameliorate information supply for food allergic consumers (Cornelisse-Vermaat, Voordouw, Yiakoumaki, Theodoridis, & Frewer, 2008). An ICT tool is able to provide food allergic consumers with product-related information flexibly and personally (Hu, Grbich, & Kemp, 2007). Methods: An online survey was carried out to collect respondents’ preferences in terms of three information delivery tools including food label, booklet and an ICT application (n = 287 participants including 55 in Germany, 65 in Greece, and 167 in the Netherlands). Conjoint analyses were conducted. The findings indicate that an ICT tool is not able to replace food labels as a food-related information source, but is considered as a complimentary tool to supply food product information. Specifically, an ICT scanner is helpful in showing all ingredients in detail, including audio and visual notifications, and glossary explanation.

The rationale for the study, “Optimising the delivery of food allergy information. An assessment of food allergic consumer preferences for different information delivery formats”

(Voordouw et al., 2012), is that confidence in truthful food-related information is important to the public (Frewer et al., 1996). Confidence is defined as consumer trust in food product's safety to a certain degree (De Jonge, van Trijp, van der Lans, Renes, & Frewer, 2008). Consumer assessment of product quality is based on information or declarations before consumption. There are other findings showing that to some extent an Information Communication Technologies (ICT) application to deliver product-related information is useful to help determine an individual's purchase-making decision (Best, 2009). Methods: An online self-reported questionnaire survey was conducted by food allergic consumers in the Netherlands, and Germany (n = 62 participants including 24 in Germany, and 38 in the Netherlands) to assess their preferences for different types of information delivery tools. The results demonstrate that food labels provide the highest perceived functionality. An electronic scanner for food traceability was perceived as the second most functional tool used for information delivery. The least preferred information delivery tool was a booklet provided by a 3rd-party following European Union legislation. Consumers appreciate obvious and unambiguous information on food labels, and detailed, informative information provided by an ICT scanner to enhance consumer trust in food products. The findings suggest that the functionality of food labels, electronic scanners, and booklets help determine consumers' preferences rather than the reliability of information provided.

The rationale for the study, "Social media as a useful tool in food risk and benefit communication? A strategic orientation approach" (Rutsaert et al., 2014), is that communication is supposed to build trust, achieve consensus, build awareness, provide somebody with education that influences one's perception, attitude, and belief and/or changes one's behaviour (McGloin, Delaney, Hudson, & Wall, 2009). Social media is applicable to communicate food risk and benefit with the audience, as well as interact with the public (Rutsaert et al., 2013). Methods: First, in-depth interviews, regarding the potential of social media use for food risk and benefit communication, were conducted with media representatives, food producers and retailers (n = 38), along with regulatory authorities and scientific professionals (n = 33) in Belgium, Ireland, Italy, Latvia, Spain and The Netherlands. Second, participants (10 food chain stakeholders and 13 experts) were subject to an in-depth interview stage to give scores for strengths, weaknesses, opportunities and threats of social media in communicating food risk and benefit. The results confirm that social media has the potential for communicating food risk and benefit. The advantages of social media are accessibility, rapidity and interaction. On the other hand, the disadvantages of social media are not having an information filter, the credibility of information supply, and information overload.

The rationale for the study, "Food and nutrition labelling in Thailand: a long march from subsistence producers to international traders" (Rimpeekool et al., 2015), is that food labels provide consumers with information about safety (Marks, 1984) and nutrition (Taylor & Wilkening, 2008a, 2008b). Methods: Legal documents about food labelling in Thai were collected from the Royal Thai Government Gazette e-database. Next, Thai document collections was extended to the Thai Food and Drug Administration (Thai FDA) e-library to search for published articles. Finally, English documents were searched in international databases including ScienceDirect, Medline, and Scopus. All data collected was categorised into six sections: (1) Thai food industry and legal provisions, (2) early stage of food labelling, (3) contemporary food labelling, (4) nutrition labelling, (5) the challenges of Thai nutrition labelling, and (6) international tensions. The results show that the international Codex

Alimentarius guidelines underlie Thai nutrition label policy. A shift in Thai food label policy has come along with economic development and social change. International trading policies have constrained Thai food and nutrition label regulations and the government is giving priority to international “fair trade” in its regulations. However, the positive impact of guidelines on food labelling regarding dietary behaviour and consumers’ health has remains elusive.

The rationale for the study, “Citizens, consumers and farm animal welfare: A meta-analysis of willingness-to-pay studies” (Clark, Stewart, Panzone, Kyriazakis, & Frewer, 2017), is that the public are interested in information about the food chain of specific food products (Jensen, 2006). Therefore, farm animal welfare (FAW) policies are needed and preferred by the public (Bennett, Butterworth, Jones, Kehlbacher, & Tranter, 2012; Farm Animal Welfare Committee, 2014). As the public drive demand for FAW standards, consumer willingness-to-pay (WTP) is proposed as a proxy for consumers’ attitude that is assessed (Ryan & Spash, 2011). In addition, WTP is an indicator of public preferences (Harvey & Hubbard, 2013) for different FAW standards. WTP refers to price premium/maximum price that a consumer is willing to pay (Breidert, Hahsler, & Reutterer, 2006; Hanley, Shogren, & White, 2001) to avoid any other risk. Methods: Relevant articles about WTP for FAW and animal production diseases were searched on multiple databases. There were 54 congruous articles after the screening process. Finally, a random effects meta-analysis and cumulative meta-analysis were conducted to investigate heterogeneity and explore changes in WTP chronologically. The results demonstrate that a small, positive WTP for FAW standards diverging in relation to animal type and region. Socio-demographic characteristics (age, income, gender and education) account for substantial variation in WTP. An amalgamation of market-based and government-based policy solutions is considered as the most effective solution for enhancing FAW standards. Because only 4 studies of the 54 examine specific production diseases in relation to reduced WTP, the evidence is not strong enough to conclude that consumers are willing to pay for higher FAW products.

Overall, information sources and communication tools have potential for affecting consumer trust (Frewer et al., 1996; Rutsaert et al., 2014). Consumers prefer food labels to electronic scanners and booklets for obtaining food-product-related information (Voordouw et al., 2012, 2011). International standards and guidelines are applied to national food labelling regulations (Rimpeekool et al., 2015). Animal type and region are associated with consumers’ positive willingness-to-pay for farm-animal-welfare-standardised products (Clark et al., 2017). However, almost most of those articles are exploratory studies. The authors have not applied any theories to explain the causal relationships between constructs. In particular, the authors have not challenged current theories about consumer trust in food safety from the perspective of information systems management and consumer behaviour. Judgements about the articles are made as follows.

	<b>Article</b>	<b>Judgement</b>
1	What Determines Trust in Information About Food-Related Risks? Underlying Psychological Constructs" (Frewer et al., 1996)	Information sources are associated with consumer trust. Semi-structured in-depth interviews were used to obtain individuals' perspectives. After describing individual perspective by interviews, a questionnaire survey was used to describe the population's characteristics by factor analysis. This study finds that well-researched information sources and multi-trustworthy sources are in association with consumer trust. However, the study has not indicated what food-product information concerns consumers most and whether causal relationships exist between information sources and consumer trust.
2	"Preferred information strategies for food allergic consumers. A study in Germany, Greece, and The Netherlands" (Voordouw et al., 2011)	ICT is believed to improve information provision for food allergic consumers. The overall ratings show that food labels are preferred as the main tool for information provision; ICT is preferred as an additional tool providing users with detailed information, audio and visual warnings, and glossary elaboration. The study corroborates that an ICT scanner is the second tool used by consumers. The study also explains why consumers use ICT scanners as a complimentary tool. Nevertheless, plenty of food-processing and supply-chain-related information provided by ICT such as traceability systems has not been examined in this study.
3	"Optimising the delivery of food allergy information. An assessment of food allergic consumer preferences for different information delivery formats" (Voordouw et al., 2012)	Information about food products is linked to individuals' perspective on food safety. Descriptive statistics identify that food labels are the most preferred; secondly, electronic scanners are preferred; and finally booklets are preferred the least. A food label is preferred because it provides direct and basic food product information. Electronic scanners are appreciated because they provide detailed and additional food product information. Booklets provide general and explanatory food product information. The study identifies food allergic consumers' preferences between three types of information delivery tools. However, the relationship between food-product-related information delivery tools and consumer trust has not been showed.

	Article	Judgement
4	"Social media as a useful tool in food risk and benefit communication? A strategic orientation approach" (Rutsaert et al., 2014)	Communication relates to building trust that impacts consumer's attitude and behaviour. Social media is deemed an effective communication tool that conveys food risks and benefits to the public. In-depth interviews were conducted, and scores were given for strengths, weaknesses, opportunities and threats of social media. The study points out some advantages and disadvantages of using social media for communicating food risk and benefit. Nonetheless, consumers' perceptions of food-product-related information on social media and the influence of social media communication on consumer trust have not been adequately examined.
5	"Food and nutrition labelling in Thailand: A long march from subsistence producers to international traders" (Rimpeekool et al., 2015)	Food labels are regulated to provide food product information about safety and nutrition to consumers. Textual analysis of legal documents and published articles was undertaken. The findings confirm that Thai food label policy complies with the international Codex Alimentarius guidelines. However, the causal relationships between food information and consumer trust have not been examined in the study.
6	"Citizens, consumers and farm animal welfare: A meta-analysis of willingness-to-pay studies" (Clark et al., 2017)	The public is concerned about information on the food supply chain and farm animal welfare. Consumers are willing to pay for food products that follow FAW standards. Meta-analysis is used to identify random effects. The study demonstrates that animal type and region are related to small, positive willingness-to-pay. Although willingness-to-pay is a proxy for consumers' attitude and preferences for farm-animal-welfare-standardised products, other important elements such as perceived food supply chain information concerning farm animal welfare, and the reliability of the food production process from farm to fork have not been investigated in this study.

Table 5 Judgements about the Articles

## 2.6 An Extended Search on Scopus Database

After the search in 3 journals with 6 relevant articles, an extended search on a broader set of journals on Scopus database was conducted. Scopus database is the largest abstract database of peer-reviewed scientific journals, books and conference proceedings (Elsevier, 2018). Scopus distributes the most complete overview of the world's research output including science, technology, medicine, social sciences and arts and humanities. The Scopus database contains of over 71 million records, over 23,700 peer-reviewed journals, and over 8.3 million Conference papers (Elsevier, 2018). The outcomes of the extended search for relevant articles on the Scopus database and screening process are showed in Table 6. Based on a keyword search, there are 11 relevant articles. After the screening process, there remains one peer-reviewed article that is pertinent to business, management and accounting.

	Keyword search	The number of articles	The number of articles after reading abstract	The number of articles after reading content
1	Keyword: Trust food information risk traceability systems online feedback	0	-	-
2	Keyword: Trust food information transparency risk	11	-	-
	<b>Screening process</b>			
3	Subject area: Business, Management and Accounting (categorised by Scopus)	2	-	-
4	Document type: Peer-reviewed articles (categorised by Scopus)	1	1	1
	<b>Total</b>	<b>1</b>	<b>1</b>	<b>1</b>

Table 6 The Screening Process and The Outcomes of Extended Search on Scopus Database

The rationale for the study, “Nanotechnology: Legal and ethical issues” (Baran, 2016), is based on the use of nanotechnology in the food industry (Matsuura, 2006). To ensure that nanofood is safe for consumption, there need officially authorised guidelines and explanations issued by experts and authorities (Brazell, 2012). The purpose is to legislate and protect consumers. Moreover, ethical aspects should be considered in nanofood (Sandler, 2009). The author wrote a conceptual paper by providing the arguments about nanotechnology regulation, potential risks, and standards of conduct. The article indicates some problems with consumer trust, potential risks, environmental impact, and information transparency before applying nanotechnology to foodstuffs. Judgement: The article has pointed out that consumer trust, risks, and information transparency play a key role in nanofood acceptance. However, the article did not mention any theory and framework to examine the influence of information transparency on consumer trust.

### 3 Conceptual Development

Food product-related information comes from a wide variety of sources and channels, especially with the support of the Internet and social media. This article aims to develop a conceptual model to predict cognitive perceptions which follow the associations between individual perceived knowledge, social information, and attitude intentions via Social Cognitive Theory (SCT). SCT focuses on cognitive factors (knowledge about a particular fact gained by each individual), environmental elements (facilities and tools designed for a person’s eagerness for certain behaviours), and behavioural capabilities (a person’s behaviour shaped by their beliefs, attitudes, and perception) that influence each other (Bandura, 1986). SCT suggests that personal perceived behaviour (intentions), beliefs (perceive knowledge) and facilities (social information) have interactive associations.

Based on an SCT perspective, perceived knowledge of food product provided by food traceability systems, food product-related discussion facilitated by social media, and consumer trust intentions interact with each other. A conceptual model is proposed as follows, which focuses on the use of traceability systems and OSN food product-related information

that support consumers' trust intentions in food safety. The following subsections will refer to the derivations of the propositions.

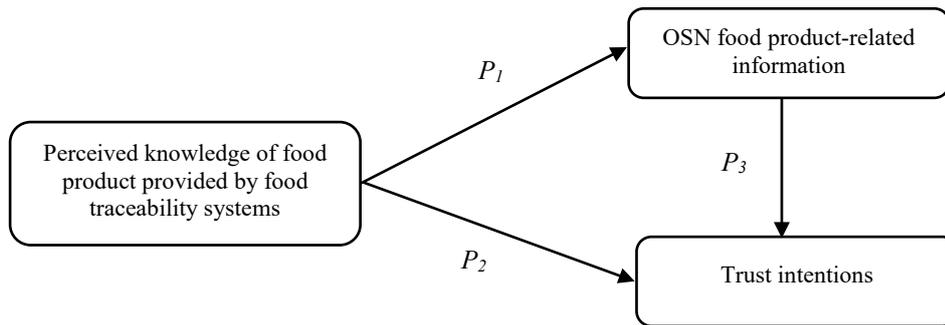


Figure 2. Conceptual Model

### 3.1 Perceived Knowledge of Food Product Provided by Traceability Systems and OSN Food Product-Related Information

Derived from SCT, a person's perceived knowledge is in association with his/her social information needs (Bandura, 1986). To diminish food contamination and incidents, firms and partners connect each other by accessing reliable and well-timed information concerning supply chain disruptions and outcomes (Premkumar, Ramamurthy, & Saunders, 2005). For instance, the information about date, health benefits, nutrition information, country of origin, and ingredients on food packaging can be communicated to consumers with the intention of increasing customer trust (Chan, Kam, Coulthard, & Button, 2012). The above food-related information is managed by FSMSs (Kirezieva et al., 2013). Based upon such product information, consumers' knowledge of food products is formed.

A person's rational reactions after acquiring knowledge of a food product, e.g. knowledge of benefits and risks, are impacted by his/her cognitive responses (De Vocht, Cauberghe, Uyttendaele, & Sas, 2015). When consumers have more knowledge about food products, they are more enthusiastic about food products (De Steur, Liqun, Van Der Straeten, Lambert, & Gellynck, 2015). In this study, perceived knowledge of a food product refers to information about a product perceived by consumers because timely and trustworthy information results in increased trust (Morgan & Hunt, 1994). In contrast, negative information decreases levels of trust. Traceability system is technology that provides food-product-related information to consumers that influences consumer trust (Mattevi & Jones, 2016). The application of traceability systems helps track and monitor farm produce, as well as transferring food chain information to stakeholders (Ruiz-Garcia & Lunadei, 2011).

Nonetheless, to lower perceived risks, consumers require more information to support their food safety expectations, which, in turn, influences their opinions towards food products and their subsequent behaviour (Eiser, Miles, & Frewer, 2002). With the support of the Internet, communication is easier for consumers who can search for information through online channels (J. Lee, Kim, & Moon, 2000). Statements made by consumers on the Internet and related to a product or corporate brand are considered as electronic word-of-mouth (eWOM) communication (Stauss, 2000). Word-of-mouth (WOM) refers to information communications between informal parties as regards assessment of goods and services (Singh, 1988; Westbrook, 1987). Electronic word-of-mouth communication refers to and includes the following: 'writing', 'liking', 'sharing', 'recommending', 'commenting on', and 'tweeting' brand-related messages on Facebook, Twitter, and other social media (Wolny & Mueller,

2013). These constitute nuanced measures of WOM from a giver's perspective about goods and services for a particular firm (Harrison-Walker, 2001). Notably, online communication presents a large volume of information that is disseminated in cyberspace, which has no geographical limitations, and many-to-many online relationships (Wolny & Mueller, 2013). Therefore, when consumers have concerns about the safety of food, they search for OSN food product-related information on popular social networking websites. OSN food product-related information refers to information about food products provided by other social media users (Wu, 2015). These arguments lead to the proposition that is:

*P1: A high degree of perceived knowledge of food products provided by traceability systems will be associated with OSN food product-related information.*

### **3.2 Perceived Knowledge of Food Product Provided by Traceability Systems and Trust Intentions**

The second association proposed by Bandura (1986) is between a person's perceived knowledge and behavioural intentions. Consumer trust in food safety is created when they think food items are safe to eat (Chen, 2008). Food is safe when it will not cause sickness or harm to people who consume it, provided that the food is consumed as instructed (Australia New Zealand Food Authority, 2016). As mentioned in Table 3, the food supply chain, government involvement, optimism and pessimism, country of origin, and brand competence are pertinent to gaining consumer trust in food products. However, there are still other elements to consider.

Food-product-related information provided by traceability systems is strongly supportive of quality assurance (Kirezieva et al., 2013). Accurate information is crucial for consumers before food choice through a critical assessment of a producer's competence (Yee, Yeung, & Morris, 2005; Yeung & Yee, 2003). The provision of transparent information related to food products encourages consumers to make their own judgements about the safety of a food product (Grunert, 2005).

Smigic, Rajkovic, Djekic, and Tomic (2015) indicated that there was a need for transparency between various legal authorities and food business operators. Yoo et al. (2015) found that information asymmetry increases consumers' perceived risk. When consumers perceive risk in food safety, it motivates consumers to seek additional information via the use of traceability systems (Yoo et al., 2015). Consumers' motives for using traceability systems are reducing perceived risk due to information asymmetry. Producers must retain sufficient records from traceability systems, including processing operations, systematic examination, harvesting areas, storage, transportation, and food receipts to show that food products are safe to eat (Australia New Zealand Food Authority, 2016). To decrease perceptions of risk, the more information provided by food traceability systems to consumers increases consumers' trust in food products (Eiser et al., 2002).

Trust refers to people's dependency on others in whom they place confidence (Moorman, Deshpandé, & Zaltman, 1993). Confidence is a strong belief in others (Larzelere & Huston, 1980; Rotter, 1971). Trust intentions in this paper refer to a consumer's intentions to place his/her strong belief in food products manufactured by trustworthy food producers (Morgan & Hunt, 1994). When consumers have very firm beliefs about products made by certain food producers, it will affect their behaviour (Bredahl, 2001). This leads to the following proposition.

*P2: A high degree of perceived knowledge of food products provided by traceability systems will be associated with trust intentions.*

### **3.3 OSN Food Product-Related Information and Trust Intentions**

The third association based on SCT (Bandura, 1986) is the relationship between social information facilitated by social media and consumer trust intentions. Trust is aroused by cognition, and evoked by emotion through interpersonal dynamics with the support of information technology (Komiak & Benbasat, 2006). Hobbs (2004) showed that consumers preferred to know the safety of food before eating it, otherwise, information asymmetry (e.g. quality attributes known only to producers) can result in market failure. Information asymmetry can frustrate consumers and lead to a loss of confidence in food products among consumers.

The development of the Internet and social network sites, aka online communication, have assisted in reducing information asymmetry and its negative effects by allowing buyers to communicate information on product quality and share their experiences (Izquierdo & Izquierdo, 2007). The use of microblogs is associated with generating public awareness of food safety scandals, and the use of microblogs is deemed as a stronger predictor of food safety risk perception compared to other offline media such as television, newspapers and magazines (Mou & Lin, 2014). Consumers provide feedback on a product, and in turn, a receiver builds up a personal judicious perception of product or service features (Allsop, Bassett, & Hoskins, 2007). Consumers are subjected to a variety of positive and negative information about food to influence their trust in a food product (Scholderer & Frewer, 2003). This leads to:

*P3: OSN food product-related information will be associated with consumer trust intentions.*

## **4 Discussion and Conclusions**

Transparency and accountability in the food production chain are desired by consumers so as to know the sources and processes from farm to fork. Incomplete information disclosure about the attributes of food product production is deemed as misspecification, and has the potential to ruin trust between consumers and producers (Mishra, Heide, & Cort, 1998). A dearth of reliable information on the market such as dishonest and cheating behaviours could result in a failure in gaining consumer trust (Granovetter, 1985), whereas providing trustful information about food products could greatly augment consumer trust (Adler, 2001).

Traceability systems enable consumers to retrieve information regarding food safety along the processing and supply chain. Traceability assists in tracking any food product through all stages from sourcing, through production, processing, and subsequent distribution. Traceability also supports mechanisms for tracing backwards and forwards at any point in the supply and processing chain (Australia New Zealand Food Authority, 2016). This pragmatic and holistic approach to food chain information is important to consumers due to potential information asymmetry between producers and consumers. Truthful and readily available information disclosure is a value-added process for both producers and consumers. The information disclosed in food traceability systems is likely to influence consumer's trust in choosing food products at the point of sale (Chen & Huang, 2013). Thus, FSMSs attempt to close this gap.

Additionally, OSN food product-related information bolsters (or undermines) consumer trust in a firm's food products. Online feedback mechanisms are corroborated to develop trust in

sellers' credibility (Ba & Pavlou, 2002). Positive feedback results in both a trustworthy signal and a good feedback profile (Greif, 1989; Milgrom, North, & Weingast, 1990). On the other hand, negative feedback leads to not only brand detriment but also financial loss (Z. Lee, Im, & Lee, 2000; Webster & Sundaram, 1998). For instance, eBay's Feedback Forum is a channel where buyers provide feedback or reviews about their transactions with sellers. Credible OSN product-related information is able to influence a consumer's judgement and increase their trust in a food product.

This research seeks to enhance SCT by examining how technology-supported information influences consumer trust in the context of food safety. Technologies here include traceability systems and OSN websites. The associations between perceived knowledge of food products provided by traceability systems, OSN food product-related information and consumer trust in food safety are articulated. Definitively, the relationships between constructs are proposed to be testable.

Research design for further research and the operations used to test the model are proposed as follows. Mixed methods, both qualitative and quantitative research methods, should be used to test the model and proposed hypotheses (Venkatesh, Brown, & Bala, 2013). The first phase involves inductive semi-structured in-depth interviews to confirm the conceptual framework. The second phase involves empirical testing of the model using a questionnaire-based survey approach. As proposed by Gaskin, Berente, Lyytinen, and Yoo (2014), the interview method is appropriately used to reveal the actors' behaviour patterns in rich detail. Therefore, semi-structured in-depth interviews for collecting consumers' perspectives and food producers' perspectives of phenomena should be used. Consumers' and food producers' activities, and the use of artefacts including the use of traceability systems, and social-networking sites should also be collected by interviews. In addition, notes should be taken during each interview in order to retrieve interviewees' responses to questions, and assist in raising further queries, following Middendorf and Macan's (2002) note-taking strategy. Semi-structured in-depth interviews with food consumers will be carried out in Australia. Australia is a western-style multicultural society that will help ensure broad-based external validity. A food company with a wide consumer base and using traceability systems will be chosen. The selected firm's food products must harmonise its food safety assurance with Australian government regulations. The company's managing staff will be contacted to interview their perceptions of information flows in the food supply and processing chain. Next, a questionnaire survey will be conducted to corroborate the proposed research framework. Measurement items will be developed from interview data and adapted from previous studies. Experts' opinions about the content validity of the measurement items will be conducted. After that, a pilot study will be undertaken. Any items with weak factor loadings will be reviewed. General food consumers, who are over 18 years old, reside in Australia, and make purchase decisions, will be randomly approached by using Qualtrics survey services to complete the questionnaire. It is estimated a sample size of 300 Australian respondents will be sufficient for hypothesis testing (Maccallum, Browne, & Sugawara, 1996).

The proposed model provides food producers with a framework to ponder which factors have positive/negative associations with consumer trust intentions. In addition, food producers can use the constructs and associations between constructs proposed in the model to ameliorate their own FSMSs and OSN communication strategy in order to increase consumer trust

intentions. Finally, it is possible to make an application providing such credible information that can influence consumer trust in a product, and win consumer loyalty.

The integrated model facilitates cognitive elaboration of consumer trust in food products. The most far-reaching implication is the identification of consumers' information needs so that some means of communication, such as mobile phone applications, company websites, and social network sites, can be developed to provide appropriate and useful food product information to consumers. Contingent on the food producer's situation, they can work out their own internal and external information systems and decide how their food product information will be disseminated. This will offer valuable assistance in gaining consumer trust. Information on food products is also useful for developing policy on food safety management to prevent foodborne diseases. This might also help reduce societal healthcare costs due to the reduction of food-induced illnesses, and diminish costs of doing business associated with product recalls.

There are several limitations in this article that need consideration. Firstly, other aspects of consumer trust such as consumer practices (L. Zhang et al., 2016) have not been included in this article. Further research may consider the association between consumers' trust intentions and their actual purchasing behaviours. Secondly, this research only considers the effects of OSN food product-related information on consumer trust. Future research could examine the influence of the general mass media on consumer trust in food products. Lastly, this is a conceptual paper that is not supported by empirical evidence. Hence, further research will use the testable model developed above to further evaluate and test the propositions using quantitative methods e.g. survey methodology.

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