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Perceived Risk Triggers the Effects of Trace-Back Information on Consumer Trust

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Abstract

Understanding how trace-back information quality with the support of traceability systems contributes to consumer trust has been of interest to academics and practitioners. Drawing upon Commitment-Trust Theory, this research examines the role of trace-back information on consumer trust in the context of food safety. A consumer-based questionnaire survey was conducted following a structural model that was tested by using structural equation modelling techniques. The findings indicate that perceived risk increases perceived informativeness of traceability systems. More particularly, providing consumers with high quality trace-back information about the sources of ingredients, the production process, storage, and the supply chain is considered as the informativeness of traceability systems. Importantly, trace-back information about a product has a positive influence on consumer trust. Once consumers have increased trust in a product, they would buy a product about which they were concerned.

Keywords

Informativeness of traceability systems, trace-back information, consumer trust.

Introduction

Consumers preferred to know the safety of food before eating it. Where consumers do not have complete information, while other parties do, can result in information asymmetry, e.g. quality attributes known only by producers, can result in consumers' perception of risk if they do not know what the producers know. Information asymmetry is defined as incomplete product information, which frustrates consumers and leads to a loss of confidence in products (Swan and Nolan 1985). Traceability systems help reduce information asymmetry between producers and consumers by properly recording information regarding manufacture and distribution along the production process and supply chain (Chen and Huang 2013).

A supply chain typically has numerous vulnerabilities, e.g. warehouse and transportation management (Whipple et al. 2009). As a result, the analysis of information concerning supply chain management (SCM) in a production chain is likely to provide insights about quality assurance, and elicit appropriate responses to product safety concerns (Kirezieva et al. 2013). Fundamental components of SCM are traceability systems to collect information about activities along the production chain.

Previous research has shown that the support of traceability systems provide consumers with additional product-related information (Choe et al., 2009; Mattevi & Jones, 2016). Perceived information quality from the systems shapes consumer trust (McKnight et al. 2017; Nicolaou and McKnight 2006). Moreover, the transparency of information systems significantly influenced perceived information quality (Nicolaou and

McKnight 2006). With the plethora of available information provided by traceability systems, it is not easy to understand what traceability information impacts consumer trust.

Consumer trust in the safety of a food product involves producers' commitment to consumers (Morgan and Hunt 1994). Commitment is shown by communication. That is timely sharing of formal and informal information between parties increases consumer trust (Morgan and Hunt 1994). Based on Commitment-Trust Theory (Morgan and Hunt 1994), this paper answers the following research questions.

- What trace-back information do consumers seek about a food product?
- How is the casual relationship between perceived trace-back information and consumer trust?

Food Safety Information Demand

Food fraud has damaged the reputations of food producers (Xie and Yao 2016) and created consumer distrust (Spink and Moyer 2011). Previous studies indicate information on food labels is enough for consumers to have confidence in food safety (Koenigstorfer and Groeppel-Klein 2010; Olynk et al. 2010). Nonetheless, it may not hold true for all cases (Choi and Choi 2016; Dörnyei and Gyulavári 2016; Hartmann et al. 2018). Therefore, this study extends the findings of previous studies (Koenigstorfer and Groeppel-Klein 2010; Olynk et al. 2010) by suggesting that consumers require additional information and need to search for additional food product-related information not contained on food labels to develop sufficient trust in the products they are considering purchasing. In particular, traceability systems provide consumers with additional product-related information not found on food labels (Choe et al. 2009; Lam et al. 2020).

In most instances, there is a demand from consumers for food safety information to increase trust. Trust is aroused by cognition through interpersonal dynamics with the support of information technology (Komiak and Benbasat 2006). The benefit of traceability systems is that it provides users with rational information (cognition). That is, when a user internalizes and understands the information provided by traceability systems, the user will have greater confidence in his/her purchasing decisions (Komiak and Benbasat 2006). Importantly, the trace-back information required by consumers has not been fully realized, with the result being that the adoption of food safety information is based primarily on food labels. Thus, it is important to note that trace-back information via traceability systems should be examined. In this study, we focus on trace-back information that is helpful for increasing trust under the instantiation of food safety.

Literature Review

Perceived Risk

When consumers perceive high risk and feel worried about a product, it has been identified that they use traceability systems to look for additional product information (Yoo et al. 2015). Perceived risk reduces reliability-related trust, and technology is helpful for the restoration of trust (Hsiao 2003). For instance, an enhancing interorganizational system (i.e. a system between organizations to share information each other and conduct business across boundaries) can lead to positive outcomes (Wang et al. 2013). Likewise, traceability systems are capable of providing reliable information by tracking and tracing product flow efficiently and synthetically (Knoll et al. 2017) that is used by regulators and the manufacturers to reduce risks and to build trust (Choe et al. 2009).

Trust

Trust is a complex emotion. Existing literature has scrutinized trust and distrust in different contexts. Some studies examine trust and distrust as a theoretical characteristic within trust's nomological network (McKnight and Chervany Norman 2001; Moody et al. 2010), and based on other theoretical frameworks such as agency-based mechanisms, and interorganizational relationships (Singh and Sirdeshmukh 2000; Vlaar et al. 2007). Some empirical studies find that trust and distrust have differential relations with motivating perception, functional perception, use intention, price premiums, and ambivalence (Benamati et al. 2010; Dimoka 2010; Moody et al. 2017; Ou and Sia 2010). Other studies examine the influence of information quality on trust and distrust in different settings (McKnight et al. 2017; Ou and Sia 2010; Zhou 2012).

Information Quality

Perceived information quality is a user's assessment of content conveyed by a system (Xu et al. 2013). Information quality is evaluated on four dimensions: accuracy, completeness, currency, and format (Xu et al. 2013). Those dimensions are categorized into intrinsic, extrinsic (contextual), and representational information quality. Information accuracy (reflecting intrinsic quality) is defined as the correctness of information; information completeness (reflecting extrinsic quality) refers to providing users with comprehensive and needed information; currency (reflecting extrinsic quality) refers to the up-to-date information provided to users; format (reflecting representational quality) means that information is presented understandably and interpretably to users (Nelson et al. 2005).

The intrinsic quality is considered as the substantial property of information separated from a particular user, task, or application (Nelson et al. 2005). The intrinsic view reflects agreement between the information accuracy in a system and the real world (Nelson et al. 2005). The extant literature shows that intrinsic information quality has a significant effect on trust and distrust (McKnight et al. 2017; Ou and Sia 2010; Zhou 2012). In this regard, traceability systems provide information, but often the intrinsic quality of this information is unknown. Furthermore, no work has investigated what trace-back information influences trust and distrust.

Traceability systems refer to the capability of providing all relevant information about a product from its supply chain to production process (Choe et al. 2009). Traceability systems involve techniques for identification, provision, collection, storage and corroboration of data (Starbird and 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). Before developing a perspective on trust, however, consumers look for high quality information via the transparency of a traceability system (Nicolaou and McKnight 2006).

Information quality refers to the relevance, accessibility, interpretability, and integrity of information (Nicolaou and McKnight 2006). Prior studies suggest that perceived information quality is a heuristic cue affecting consume trust (McKnight et al. 2017; Nicolaou and McKnight 2006). Perceived information quality is a consumer's perspective to the characteristics of information provided by a system versus his/her information requirement (Nicolaou and McKnight 2006). Whereas the influence of perceived information quality for consumer trust has been shown to be significant (McKnight et al. 2017; Nicolaou and McKnight 2006), little is known about what and how trace-back information affects consumer trust.

Research Model and Hypotheses

Perceived Risk and Informativeness of Traceability Systems

The extant literature shows that consumers favor information on the labels (Bosman et al., 2014; Cornelisse-Vermaat et al., 2008). However, perceived insufficient product-related information increases consumers' perceived risk (Knoll et al., 2017). From consumers' perspective, risk is perceived as an emotional problem that makes consumers (1) worried, (2) concerned, (3) uncertain and (4) nervous.

To reduce this risk, consumers seek additional information concerning a product to fill the void left by the perceived insufficient information (Böcker & Hanf, 2000). Thus, consumers use traceability systems to acquire additional information about products if they were available (Tsai et al., 2014; Yoo et al., 2015). Traceability systems require producers to properly record information regarding manufacture and distribution in order for consumers to trace back the production process and supply chain (Zhang et al., 2011). The recorded information consists of cultivation processes, source of origin, chemicals used, and other inputs to the production process and supply chain (Choe et al., 2009; Hall, 2010; Liao et al., 2011). Perceived informativeness of traceability systems is defined as the extent to which the information offered to consumers by traceability systems is perceived to be helpful (Choe et al., 2009). The trace-back information is perceived as (1) necessary, (2) essential, (3) crucial, and (4) vital if traceability systems provide consumers with helpful information about food products. Therefore, initially traceability systems provide useful information to consumers. These arguments lead to the hypothesis that:

H₁: Perceived risk has a positive influence on perceived informativeness of traceability systems.

Perceived Informativeness of Traceability Systems and Trust

Communication in Morgan and Hunt's model (1994) refers to timely and reliable *information* between parties. The empirical research on effective channels for communication is crucial (Mohr and Nevin 1990; Morgan and Hunt 1994). Traceability systems are competent and efficient in providing information to consumers (Budiardjo et al. 2017).

Due to globalisation, supply chains necessitate traceability systems to ensure safety and to identify failures in food processing. Many countries have imposed a requirement for traceability systems (King et al. 2017). The integration of traceability systems into organizational information systems assists product traceability, and facilitates the development of mobile applications for users (Cagliano et al. 2017). For instance, the application of radio-frequency identification (RFID) technology helps track and monitor farm produce and transform the conventional methods of food chain management (Ruiz-Garcia and Lunadei 2011). As a result, tracking and tracing systems throughout the processing and supply chain are informative about product safety to stakeholders as they provide on time data collection and thus information transparency (Li et al. 2017).

The retention of information transparency in supply chain makes consumers feel safe (De Steur et al. 2015), and aids in gaining consumer trust in a product (Chiu 2016; Soregaroli et al. 2003; Yee et al. 2008). The embedded characteristics of consumer trust provided by traceability systems are in relation to (1) no doubt about the safety of food products, (2) confidence in the safety of food products, (3) feeling about the safety of food products, and (4) a lot of faith in the safety of food products. The additional and customized information supported by traceability technology can be made available to consumers. This leads to following hypothesis:

H₂: Perceived informativeness of traceability systems has a positive influence on traceability-based consumer trust.

Consumer Trust and Purchase Intentions

The primary mechanism used to develop consumer trust in food safety is the information provided via food labels. More specifically, consumer trust in nutrition information (Koenigstorfer and Groeppel-Klein 2010), country-of-origin information (Loureiro and Umberger 2007), certification information (e.g. animal welfare) (Olynk et al. 2010), and production processes information (Umberger et al. 2009) is influential in consumers' purchase intentions. Purchase intention is defined as the consumer's intention to buy a product (Kim and Thorndike Pysarchik 2000).

Other things contribute to consumer trust such as information provided by traceability systems (Chen and Huang 2013). Traceability systems can provide consumers with farmers' records that can alleviate consumers' fears. Farmers' records support consumers in reducing concerns about perceived information asymmetry, which in turn reinforces purchase intentions (Chen and Huang 2013). In another empirical study, providing reliable information about food safety by farmers is influential in increasing consumer trust in food products, which subsequently affects positively consumers' purchase intentions (Yee et al. 2005). These arguments lead to the following hypothesis.

H₃: Traceability-based consumer trust has a positive influence on traceability-based purchase intentions.

Based on the preceding discussions, Figure 1 shows a research model that is grounded on the relationship between communication and trust in the context of food safety. The model aims to provide insights into the elements that increase consumer trust.

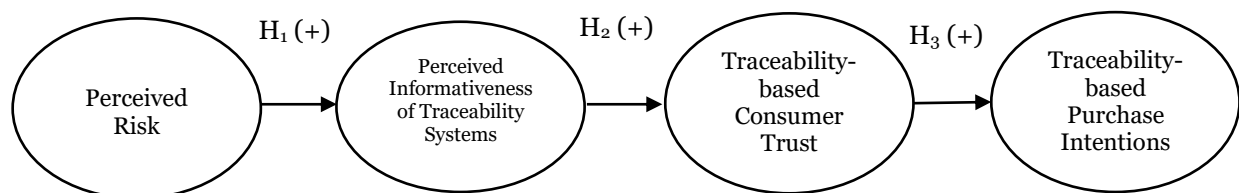


Figure 1. Research Model

Method

A questionnaire survey was conducted to test the proposed research model. Generally, data from surveys are analyzed by inferential statistics to support or refute the relationships between constructs (Straub et al. 2018). Measurement items were adopted and adapted from the literature: perceived risk (Yoo et al. 2015), perceived informativeness of traceability systems (Park and Lee 2008), consumer trust (Chen 2008), and purchase intentions (Teng and Wang 2015). The questionnaire items were measured using a 7-point Likert scale, ranging from 1 = totally disagree to 7 = totally agree.

General food consumers who were over 18 years old, and made purchase decisions in relation to food were approached to participate in an online survey (using Qualtrics's data collection services). Based on the appropriate confidence intervals for fit indices, a sample size of 200 respondents was determined to be sufficient for hypothesis testing (Maccallum et al. 1996). Qualtrics provided 240 completed responses after eliminating any failed responses that did not meet the *a priori* requirements specified in the questionnaire (i.e. 18-year old or over, and grocery shoppers). The responses were subjected to Qualtrics' internal data quality checks. Following data collection, the Amos 24 software package was used to analyze the structural model. The structural model analysis was undertaken to assess the strength of the paths between the constructs.

Results

The empirical work shows that besides information presented on food labels, consumers are interested in (1) source of ingredients, (2) food production process information, (3) food contamination notification, and (4) quality testing reports (please see Table 1). Those types of additional information can be provided by traceability systems.

	Additional Information about a Food Product	The Number of Cases
1	Source of ingredients	74
2	Food production process information	53
3	Food contamination notification	52
4	Quality testing reports	21
5	Recipe	14
6	Terminology explanation	9
7	Storage/handling instruction	8
8	Food supply chain information	5
9	References	4
	Total	240

Table 1. Additional Information about a Food Product Sought by Consumers

The survey results also show six types of information that consumers seek from traceability systems. Consumers mostly seek information about (1) the source of ingredients, (2) the food production process, (3) storage, and (4) the food supply chain (please see Table 2). Those types of trace-back information are perceived as informativeness.

	Particular Types of Trace-back Information about a Food Product	The Number of Cases
1	Source of ingredients	145
2	Food production process information	52
3	Storage	18

4	Supply chain	12
5	Packaging	10
6	Transportation	3
	Total	240

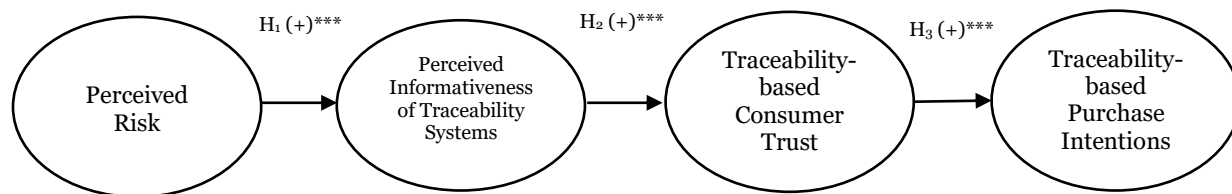
Table 2. Particular Types of Trace-back Information that Consumers Seek about a Food Product

The structural model was tested to assess the structural paths between constructs. That is, to test if perceived risk has a positive influence on perceived informativeness of traceability systems (H₁); perceived informativeness of traceability systems has a positive influence on traceability-based consumer trust (H₂); finally, traceability-based consumer trust has a positive influence on traceability-based purchase intentions (H₃). The computed results of fit indices and acceptable threshold levels are presented in Table 3.

Fit Index	Acceptable Threshold Level (Kline 2005)	Computed Results (n = 240)
χ^2/df	Not greater than 5	3.76
SRMR	Not greater than 0.10	0.05
TLI	Greater than 0.90	0.92
CFI	Greater than 0.90	0.93

Table 3. Fit Indices for Testing the Research Model

The results of fit indices indicate an acceptable fit between the structural model and the data set. Figure 2 shows the significant relationships from testing the research model. The structural relationships between constructs in the model are as follows.



Notes: *, **, *** Significant at 5, 1 and 0.1 per cent confidence levels

Figure 2. Results of Testing the Research Model

Discussion

The positive causal relationships tested in this study demonstrates the initiative and originality of this work. The findings indicate that perceived risk increases perceived informativeness of traceability systems (H₁: supported). That is, consumers use traceability systems to obtain additional information of a product in order to reduce risk. Well-developed traceability systems contribute to the perceived informativeness of traceability systems that previous studies have not examined (Knoll et al. 2017; Yoo et al. 2015).

Newspaper coverage of food safety is positively related to consumer trust (De Jonge et al. 2010), but additional information provided by traceability systems through a bar-code or quick response (QR) code is helpful for consumers (1) to understand, (2) to judge, and (3) to evaluate the safety of a product about which consumers are concerned (H₁: supported). The results of data analysis indicate that information provided by traceability systems increases consumer trust (H₂: supported). Traceability-based consumer trust is related to perceived informativeness of traceability systems directly, and perceived risk indirectly, rather than simply having trust in industry, sellers, government, individuals, and agencies (Ghasemi et al. 2013; Sodano et al. 2016; Stampfli et al. 2010; De Vocht et al. 2015; Yoo et al. 2015).

The research model identifies the antecedent and the mediating factor of consumer trust. When consumers perceive risk, it triggers consumers' use of traceability systems to search for additional product-related

information. The use of traceability systems is a complement to trust, and trustworthy information from the transparent traceability systems plays an important role. In the context of this study, traceability systems data can be used to monitor and control the safety of a food product. The perceived informativeness of traceability systems mediates between perceived risk and consumer trust. This finding contributes to aspects of a generic model of trust for traceability systems from the perspective of consumers.

Conclusion

This study contributes to Morgan and Hunt's (1994) Commitment-Trust Theory by developing and experimentally validating a model in the context of food safety with the support of trace-back information. Our model highlights a construct that has not been investigated in Morgan and Hunt's model (1994), i.e. perceived risk.

The findings of this study contribute to the literature on information quality and trust by uncovering the informativeness of traceability systems. It is important to note that the information quality literature has acknowledged the importance of information quality but has given trace-back information quality little attention (McKnight et al. 2017; Nicolaou and McKnight 2006). Our findings suggest that high quality trace-back information about (1) the source of ingredients, (2) the food production process, (3) storage, and (4) the food supply chain helps consumers make a judgement about food safety. As a result, high quality trace-back information increases consumer trust.

Understanding the effects of these specific cues throws new light on how consumers use information provided by traceability systems. Therefore, our findings have some implications for practitioners. Food producers can use the constructs and relationships proposed in the model to ameliorate their own food safety management systems for increasing consumer trust. The use of traceability systems helps ensure product quality by tracking and tracing the production process. It can also lead to cost reduction in the event of food recall by identifying the sources of the recall issue. If food producers include food traceability facts by attaching links on their packaging, they would benefit from providing consumers with the standard information usually provided on the food label in addition to information about the origin, food processing and supply chain. This helps to reduce potential information asymmetry between producers and consumers.

Our study has several limitations. First, data collection in this study may not represent the whole population of information receivers. Our research model should be tested in different paradigms. Second, this study followed the causal relationship between communication and trust proposed by Morgan and Hunt (1994). This is at an initial stage in exploring consumer trust in the context of food safety. However, it did not investigate other dimensions influencing trust such as products' attributes and quality. Further research may consider other aspects of a product as antecedents that facilitate consumer trust.

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