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## **Food safety as a field in supply chain management studies: a systematic literature review**

### **RESEARCH ARTICLE**

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### **Abstract**

The increasing number of food contamination events has called the attention of both practitioners and scholars to food safety problems and their consequences. Many of these events are related to the supply chain because food production is now a global process of commoditized goods, made by large corporations that purchase inputs from producers in many countries. Given the linkage between supply chain and food safety issues, we investigated how studies in the supply chain management area have examined food safety issues, exploring some of their important characteristics. To do so, we conducted a systematic literature review of 46 papers, published in 23 journals, indexed in the Web of Science database. As a result, we pointed out some main characteristics of these papers, including journal attributes, authorship data, citation network, methodological characteristics, and theoretical approaches. Results serve as a reference to scholars and allow us to discuss some potential opportunities for future research in the field of food safety in the supply chain management area.

**Keywords:** supply chain management, food safety, systematic literature review.

**JEL code:** M11, L66, L23, Q56, M19

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## 1. Introduction

The food contamination events occurring in the last few years have called the attention of practitioners and scholars to better food safety practices. In 2008 and 2009, the United States and Canada found evidence that peanut butter paste was contaminated with salmonella, causing 9 deaths and affecting another 637 people, (Layton and Miroff, 2009). In 2008, pork goods produced in Ireland were contaminated by dioxin and affected international suppliers in several countries (EFSA, 2008). In China, milk powder was adulterated with melamine and was associated with 6 deaths and 294,000 contaminated people (Spencer, 2009). In 2011, bean sprouts produced in Germany were contaminated by *E. coli*, resulting in 37 deaths and another 3,000 people contaminated (Marucheck *et al.*, 2011). These episodes and their consequences claim urgent and rigorous treatment, as they cause serious problems for public health and firms' value and profits (Resende-Filho and Hurley, 2012; Roth *et al.*, 2008).

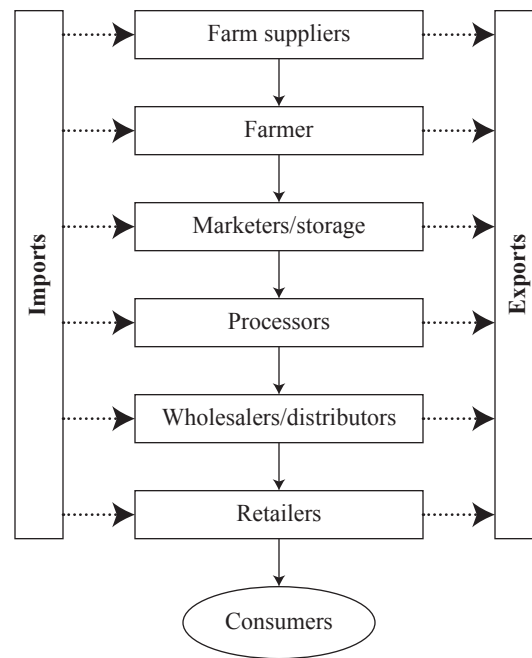
These contamination events are partially related to changes in modern supply chains, such as the globalization of food produce, consolidation of large companies, and commoditization of food products (Roth *et al.*, 2008). These changes put pressure on producers to reduce cost (Tang and Babich, 2014), which, in turn, respond by reducing the investment in safety actions. Also, in global supply chains, the distribution centers play another essential role in helping the prevention of safety hazards, because they store food products and can detect food contamination before such food reaches the consumers (Chebolu-Subramanian and Gaukler, 2015; Lao *et al.*, 2012). The number of tiers in the chain, for example, also influences the risk of food contamination, because the existence of many interacting elements increases the likelihood of chemical and physical contamination (Reiner and Trcka, 2004; Sloane and O'Reilly, 2013; Van der Gaag *et al.*, 2004).

Given the growing importance of supply chain elements in food contamination events and the increasing number of papers published about this topic, we seek to investigate how supply chain scholars have examined food safety issues by answering the following research questions: What are the main characteristics of studies about food safety in the area of supply chain management research? What are the aspects that describe the authors involved in these studies? Which methodological and theoretical features do these studies have? To answer these questions, we propose a systematic literature review to analyze a sample of papers published in respected management journals and to reveal their main characteristics. By answering these questions, we can contribute to the literature by summarizing how issues related to food safety have been explored by supply chain management scholars. In doing so, we hope to contribute by indicating some points that could be better designed in future researches, particularly aspects such as methodological characteristics, theoretical approaches, possible partnerships between scholars and institutions, country focus available, and journals for potential publication.

## 2. Background

A supply chain can be viewed as a network or a group of firms interconnected by multiple buyer-supplier relationships in which products and information flow to help the process of developing, producing, and delivering goods and services to consumers. For instance, a firm could be the supplier or customer of other similar firms, selling or buying inputs for production activities. Because of these relationships, the supply chain management has emerged as one of the important concepts to help companies improve their performance through the use of better supply chain practices (Burgess *et al.*, 2006). There are many studies related to different issues of supply chain management, all of which attempt to find ways to improve the performance of the entire supply chain (Marucheck *et al.*, 2011; Pérez-Mesa and Galdeano-Gómez, 2015).

Following this same line of reasoning, a food supply chain can be defined as a set of interdependent companies that manage the flow of goods, services, and information along the value-added chain of agricultural and food products seeking to achieve superior customer value at the lowest possible cost (Beske *et al.*, 2014). A typical food supply chain is illustrated in Figure 1 (Roth *et al.*, 2008). It is important to note that importers



**Figure 1.** Generic model of food supply chain (adapted from Roth *et al.*, 2008).

and exporters are linked to all phases of the supply chain system, showing that any tier of the chain can be connected to the global supply chain.

Globalization of the food supply chain gives rise to some challenges to management, especially because this type of chain has become increasingly dynamic and industrialized (Roth *et al.*, 2008). Some of these challenges are food traceability (Alfaro and Rábade, 2009; Epelbaum and Martinez, 2014) and tracking (Fritz and Schiefer, 2009), supply chain dispersion (Rong and Grunow, 2010) and food distribution (Akkerman *et al.*, 2010), quality assurance (Ting *et al.*, 2014), risk assessment (Dani and Deep, 2010; Wang *et al.*, 2012), and related trust and commitment among firms (Ding *et al.*, 2014).

One common characteristic of these studies is that they can be viewed from two perspectives: food security and food safety. Food security refers to the delivery of food 'that is uncompromised by intentional contamination, damage, or diversion within the supply chain' (Maruchek *et al.*, 2011: 708). Security problems can arise from other people or organizations that intentionally perform actions to alter the food characteristics or disrupt the supply chain to prevent its functionality. Food safety refers to the development of actions to reduce the likelihood of food contamination and prevent the resulting harmful consequences of unsafe food, such as illness and death (Akkerman *et al.*, 2010; Maruchek *et al.*, 2011). A supply chain perspective can highlight the safety problems that arise from transfers along the chain, such as improper storage, handling and distribution of the food (Maruchek *et al.*, 2011). Because we are interested in understanding the development of studies on food contamination in the supply chain management, we focus on food safety.

### 3. Methods

We developed a systematic literature review to analyze a sample of papers published about supply chain management issues related to food safety. The systematic literature review is considered appropriate when the principal purpose of the study is to summarize the studies on a given topic. It allows for reduction of many pieces of literature in an explicit and systematic way, providing a short coherent report that helps readers to know and understand something about a given topic (Pittaway *et al.*, 2004; Tranfield *et al.*, 2003). This

method helps the researcher reduce his/her research bias and be more explicit in terms of research choices (Akobeng, 2005; Tranfield *et al.*, 2003).

The first step is to choose the keywords to be used in the selection process of the papers (Tranfield *et al.*, 2003). We chose the keywords, 'supply chain' and 'food safety', because they are common to most papers about this topic. The second step is to determine the database to be used for data collection. We chose the Web of Science database, because this is one of the most complete and cited reference databases in the supply chain management field. The third step is to determine the period for data collection. We did not set any restrictions related to time, allowing for the inclusion of papers published in any year. The fourth step is to determine the data collection categories. We chose the categories, 'Business', 'Management' and 'Operations Research Management Science', because our study focuses on studies related to business and management. It is important to note that we excluded studies about the production process of food, such as agriculture, chemistry, nutrition, biology or food engineering, given that we focused on the management of the supply chain after the production process is concluded and not during the production process itself. In summary, we entered the keywords, 'supply chain' and 'food safety' and the aforementioned categories into the search tool on the Web of Science database to refine our search and obtain a sample of papers to be analyzed in our study. This process was conducted in June 2015, and we found 47 papers that matched our sample criteria.

The final step consists of reading the abstract of each paper to evaluate its adherence to our study. To do so, we used the HistCite software (Thomson Reuters, New York, NY, USA) to export the information about each paper to a word processor. After reading the abstracts, we excluded one paper because it was a retraction. Our final sample was composed of 46 papers (Supplementary Table S1).

## 4. Results

### *Journals and citation results*

Table 1 presents information about the journals and their Journal Citation Report (JCR) Impact Factor 2014 Edition, the number of papers in each journal, and the citation score in the Web of Science database. The 46 papers in our sample were published in 23 journals. The JCR impact factor of these journals varies from 0.386 to 4.376. The International Journal of Production Economics published 10 papers, which represent 21.74% of the sample, and was the journal containing the greatest number of published papers about supply chain management and food safety. Another 15 journals (65.22% of the total) published only one paper. These results show a concentration of 31 papers published in 8 journals. This means that 8 journals account for 67.39% of all papers published on food safety and supply chain management in our sample.

The citation score in the Web of Science database refers to the number of citations that the papers of a particular journal received in papers indexed by the Web of Science database. For example, there is only one paper published in the Journal of Supply Chain Management that received 82 citations in journals indexed by the Web of Science database. Another example is the International Journal of Production Research, which has 3 papers published about this topic that received 50 citations.

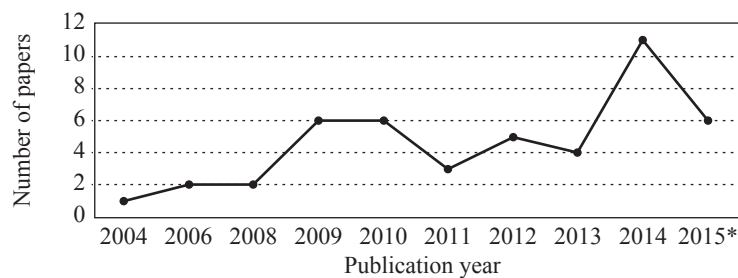
Another characteristic of papers in our sample is the publication year, which provides information about the evolution of publications at the time. As we can see in Figure 2, all the papers were published after 2004. It is important to note that this research was conducted in July 2015, considering only papers published until that date. Figure 2 shows that an increase in the number of papers published about food safety. One reason for such an increase may be the growth in the number of cases of food contamination in recent years.

**Table 1.** Journals in the sample.

Journal	JCR <sup>1</sup> Impact Factor 2014	Papers in the sample	Citation scores in Web of Science
1 Omega-International Journal of Management Science	4.376	1	–
2 Journal of Supply Chain Management	3.857	1	82
3 Journal of Operations Management	3.818	1	25
4 Supply Chain Management: An International Journal	3.500	3	6
5 International Journal of Production Economics	2.752 <sup>2</sup>	10	76
6 Technovation	2.526	1	49
7 European Journal of Operational Research	2.358	6	60
8 Expert Systems with Applications	2.240	2	8
9 International Journal of Electronic Commerce	1.872	1	2
10 International Journal of Physical Distribution and Logistics Management	1.802	1	4
11 International Journal of Production Research	1.477	3	50
12 Production Planning and Control	1.466	1	8
13 Journal of Business Ethics	1.326	1	22
14 International Journal of Consumer Studies	1.293	2	2
15 Business Horizons	1.163	1	–
16 OR Spectrum	0.987	2	58
17 International Journal of Logistics Management	0.946	3	–
18 Information Technology and Management	0.897 <sup>2</sup>	1	10
19 International Journal of Shipping and Transport Logistics	0.862	1	–
20 Service Industries Journal	0.832 <sup>2</sup>	1	–
21 Journal of Business and Industrial Marketing	0.750	1	4
22 International Journal of Logistics Research and Applications	0.482	1	7
23 Transportation Journal	0.386	1	–
Total		46	473

<sup>1</sup> JCR = Journal Citation Report.

<sup>2</sup> Impact factor in 2012 JCR edition.

**Figure 2.** Number of papers by publication year (\*papers published from January to July).

### Authorship results

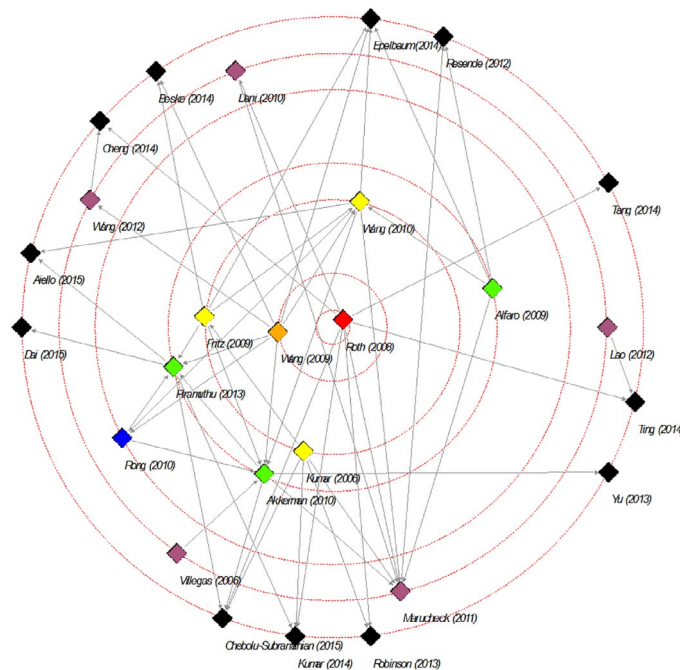
Table 2 shows the number of authors in the same paper, the number of papers published, and the authorship. The number of authors in the same paper varies from 1 to 7. There are 34 papers with 2 and 3 authors, which represent 73.91% of the sample. The authorship refers to the number of papers written by a given author. This means that one author can have written multiple papers. For this reason, the third column multiplies

**Table 2.** Papers by number of co-authors

Authors in the same paper	Published papers	Authorship (authors × papers)	%
1	1	1	2.17
2	18	36	39.13
3	16	48	34.78
4	7	28	15.22
5	1	5	2.17
6	2	12	4.35
7	1	7	2.17
Total	46	137	100.00
Average mean of co-authors by paper	2.98		

the number of authors by the number of papers, providing information to help us create a map of citations and summarize the authorship by the country of author affiliation, which is presented later. A total of 126 authors results in 137 authorships, which means that some authors wrote more than one paper.

To better understand the impact of some authors and their papers on the development of other studies about food safety and supply chain management, we developed a citation network analysis. For this analysis, we consider only papers that receive the citation by papers of our sample, that is, papers that are not in our sample are not considered for this analysis. Figure 3 illustrates the results. Each 'arrow out' of a box represents a citation received by the paper in that box. For example, the paper by Roth *et al.* (2008) was cited 8 times by other papers in the sample. Because this paper is the most cited paper, it is in the center of the network. The more centralized a paper is, the more citations it received. Thus, each circle in Figure 3 represents the number of citations that papers in that circle received. Conversely, papers in the outer circle did not receive any citation. It is important to note, however, the most recent papers tend to be in the outer circle, while

**Figure 3.** The citation network analysis.

Each 'arrow out' of a box represents a citation received by the paper in that box. Each circle represents the number of citations that papers in that circle received.

older papers in the center. The number of citations may be related to the time a paper is available to be cited by other authors, influencing the position of these papers in our analysis.

Table 3 shows the country of the institution where the author is affiliated. There are authors from institutions of 20 countries. Most authors are from the United States and the United Kingdom, 30 and 19, respectively. This corresponds to 21.89 and 13.87% of all authors in our sample. On the other hand, Finland, India, Mexico, Norway, and Sweden have one author each.

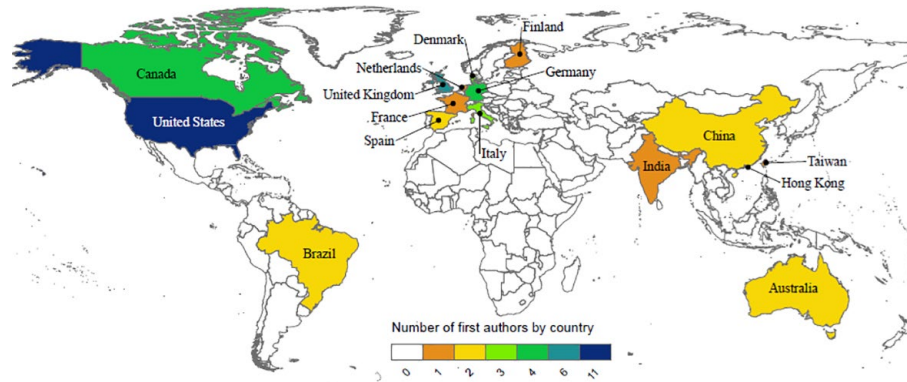
Figure 4 illustrates the country of the institution where the first author is affiliated. This figure shows the concentration of authors in developed countries located in North America and Europe. It is interesting to note that some countries that are big food producers, such as Brazil, Australia, China and India have few authors that published papers about food safety.

### *Methodological characteristics*

We also analyzed some methodological characteristics of the papers. First, we examined the study design adopted by authors considering: (1) a qualitative approach; (2) a quantitative approach; and (3) a combination of these two approaches. Out of 46 papers, 30 (65.22%) are based on quantitative design, 12 (26.09%) are based on a qualitative design, and 4 (8.69%) are based on a quali-quantitative design. These results suggest a trend toward more quantitative studies. Also, although the number of papers with a quali-quantitative design is not high, it suggests that some authors employed a more sophisticated methodological design to answer their questions, as recommended by theorists like Shah and Corley (2006) and Weick (1995).

**Table 3.** Country of the institution where the author is affiliated.

Country of institution	Order of authorship							Total
	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	5 <sup>th</sup>	6 <sup>th</sup>	7 <sup>th</sup>	
Australia	2	2	1	1				6
Brazil	2	1	1					4
Canada	4	3	1					8
China	2	2	2	2	1		1	10
Denmark	3	3						6
Finland	1							1
France	1	1	1					3
Germany	4	4	5	1				14
Hong Kong	2	2	2	2	1	1		10
India	1							1
Italy	3	2	1					6
Mexico		1						1
The Netherlands	1	1	1	1	1	1		6
Norway			1					1
Saudi Arabia			1	1				2
Spain	2	3						5
Sweden		1						1
Taiwan	1	2						3
United Kingdom	6	7	4	1	1			19
United States	11	10	6	2		1		30
Total	46	45	27	11	4	3	1	137

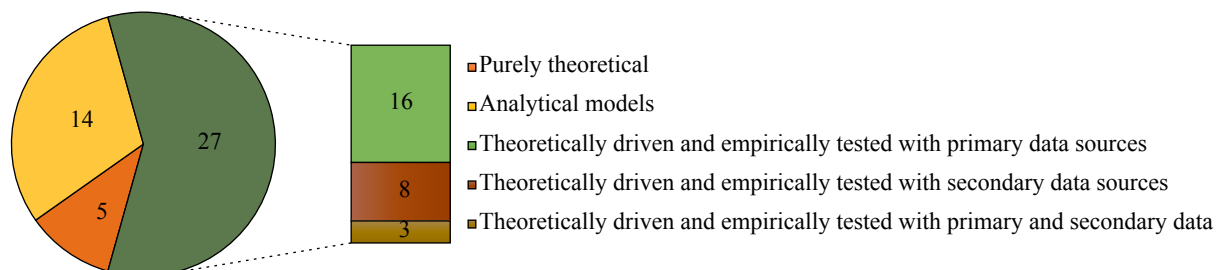


**Figure 4.** First author by country.

Second, we examined if the paper is: (1) purely theoretical; (2) analytical models; and (3) theoretically driven and empirically tested. Furthermore, for the papers that are theoretically driven and empirically tested, we analyzed their data sources: primary, secondary or a combination of these two. Figure 5 shows the results.

Of the 46 papers analyzed, 5 (10.87%) are purely theoretical, 14 (30.43%) are analytical models, and 27 (76.09%) are theoretically driven and empirically tested. A total of 8 analytical model papers employed empirical data to test their models, while the other 6 did not make use of any type of data. Of the 27 theoretically driven and empirically tested papers, 16 used primary data sources, 8 used secondary data, and 3 used a combination of primary and secondary data sources. Analysis of the primary data sources reveal that survey was employed in 9 papers, case study was employed in 5 papers, and interview was used in 2 papers.

Regarding the major subject of each paper, traceability was the most analyzed subject, accounting for 10 papers (21.74% of the sample). In this group, the way supply chain managers could use systems and tools to track or trace raw materials and final products particularly in food chains was the central point of the discussions. The second most studied subject was risk, amounting to 5 papers (10.87%). Here, supply chain scholars explored some alternatives to overcome problems that practitioners could face when supplying raw materials and final food products, both being proactive or reactive to such problematic issues. Another major subject, distribution accounted for 5 papers (10.87%). Distribution of food products is particularly important to supply chain practitioners and scholars, given the inherent characteristics of food, such as perishability, health or even safety. The way practitioners could better perform distribution, taking into account these characteristics, was the major point in this group. Finally, 4 papers (8.70%) discussed quality as the major subject. Here, issues related to what supply chain practitioners could do to deliver food products at high-quality levels, especially in accordance with international quality standards, was the major point of analysis. To summarize, these four subjects were the most important themes discussed in our sample, accounting for 24 papers (52.17%).



**Figure 5.** Type of paper and the sources of data.



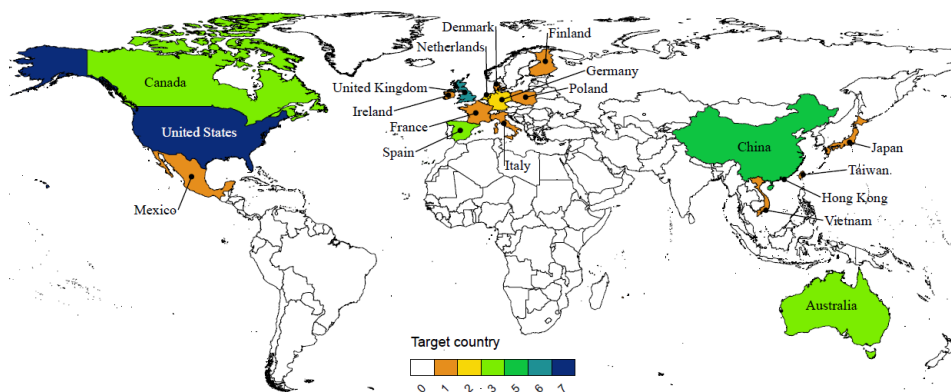
Results about major subjects are in agreement on the relevance of papers considering the number of citations by papers in the sample, as in the case of network citation (Figure 3). In this case, there are 14 papers that received this kind of citation, and traceability is the central point in 4 of them, risk in 3, distribution in 2, quality in 2, food safety plan, recall and stock accounted for 1 paper each. Citing the papers and considering the network citation again, the central point of relevance is the paper written by Roth *et al.* (2008) discussing supply chain quality management, followed by Wang *et al.* (2009) analyzing quality, Fritz and Schiefer (2009) discussing traceability, Wang *et al.* (2010) examining traceability, and Kumar and Budin (2006) studying recall. All of these results revealed the same idea, that traceability, quality, risk, and distribution are the most relevant aspects of food supply chain management in the sample.

Finally, we analyzed in which countries authors focused on testing their research ideas in the papers of our sample, that is, what country, or group of countries, was/were the target of analysis. It is important to note that 33 papers (71.73%) mentioned which country/countries was/were analyzed and 13 (28.27%) cited any, because they did not analyze empirical data. In these 33 papers, there are 47 indications of target countries, since a given paper could analyze more than one target country. For instance, a given paper could analyze China, the United Kingdom, and Australia, accounting for 3 target countries and summing up only one paper. Thus, the set of 33 papers cited 2 continental regions and 19 countries as their targets. From the continental regions point of view, Europe was cited twice, and Latin America was cited once. Regarding countries, the United States was the target country of 7 papers, the United Kingdom 6, and China 5, as shown in Figure 6. Together, these three target countries accounted for 38.30% of the total number of targets in the sample, showing their importance in the studies about food safety in the supply chain. If we group the 47 targets into continental regions, Europe accounts for 21 targets (44.68%), North America for 11 (23.40%), Asia 11 (23.40%), Oceania 3 (6.38%), and Latin America only 1 (2.13%). It is worth noting that Latin America was cited only as a continental region and not its individual countries.

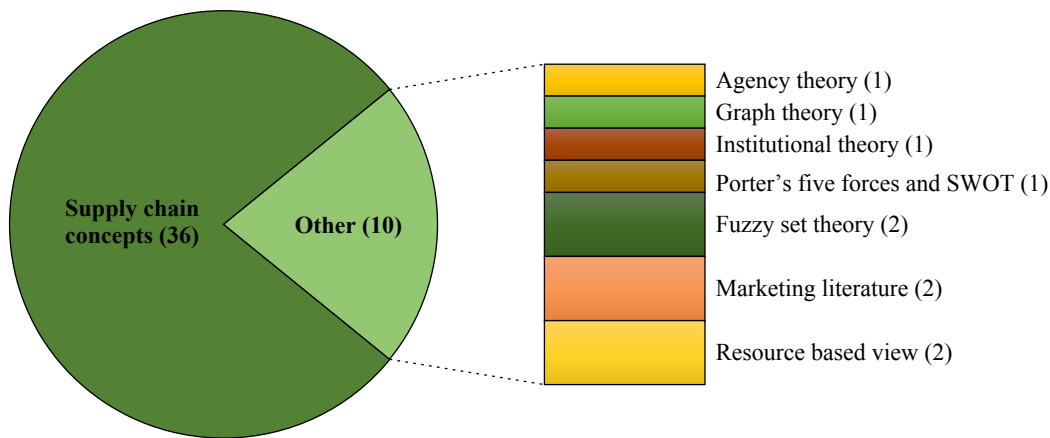
### Theoretical approaches

We also analyzed the theoretical approaches in the papers. Figure 7 shows that 36 (78.26%) papers were based on concepts and models from the supply chain management perspective, such as, distribution management, risk assessment, supply chain performance, traceability, transportation planning, factors influencing supplier selection, and batch dispersion. The other 10 papers are based on theoretical approaches, such as, agency theory, institutional theory, resource-based view, among others. Figure 7 summarizes the results.

Two papers adopted a marketing perspective. The first paper discusses results of traceability systems from the customers' point of view about sustainable products. The second paper uses concepts of attributes by the end customers to buy their food, especially beef. One paper employed the Porter's five forces and a SWOT analysis to evaluate best practices for prevention and management of product recalls. Finally, three



**Figure 6.** Target country of the studies.



**Figure 7.** Theoretical approaches in the sample.

papers were based on general theories. The first employed graph theory to compose the network of the dairy industry in Germany, mapping the supply chain and analyzing risks of deliberate food contamination. To solve problems with a large range of uncertainty, the other two papers employed fuzzy theory as a methodological approach to help analysis of risk assessment, and supplier selection attributes in a supermarket context.

## 5. Discussion

Because of the growing number of events of food contamination and because of their relationship with supply chain management, we are motivated to conduct a systematic literature review to describe and understand characteristics of papers published about food safety in the area of supply chain management studies.

Our results show an increase in the number of papers published on this topic, which is consistent with the growing number of food contamination events in the last few years. This may also be the reason we see many journals publishing papers about it. As the food supply chain becomes more global in the sense that more food producers are spread out all over the world, food safety is an important factor in delivering food products to consumers.

Some papers in our sample tend to be more influential than others. This is the case of papers in more central positions of our citation network analysis. One explanation for this position may be the topics and results presented by these papers, which create research opportunities for other authors. For instance, the Roth *et al.* (2008) paper discusses issues that impact food safety and presents a framework containing six constructs to improve food safety. Given its many propositions, this paper may serve as a source of ideas for other authors. Thus, depending on the objective of the paper, it may provide more ideas to another author. More theoretical papers may serve as a basis for the development of ideas that are tested by other authors. Another explanation may be the year in which the paper was published. The older the paper, the more likely it tends to be cited because more authors are likely to read it.

The country of origin of the first author's institutions suggests a concentration of papers in developed countries, mostly from the United States and the United Kingdom. The higher number of institutions and researchers in these countries may help to explain these results. The country of origin of the first author's institution is important to show which countries and institutions are conducting more research about food safety and supply chain management. Other authors interested in partnering with scholars publishing about this topic may find this information useful. Also, other institutions can identify those institutions that have higher numbers of publications and may seek partnership.

Considering the target country, however, China and Australia have to be taken into account jointly with North America and Europe. Even if the group of analyzed datasets continues to pay major attention to developed countries, the emerging market China is an important player in global markets as well as in the global economy. However, some developing countries considered big food producers, such as Brazil and India, have been less investigated. Taken together, these results suggest opportunities for future research by having researchers from developed and developing countries working together to investigate ideas and collect data from their countries. Scholars from institutions located in developing countries may have more information and more knowledge about food supply chains in these countries and, therefore, may contribute with different ideas for research projects developed by their peers in developed countries. Also, collecting data from countries that are big food producers could help to reveal their food safety and supply chain management practices, providing more ideas to better understand and explain these issues.

The methodology adopted by authors in the analyzed papers show the predominance of a theoretically-driven, empirically-tested approach based on the quantitative design to analyze empirical data. We note a balance between the use of primary and secondary datasets, which may enrich results about food safety and supply chain management, because it is possible to have an objective perspective by using secondary data, and a subjective perspective by using surveys or interviews. Two literature reviews are noteworthy, which suggests that some scholars are trying to collect data on what other authors are doing in an attempt to synthesize their findings. A smaller number of papers were based on analytical models. This variety of methodological approaches demonstrates that this topic has called the attention of researchers from many methodological backgrounds. These results also suggest that an effort will be needed to organize these findings and reconcile the literature on sub-topics of food safety and supply chain management.

The theoretical approaches used by authors to view food safety problems are more related to the supply chain management literature. It is important to draw attention to the fact that the supply chain management literature is an evolving discipline (Harland *et al.*, 2006) and still needs more theoretical robustness to become a theory (Burgess *et al.*, 2006). For this reason, as the theoretical background for their ideas, most studies employed supply chain management concepts and models, such as, distribution management, risk assessment, supply chain performance, traceability, to cite just a few. The application of these concepts and models is expected given the supply chain management perspective adopted by these papers. This is also the reason few papers employed more robust theoretical approaches, such as agency and institutional theories, to explain a phenomenon that exists along the chain of goods and information. Even so, there is still room for use of more robust theories, such as, social capital theory (Burt, 1997; Coleman, 1988), transaction cost theory (Williamson, 1985), and population ecology theory (Hannan and Freeman, 1977), as well as theoretical perspectives, such as, organizational power (Hickson *et al.*, 1971; Pfeffer, 1981) and property rights (Demsetz, 1967).

## 6. Conclusions

The objective of our paper was to review a sample of papers published about food safety and supply chain management to understand the main characteristics of these papers. We conducted a systematic literature review using the keywords 'food safety' and 'supply chain management' in the Web of Science database, and found 46 papers that match our requirements. The results show a concentration of publications from authors of North American and European countries, using data also collected in these countries and employing quantitative methods based on analytical models and a theoretically-driven, empirically-tested approach. The theoretical approaches used by most papers come from the supply chain management literature and use concepts and models, such as, those related to traceability, transportation planning, factors influencing supplier selection, and batch dispersion.

Our paper contributes to the literature on food supply chain management by showing how scholars have been working to understand and solve problems related to food safety in the supply chain arena. By doing so, we reveal the path followed by previous scholars in the process of conducting their research projects regarding

methodological and theoretical issues, as well as network citations and institution nationalities where the studies were conducted. Future scholars can follow a similar path to contribute to the research about the topic discussed in our paper, as well as contact partners in accordance with their own research topic(s). In addition, other scholars can perceive research opportunities by following a different path, designing their studies using distinct methodological or theoretical approaches, rather than those included in our paper. Both paths could provide new insights into the food safety supply chain phenomena.

One limitation of our paper relates to the keywords and database used to collect the papers in our literature review. For example, we did not include the keyword 'food contamination', which is a keyword somewhat related to 'food safety' and could increase the number of papers in our sample. Other studies should include other related keywords to expand the search for papers. In addition, other studies could include other databases to capture a higher number of papers. Another research opportunity is to include a higher number of keywords and databases, but restrict the journals to be analyzed based on some criteria, such as, the journal impact factor and the 'H' index. Finally, other studies could evaluate the number of papers published about food safety and supply chain management relative to the total number of papers published by the journal to provide more accurate information about the importance of this topic to a given journal.

## Supplementary material

Supplementary material can be found online at <https://doi.org/10.22434/IFAMR2016.0003>.

**Table S1.** Analyzed papers.

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